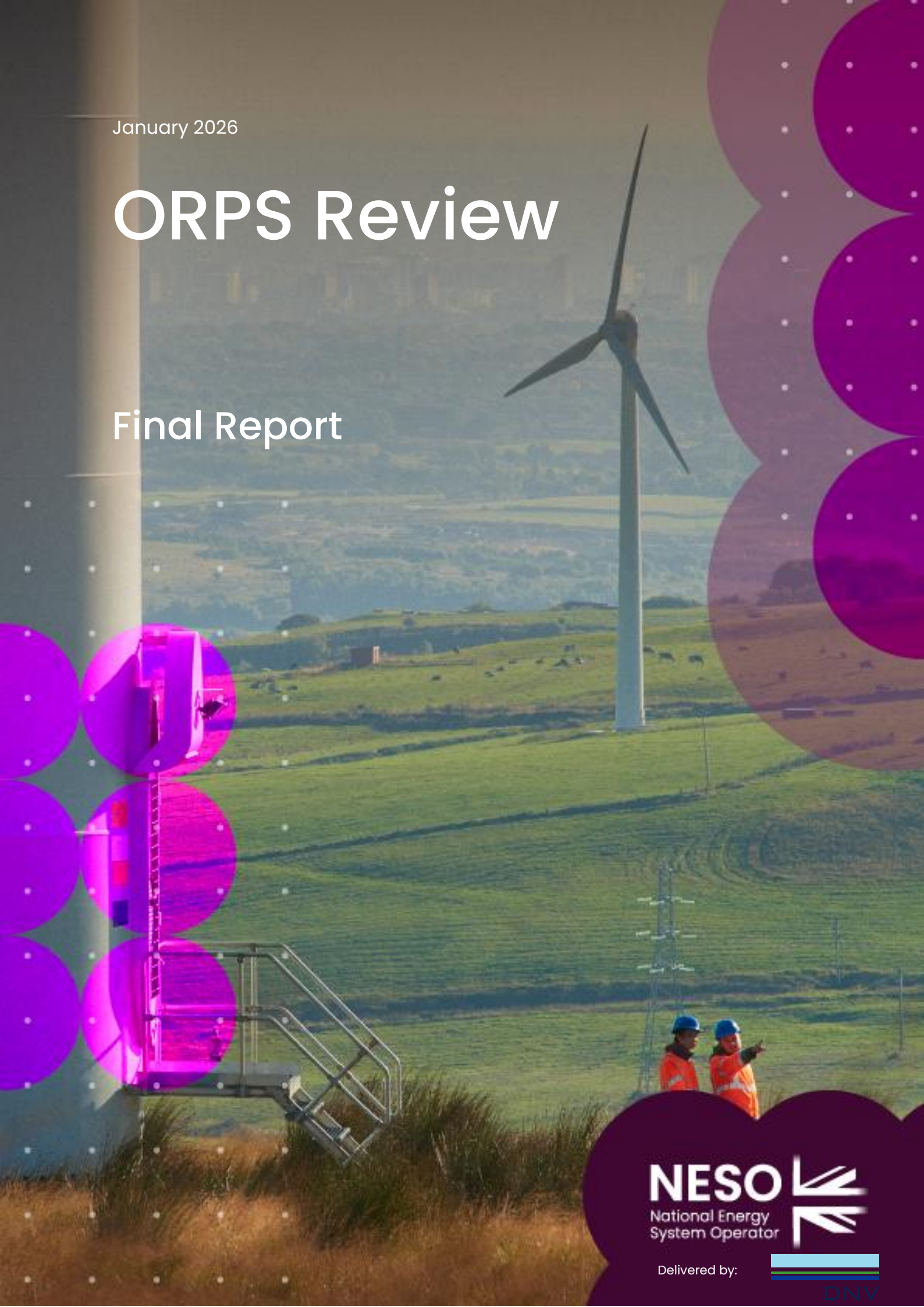
January 2026

ORPS Review

Final Report



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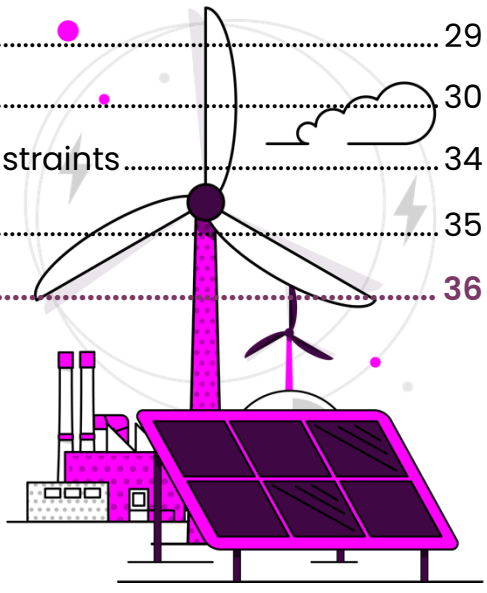


Abbreviations

Acronym	Description
AEMO	Australian Energy Market Operator
BAU	Business-As-Usual
BESS	Battery Energy Storage System
CBESS	Containerised Battery Energy Storage System
CC User	Connection Conditions User
CCGT	Combined Cycle Gas Turbine
CPI	Consumer Price Index
CUSC	Connection and Use of System Code
DESNZ	Department for Energy Security and Net Zero
ECC User	Electricity Connection Conditions User
ENTSOE	European Network of Transmission System Operators for Electricity
ERCOT	Electric Reliability Council of Texas
FES	Future Energy Scenario
GB	Great Britain
GDP	Gross Domestic Product
LCOE	Levelised Cost of Electricity
MVArh	Megavolt-Ampere Reactive hour
MWh	Megawatt hour
NIA	Network Innovation Allowance
NESO	National Energy System Operator
O&M	Operations & Maintenance
OCGT	Open Cycle Gas Turbine
OFTO	Offshore Transmission Owner

ORPS	Obligatory Reactive Power Service
P	Active Power, unit is MW
PPI	Power Price Index
Q	Reactive Power, unit is MVAr
RPI	Retail Price Index
RTE	Réseau de Transport d'Électricité
S	Apparent Power, unit is MVA
SP	Service Provider
TSO	Transmission System Operator
Q&A	Questions & Answers

1. Executive Summary

- Problem statement
- Approach
- Key findings
- Conclusions and recommendations



Executive Summary

The National Energy System Operator (NESO) is the Operator of Great Britain's (GB) electricity transmission network, responsible for connecting electricity generation and demand and maintaining a stable, reliable, affordable, and fair electricity system for all users. As part of this commitment, NESO is