

Public

CUSC Modification Proposal Form

CMP457: Revision of the Obligatory Reactive Power Service (ORPS)

Overview: The rising cost of ORPS provision reflects the compensation rate for ORPS, derived many years ago, being reflective of gas prices. The increasing shift away from gas to low carbon generation requires a re-evaluation of compensation principles rather than a simple updating of values. This update to the CUSC will incorporate the output from the ORPS project to introduce a fair and transparent payment methodology.

Modification process & timetable



Status summary: The Proposer has raised a modification and is seeking a decision from the Panel on the governance route to be taken.

This modification is expected to have a: High impact on all Generators that have agreed to be bound by the provisions of the Grid Code.

Proposer's recommendation of governance route	Standard Governance modification with assessment by a Workgroup	
Who can I talk to about the change?	Proposer: Jeremy Taylor (Jeremy.Taylor@neso.energy) / Stephen Dale (Stephen.dale1@neso.energy)	Code Administrator Contact: cusc.team@neso.energy

Public

Contents

What is the issue?	3
Why change?	3
What is the Proposer's solution?	4
Draft legal text.....	6
What is the impact of this change?.....	6
When will this change take place?	8
Implementation date:.....	8
Date decision required by	8
Implementation approach	8
Proposer's justification for governance route.....	9
Interactions	9
Acronyms, key terms and reference material	9

Public

What is the issue?

All Generators that have Transmission Entry Capacity on the Transmission Network and signed up to the Grid Code have an obligation to support the System Operator in maintaining a stable and secure Transmission Network by providing reactive power when operating on the transmission network. The rate that they are compensated for their contribution is based on a network predominantly supported by fossil fuelled generation using a number of historical assumptions. National Energy System Operator (NESO) has commissioned an in-depth review of what a revised approach to the compensation for this essential service should be and the output of this work forms the basis of the modification proposal.

Why change?

Historically the production of real power (MW) using traditional centralised power stations with large generators synchronised to the network provided predictable needs and control of the reactive power (MVAR) provision. The compensation for reactive power provision utilised a number of parameters that were reflective of these power generations operational costs, including gas prices, it being the predominate fuel at the time.

Recent years have seen a continued rise in the adoption of renewable power generation and an associated growth in battery storage. The intermittent generation characteristics of these assets output, along with the non-synchronous nature of their generation further contributes to the increased unpredictability of the need for Reactive power provision. These changing characterises of generation technology has also led to the shift in much of the generation location, this can in itself be an issue as reactive power correction is a local requirement.

It has been the intention of the Obligatory Reactive Project rather than refresh the various parameters in the current methodology, to review the approach to reactive power remuneration and ensure that it was still fit for purpose for the current Network configuration and able to support developments in the Network reactive power requirements for the foreseeable future.

The project aims were to ensure that the Reactive power remuneration for generators is

- Cost reflective for the provider & economic for the consumer
- Fair and transparent
- Robust and able to support future network development

Public

- Reward all generators fairly for meeting the Grid Code obligations.

The approach of the compensation model aims to compensate the providers proportionally to their operational costs.

What is the Proposer's solution?

The Obligatory Reactive Power Service (ORPS) project progressed through a number of steps to ensure the rigorous approach to the defect identified.

- The project interviewed industry service providers.
- Interviewed other system operators and analysed their approaches.
- NESO initially identified 11 technologies that provide reactive power services. DNV's analysis identified and evaluated 12 technologies, as well as developing an approach that accommodates new technologies as they arise, for which there was a specific project deliverable.
- 18 initial options were identified by combining design features noted during interviews with other system operators. 8 were rejected due to overlap or not aligning with the project objectives.

After evaluating different approaches, the project team has identified a methodology which meets the above requirements and is designed to tie to the charging principles in CUSC Schedule 3, Appendix 7.

The recommended new pricing methodology consists of multiple compensation rates, assigning one unit rate to each technology type. As with the current methodology, the new rate applies to the payment for actual reactive power volume (MVARh) delivered, including both absorption (lead) and injection (lag).

The proposed formula is similar to the existing ORPS payment methodology in some respects, regarding volume measurement and factors X and Y, which are components relating to supplier performance but differs in its unit rate with a distinct formula that relates to contribution. The structure of the new pricing methodology is based on the following equation that the unit rate is intended to be tailored per service provider (SP) for a given technology type:

$$\text{Monthly Payment for a } SP_m = \sum_{i=1}^n (\text{Unit Rate}_m \times \text{Volume}_i \times \text{Factor } X_i \times \text{Factor } Y_i)$$

- The monthly payment is the sum of all individual Settlement Period (30-minute interval) payments, represented by the n variable for that month.