responsible for ensuring that they can operate the electricity system safely, efficiently and economically. A key factor in achieving these goals is the management of the reactive power that is provided by generators, also referred to as Service Providers (SPs) as part of their mandatory reactive power capability requirement. In return for the delivered reactive power, SPs receive Obligatory Reactive Power Service (ORPS) payment.

NESO is reviewing the payment methodology of the Obligatory Reactive Power Service which was last updated in 2007 and is now considered unfit for purpose in the context of an evolving energy landscape with increasing renewable energy integration.

1.1 Problem statement

The existing ORPS payment methodology, which has not changed since 2007, is based on the Retail Price Index (RPI) and Power Price Indexes (PPI) and was originally tailored for a system reliant on a generation mix dominated by gas and coal generation that since changed with increased renewable units. Recent volatility in gas prices, especially in 2021–2022, highlighted significant flaws in this approach, particularly its lack of transparency and its link to gas prices that is no longer cost-reflective of the new generation mix and value for consumers. As a result of these flaws, the need for an overhaul of the payment methodology has become clear.

1.2 Approach

To address these issues, the NESO project team, supported by Network Innovation Allowance (NIA) funding and in partnership with DNV, has launched a comprehensive review of the ORPS payment methodology. This review aims to develop a new payment methodology that more accurately reflects the true costs of providing reactive power services across a wider range of technologies.

The project, which began in early 2025, is now nearing completion, with continued industry consultation planned. The final recommended approach will proceed through the standard Connection and Use of System Code (CUSC) modification process, ensuring continued stakeholder involvement and wider industry engagement within the future development of ORPS payments.

1.3 Key findings

Early engagement included interviews with five transmission system operators (TSOs) worldwide and one-to-one meetings with eight SPs covering 11 generation technologies (see listing in Table 8 and Table 9). These discussions highlighted SPs' views on the strengths of the existing ORPS payment mechanism, such as its simplicity and fairness, but also revealed weaknesses including a lack of cost reflectivity and transparency, and an over-reliance on gas prices.

Building on received feedback, several design features for a new payment mechanism were identified and combined to create 10 possible options. These options were then evaluated against the project criteria (see the options in section 2.3.2).

The selected approach was the "multiple rates" option based on utilisation payments, as this is best aligned with the CUSC (Schedule 3 Appendix 7) and project objectives.

Two variants of the "multiple rates" option were considered: one offering different rates per different group of technologies (e.g. synchronous and non-synchronous SPs), and another with individual rates for each eligible technology. Quantitative assessments using PLEXOS simulations were performed to estimate compensation levels and compare them to the current ORPS mechanism. Although the PLEXOS modelling is based on simplified model, the approach provided reasonable projections of reactive power volumes across technologies through 2030 and the simulation results provided an illustration of a fairer compensation to the supplier and Consumers using the proposed multiple rates than when using the existing single fixed rate method.

Following analysis and review, the "multiple rates—one rate per technology" variant was selected as the best identified future payment mechanism for ORPS service providers because it best aligns with the CUSC payment principles on ORPS and is the most cost-reflective for all technologies.

1.4 Conclusions and recommendations

The proposed new ORPS pricing methodology would use separate rates for each technology type, replacing the current single-rate method. This report introduces the proposed multiple rates payment methodology and makes recommendations on future work related to this methodology, adopting the Levelised Cost of Electricity (LCOE) from the Department of Energy Security and Net Zero (DESNZ).
Additionally, any areas that have been identified in the course of the project as potential areas for improvement, and which are outside its scope, will be considered as appropriate.

2. A Deeper Insight

- Introduction
- Criteria of a new payment methodology
- Summary of the work
- The Selected Option
- Validation by PLEXOS model
- Public engagement



2.1 Introduction

The current ORPS payment methodology, which has remained unchanged since 2007, is indexed to RPI and PPI, and was originally designed for a network predominantly composed of gas and coal generation. The significant increase in gas prices during 2022 exposed the volatility and consumer impact inherent in the legacy methodology, as illustrated in Figure 1.