Public

- The payment (£) for a Settlement Period is determined by multiplying the applicable technology unit rate for that period by the volume (MVarh) delivered, then adjusted using Factor X (1 or 0.2), if applicable.
- The unit rate for a given month (m) is defined as the amount in £ per MVarh assigned to a SP according to its associated technology type. This unit rate is applied to the combined lead and lag volume (denoted as the i variable in the above equation) delivered by a SP during a Settlement Period.

The Unit Rate applicable to a specific SP and month (m) is calculated based on the equation below:

$$Unit\ Rate_{(m)} = Initial\ Unit\ Rate \times \frac{CPI_m}{Initial\ CPI_{(1)}}$$

The Unit Rate for a particular month will be determined from the Initial Unit Rate that will be indexed using CPI for the period under consideration. It is proposed to set the Initial Unit Rate from the LCOE (Levelized Cost of Energy) data routinely published by DESNZ. The LCOE report issues values for the variable O&M costs and fuel costs specific to each technology type. Since the LCOE costs are based on £/MWh, it is essential to convert it to £/MVarh for the purpose of ORPS.

The Initial Unit Rate is as follows:

- Converted LCOE Variable O&M cost + Converted LCOE fuel cost (where applicable)

The LCOE Variable O&M cost is converted from £/MWh to £/MVarh based on the following formulae and is designed to align with the charging principles in CUSC Schedule 3, Appendix 7.

- For Synchronous generation the following conversion ratio is used: $(0.5 \times 19.6_{lead}) + (0.5 \times 34.9_{lag}) = 27.25\%$
- For non-Synchronous generation the following conversion ratio is used: $(0.5 \times 19.6_{lead}) + (0.5 \times 19.6_{lag}) = 19.6\%$

The rationale for the conversion ratios is that it is assumed that wear and tear is affected by, and in proportion to, the total current that is associated with apparent power. Therefore, the provision of reactive power is assumed to result in a proportional variation of the O&M MWh cost based on the ratio of reactive power and the apparent power. The conversion table which forms the basis of these ratios is illustrated below:

Public

p.f.	P=MW	Q=MVar	S=MVA	% Q/P	% Q/S
1	100	0	100	0	0.00%
0.99	100	14.25	101.01	14.25%	14.11%
0.98	100	20.31	102.04	20.31%	19.90%
0.97	100	25.06	103.09	25.06%	24.31%
0.96	100	29.17	104.17	29.17%	28.00%
0.95	100	32.87	105.26	32.87%	31.22%
0.94	100	36.30	106.38	36.30%	34.12%
0.93	100	39.52	107.53	39.52%	36.76%
0.92	100	42.60	108.70	42.60%	39.19%
0.91	100	45.56	109.89	45.56%	41.46%
0.9	100	48.43	111.11	48.43%	43.59%
0.89	100	51.23	112.36	51.23%	45.60%
0.88	100	53.97	113.64	53.97%	47.50%
0.87	100	56.67	114.94	56.67%	49.31%
0.86	100	59.34	116.28	59.34%	51.03%
0.85	100	61.97	117.65	61.97%	52.68%
			1-0.95 average	20.28%	19.59%
			1-0.85 average	38.58%	34.92%

Some technologies need fuel to provide ORPS (i.e. extra fuel costs associated with delivering reactive power and the additional energy loss impact'). It is proposed to use the fuel costs in DESNZ's LCOE report and apportion these costs accordingly. In a previous experimental study carried out by DNV in 2016 for an overseas TSO, a few designated thermal generators of different capacity sizes were selected to operate at different load factors (e.g. 50%, 100%) and at different power factors (e.g. 1.0, 0.99, 0.98, etc) to measure the additional fuel consumption for generating a unit of reactive power. It was found that the additional energy consumption for producing 1 MVarh would be less than 10kWh in all scenarios.