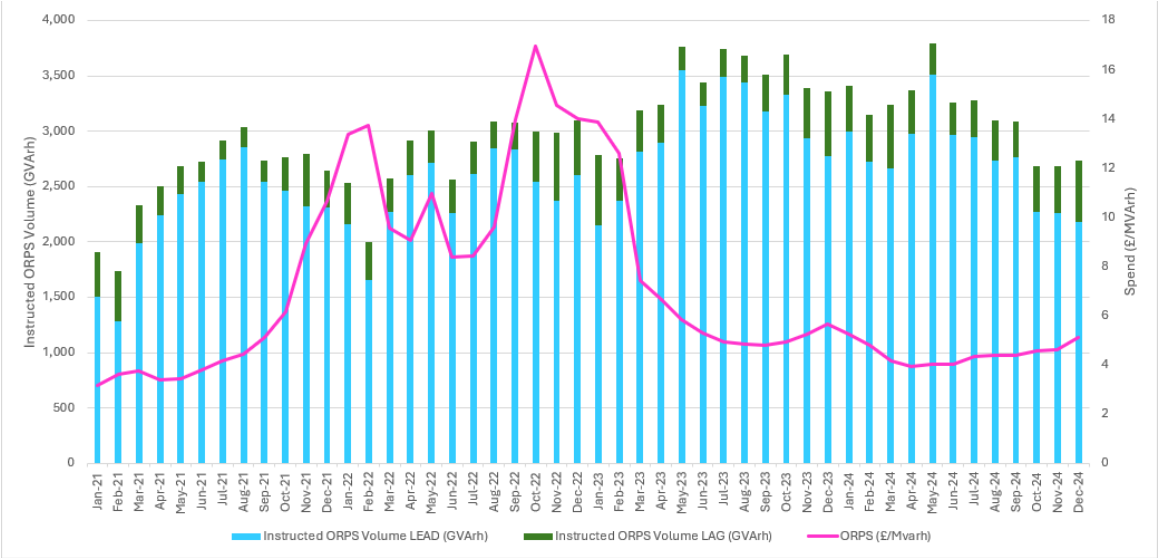


Figure 1 Profile of lead and lag dispatch instructions (GVArh) and the cost of the existing ORPS (£/MVArh)

Although the unit rate of reactive power £/MVArh has dropped from the 2022 peak in line with the gas price, the existing approach remains problematic as it does not provide a technology specific cost-reflective compensatory payment rate. This factor reinforces the necessity for a comprehensive review and update of the ORPS payment methodology.

The project commenced at the beginning of 2025 and has followed a rigorous, multi-stage approach aligned with the core criteria of the project, presented in the remainder of this report. It is now entering its final phase, with this final report summarising the findings of this work for public release.

2.2 Criteria of a new payment methodology

The key criteria considered for the identification of a new ORPS payment methodology which includes:

- **Comply** with the CUSC core payment principle that is only to compensate ORPS SPs for their variable costs directly incurred by SPs for the provision of reactive power.
- **Fairness**: Ensure fairness to both ORPS SPs and end consumers.
- **Proportionality**: Payments should be proportionate to the actual provision of ORPS by SPs.
- **Robustness**: Create a mechanism that is resilient and not affected by high volatility as much as practicality possible. The variables considered as part of the new mechanism should remain suitable and available over the long term.
- **Transparency**: Make both the payment process and supporting data transparent to allow SPs to forecast revenue.
- **Simplicity**: Ensure the methodology structure is straightforward and easy to understand.
- **Inclusivity**: Make the approach applicable to all existing technologies and also future ones.

The scope of work addresses the reform of the ORPS payment methodology following the dispatch of SPs, while the dispatch process itself is not included within the scope.

2.3 Summary of the work

2.3.1 Early Engagement

Initial discussions with multiple parties were held to gather insights for the new payment mechanism. Interviews with five TSOs worldwide were conducted, and the main findings are summarised in Table 1.

TSO	ORPS equivalent mechanism
AEMO (Australia)	No compensation
Elia (Belgium)	Market base: Pay-As-bid but regulator can prevent excessive bidding
ERCOT (Texas)	No compensation
RTE (France)	Capability payment + utilisation payment + penalty system
Svenska (Sweden)	No compensation, but developing a new approach based on Tariff linking to selected "voltage pathfinder" projects

Table 1 List of Overseas TSO Interviewed

Subsequently, 1-to-1 meetings were also held with 8 x SPs covering 11 generation technologies for discussions of their views on the existing ORPS payment method. The key feedback received from the SPs during meetings are summarised in Table 2.

Strength of Existing ORPS	Weakness of existing ORPS
• Simple • Applicable to all technologies • Same rate for all Service Providers (fair to SP) • Utilisation payment (fair)	• Expensive to end consumers • Single rate – not cost reflective • Lack of transparency of some parameters • Gas price driven formulae

Table 2 SPs engagement key feedback

2.3.2 Development of Options

Based on the early engagement, several design features corresponding to the key elements, such as payment basis or potential variables of the new mechanism, were identified as shown in Table 3.

Design features	Design Features Values
Payment Basis (type)	• Fixed tariff • Market-based • Hybrid • No compensation
Payment Measurement	• Utilisation based on Metered Volume (MVArh) or • Capability based on declared MVAr
Tariff structure	• Single rate for all technology or • Multiple rates depending on technology types
Market-based	• Pay-as-Bid or Pay-as-Clear
Locational factor	• All GB or regional
Tariff Cap & Floor	• With or without Cap & Floor
Penalty	• With or without Penalty

Table 3 Design Features

The identified 10 options are presented in table 4. They were evaluated in collaboration with NESO project team using the following staged approach:

- An initial screening - qualitative assessment, and
- A quantitative evaluation of the shortlisted two options.

The screening of the 10 possible options was based on criteria presented in the previous Section 2.2 and through multiple workshops held with NESO project team.

The key decision/justifications associated with each of the option are presented in Table 4.

#	Options	Key Decision/Justification
1	No compensation model	• Considered unfair and unacceptable to SPs in GB • Potentially contravenes the existing charging principle in the CUSC, which states that payments should be sufficient to cover the variable costs incurred by SPs • SPs may seek to recover their costs through the active power market, which lacks transparency and would still result in some form of indirect payment by end consumers
2	Existing model with no changes	• Does not address the underlying issues (i.e. linked to volatile wholesale gas prices. Not proportionate to all technologies as many of them are not gas-fired generation) • The unit rate has been high in recent years, which contravenes the existing charging principle in the CUSC, that states that payments should be sufficient to cover the variable costs incurred by SPs
3	Fixed tariff – capability payment with a single rate	• Reactive power demand is locational in nature; therefore, it is considered unfair to SPs and end users to compensate all SPs based on their available capability rather than the actual MVArh volume delivered. This is because some SPs may provide significantly greater volumes of reactive power than others due to their geographical location • Capability payment is not reflective of utilisation
4	Fixed tariff – utilisation payment with a single rate	• Single rate is not proportionate, it will result in over or under compensation for some technologies and end consumers • Potentially contravenes the existing charging principle in the CUSC, which states that payments should be sufficient to cover the variable costs incurred by SPs
5	Fixed tariff – utilisation payment with different / multiple rates	• Best alignment with CUSC charging principles to cover the variable costs of SPs and provides the greatest end consumer value • Improved fairness to SPs and end consumers
6	Market-based mechanism – pay-as-bid	• Not considered suitable for a mandatory system security service with regions of low liquidity • Potentially contravenes the existing charging principle in the CUSC, which states that payments should be sufficient to cover the variable costs incurred by SPs, as bid price is normally higher than the actual cost incurred by SPs for the provision of ORPS

7	Market-based mechanism – pay-as-clear	• Disadvantages are similar to option 6
8	Hybrid tariff – fixed tariff with capability and utilisation payments – single rate	• Similar to option 3, payment on capability is deemed a disproportionate remuneration mechanism • A hybrid pricing formula largely increases the level of complexity in implementation and ongoing operations • Remuneration deemed disproportionate due to challenge of balancing capability and utilisation payments across a range of system conditions • Potentially contravenes the existing charging principle in the CUSC, which states that payments should be sufficient to cover the variable costs incurred by SPs
9	Hybrid tariff – market-based (pay-as-bid) tariff with a backup fixed tariff with utilisation payments	• Disadvantages are similar to option 6 • Not considered suitable for a mandatory system security service with regions of low liquidity • Potentially contravenes the existing charging principle in the CUSC, which states that payments should be sufficient to cover the variable costs incurred by SPs • A hybrid pricing formula largely increases the level of complexity in implementation and ongoing operations
10	Hybrid tariff – market-based (pay-as-clear) tariff with a backup fixed tariff with utilisation payments	• Disadvantages are similar to option 9 • Pay-as-clear further incurs overcompensation problem

Table 4 Options Evaluated

As a result of evaluation, the single rate with utilisation payment (Option 4) and multiple rates with utilisation payment (Option 5) were the front two runners that were further analysed.