Based on this work, it is proposed that the converted LCOE fuel cost (£/MVarh) should be 1% of the value of the fuel cost considered in LCOE for MWh:

- Converted LCOE fuel cost to £/MVarh basis = LCOE fuel cost (£/MWh) x 1%

Draft legal text

The legal text hasn't been drafted currently as the solution is intended to be finalised through work groups. It was agreed that there will not be chargeable elements in the revised model, so the change is limited to the non-chargeable principles for evaluation, with changes to the CUSC limited specifically to the ORPS compensation formulae, (Schedule 3, Appendix 1).

What is the impact of this change?

This proposal will impact all Generators connected to Transmission network, by ensuring the compensation for provision of reactive power and meeting their grid code obligations reflects the operational costs incurred in provision. By developing a new compensatory model for obligatory reactive power generation as outlined by the project

Public

requirements the expectation is that the consumer will benefit from a more economic procurement of the reactive power needs.

Proposer's assessment against CUSC Non-Charging Objectives	
Relevant Objective	Identified impact
(i) The efficient discharge by the Licensee of the obligations imposed on it by the Act and by this licence*;	Positive The NESO as System operator has an obligation to provide a safe and secure Transmission network at a fair cost to the consumer, this modification is focussed at both these objectives.
(ii) Facilitating effective competition in the generation and supply of electricity, and (so far as consistent therewith) facilitating such competition in the sale, distribution and purchase of electricity;	Positive The current single rate ORPS payment has not been revised for an extended period. The historical basis of the calculation and the emerging diverse generation technology types providing ORPS has resulted in disparity between providers costs and remuneration and contributed to disproportionate rises in costs to consumers.
(iii) Compliance with the Electricity Regulation and any relevant legally binding decision of the European Commission and/or the Agency **;	Neutral Interconnectors are in scope.
(iv) Promoting efficiency in the implementation and administration of the CUSC arrangements.	Neutral Revising the methodology won't be inherently more efficient, but should remove obvious errors in the current CUSC model and create a more transparent and cost reflective model that provides a fair compensation to providers and a fair cost for consumers.

* See Electricity System Operator Licence

**The Electricity Regulation referred to in objective (iii) is Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast) as it has effect immediately before IP completion day as read with the modifications set out in the SI 2020/1006.

Public

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 The current approach to Obligatory Reactive Power is no longer representative of the operational environment and has created distortion in the payment to service providers that isn't reflective of the costs incurred or their overall contribution.
Lower bills than would otherwise be the case	Positive The current model is based on a set of historical parameters that are not the main cost drivers in today's operational environment. The accurate allocation of consumer resources to reward the suppliers that provide the service relative to their contribution and costs incurred should result in a more cost-effective model.
Benefits for society as a whole	Neutral No anticipated benefits
Reduced environmental damage	Neutral We do not anticipate significant change in the incentives to protect the environment. The aim is for a transparent and fair remuneration for industry to ensure all to contribute in ORPS provision to minimise the need for some gas generation instruction from NESO to meet reactive power needs.
Improved quality of service	Neutral No anticipated benefits

When will this change take place?

Implementation date:

10 Business Days following an Authority Decision.

Date decision required by

To be confirmed.

Implementation approach

The proposal would be to implement the changes in the CUSC 10 Business days after an Authority Decision.

Public

Proposer's justification for governance route

Governance route: Standard Governance modification with assessment by a Workgroup
 - It is believed currently there are a number of outstanding questions that require industry input. Some of these may be resolved through the planned engagement by the project including webinars, TCMF (Transmission Charging Methodology Forum) and GCDF (Grid Code Development Forum), discussions but it is seen as important that industry have the opportunity to ask any questions and gain understanding, so the proposal is to provision for Workgroups.

Interactions

☒ CUSC ☐ BSC ☐ STC ☐ SQSS
☐ European Network Codes ☐ EBR Article 18 T&Cs¹ ☐ Other modifications ☐ Other

Currently the belief is that the proposed modification doesn't impact any other code apart from the CUSC.

Acronyms, key terms and reference material

Acronym / key term	Meaning
BSC	Balancing and Settlement Code
CUSC	Connection and Use of System Code
EBR	Electricity Balancing Regulation
GC	Grid Code
GCDF	Grid Code Development Forum
ORPS	Obligatory Reactive Power Service
MVAR	Mega Volt-Amperes Reactive
MW	Megawatt
SQSS	Security and Quality of Supply Standards
STC	System Operator Transmission Owner Code

Public

TCMF	Transmission Charging Methodology Forum
T&Cs	Terms and Conditions