In order to ensure the single rate option would not be linking to any wholesales power price or gas price (a major disadvantage of exiting methodology), DNV has generated a number of choices (or formula) for unit rate setting in Option 4. These choices are:

1. Reset / Re-based the unit rate of existing ORPS payment by eliminating all the annual adjustments affected by abnormal events
2. Budget sharing: a fixed monthly budget to be shared by the SPs according to the volume shares of the total utilisation
3. Link the unit rate to the UK Government approved retail price tariff

4. Link the unit rate to the alternative source of reactive power supply such as designated pathfinder project for voltage stability
5. A blended (weighted average) unit rate derived from the multiple rate option

Table 5 below presents the pros and cons of each of the above variant of the single rate with utilisation payment option.

Choices	Descriptions	PROS	CONS
1. Recalculate the initial value of existing ORPS for year 0	• This option is based on the extrapolation of the existing ORPS tariff trend, without considering abnormal peaks • Replacing RPI by Consumer Price Index (CPI) [since the year 2015=100%] • Removing the abnormal PPI figures due to single incident [conduct linear regression to have an adjusted PPI]	• Similar to current regime but reset the initial value with a lower value	• This approach does not reflect the actual variable costs incurred by the SPs
2. Locking the total expenses of NESO for Revenue Sharing	• The unit rate is calculated based on pre-announced NESO ORPS expenses divided by the actual metered volume • E.g. if the announced ORPS payment is £12m in Jan, the utilisation in Jan is 10m MVArh, then each would be £1.20 per MVArh. If the utilisation is then 20m MVArh, the unit rate is readjusted to only £0.60 per MVArh (as budget is fixed)	• Top-down approach, high controllability on total ORPS expenses • High transparency to SP and to end consumers • Encourage SP to provide more reliable ORPS service	• The latest total ORPS expenses have been distorted by the historical high gas prices (see Figure 1) • This approach does not reflect the actual variable costs incurred by the SPs
3. A fixed % in the standard retail price approved by the Gov.UK	• Assume each year, Gov.UK will approve a standard retail electricity price (e.g. 24.40p / kWh in T-1 year, and the total sales is 285 TWh in T-1) • A fix % of this rate is allocated for the ORPS expenses in year T. Based on the estimated utilisation volume of year T, set the unit rate of the new ORPS (single rate for all technologies)	• Strong linkage of the network services expense to the approved standard retail price • No additional index is required for adjusting the unit rate	• The unit rate can go up and down due to the MVArh utilisation forecast, then it may require a balancing fund to stabilise the under/over spending on ORPS due to variations of the utilisation volume • The unit rate still does not reflect the actual variable costs incurred by the SPs
4. Value approach (i.e. the alternative cost for NESO to source the reactive power)	• Find a value from the other sources of the reactive power (e.g. pathfinder project, commercial contract offers), convert it into an equivalent £ per MVArh (which is the alternative cost) to set the initial value • NESO can select a portfolio of alternative sources to have a blended equivalent unit rate £ per MVArh	• If the price of alternative source is fair to the end consumer, then setting it for fixed tariff initial value should also be fair	• The pathfinder projects or commercial contract offers may be higher than existing ORPS tariff rate • ORPS is an obligatory service, and no profit should be considered

5. Referencing to the (Blended) LCOE cost of each technology	• Using the DESNZ LCOE figures • Calculate a blended cost for all variable O&M cost of all technology • Taken the actual utilisation volume of each technology in previous year • Initial vale = weighted average of (the Variable Cost of per technology x previous year utilisation distribution)	• It links to the variable costs of the SPs per technology • A blended value can better reflect the system-wide average cost per unit MVArh	• Blended cost means a single rate applies to all SPs regardless of the technologies • Majority of SPs would be either over-compensated or undercompensated • ORPS is an obligatory service, and no profit should be considered

Table 5 Pros and cons of each choice

Following a further evaluation of the shortlisted two options, i.e. option 4 and 5, it was opined that in general, there is no suitable choice for a single rate that can fulfil the objective of cost reflective and fair to both the SPs and the end consumers and avoid over/under compensation. Therefore, the Single Rate option was rejected for the modelling stage and the multiple rates a single rate per technology type (Option 5) was selected as the selected option.

2.4 The Selected Option

2.4.1 Underlying data

DNV undertook research to identify data that could support the objectives of the project, in particular the variable costs of reactive power provision of the service providers according to the CUSC payment principles. The research covered publicly available sources including university and government related institutions.

This research pointed to the DESNZ LCOE data on the basis that:

- It provides a comprehensive cost breakdown that include the variable cost items: a) Variable O&M cost and b) fuel cost for reactive power provision
- These costs are provided for a wide range of the technologies as considered by NESO for this project
- The cost data are based on defined assumptions considering plant operating life, their capacity and efficiency
- The data set is maintained and revised at regular intervals, DESNZ publishes their report at regular intervals (every 3-5 year) and on ad hoc basis when new data sets are made available (e.g. as per request from SPs)
- The approach and the associated data are independently reviewed by third parties before being published.

It includes long term projections in 5-year intervals (from 2025 until 2040) which increase the relevance of the data for long term application. However, in the context of this work, some data processing of the LCOE data is required on the basis that the provided variable O&M costs are expressed in £/MWh, and the project extrapolated these to identify £/MVArh basis to make them applicable to reactive power.

The LCOE data has been proposed as the mechanism's baseline data as it is the most appropriate public data available which has been identified. There are some generalisations it makes which should be noted:

- The data is based on current projects notified to DESNZ, as can be expected older installation may have variances due to design and wear and tear
- For each technology, there is no single set of costs that are reflective of the wide range of actual costs associated with the assets in as given category, as these costs can be affected by numerous factors such as project size
- While initial use of DESNZ's data has been for policy making, the LCOE data is still relevant to the context of ORPS, as it provides the most comprehensive source of data which covers variable costs for different technologies.

It should be noted that where the LCOE data does not cover a technology's generation costs, DNV have used their expertise to perform a reasonable extrapolation to provide a value for each technology within the project's scope. Industry may find opportunity for further refinement subsequent to the project's conclusion.

2.4.2 Details of formula

2.4.2.1 Overarching formula

The overarching structure of the formulae to be adopted for each technology is presented in equation 1

$$Monthly\ Payment\ for\ a\ SP_m = \sum_{i=1}^{n}(Unit\ rate\ _m \times Volume_i \times Factor\ X_i \times Factor\ Y_i) \quad \text{equation (1)}$$

In the proposed option, payment to SPs will still be done on a monthly basis based on the delivered volume, which is the combination of lead and lag reactive power delivered by a SP over a settlement period.

The payment for a particular month will be the sum of the SP contribution during all the settlement period of that month, hence the sum of 1 to n.

For each settlement period, the payment is the **unit rate** applicable to the technology of that SP multiplied by the **volume delivered** during that settlement period.
The **Factor X and Y** in this equation are the same as those in the existing ORPS mechanism.

2.4.2.2 Unit Rate formula

The monthly unit rate of a technology is based on the monthly indexation of the **Initial Unit Rate** for that technology, as shown in equation (2).

$$Unit\ Rate\ _{(m)} = Initial\ Unit\ Rate \quad \times \frac{CPI_m}{Initial\ CPI_{(1)}} \quad \text{equation (2)}$$

Where CPI_m is the forecasted CPI value of the month m that is announced before the start of the month m. In the existing method, forecasted RPI is used ahead of the delivery month. In new method, CPI is used instead. Please also see section 2.4.3.3 for details of the update to the proposed mechanism.

The Initial Unit Rate of a technology is derived from the **LCOE Variable O&M cost** and, where applicable, fuel cost, see equation (3).

Initial Unit Rate = Converted LCOE Variable O&M cost (0)+ Converted LCOE fuel cost(0) to MVArh basis equation (3)

The **LCOE Variable O&M cost** is originally calculated by DESNZ as £/MWh, it is proposed to convert it to £/MVArh for ORPS (see Conversion process section below). This ***Converted LCOE Variable O&M cost*** is calculated for the revised ORPS year 0 – when the new mechanism will start and it is presented in section 2.4.2.3.1.

Some technologies need fuel to provide ORPS i.e. cost of additional energy loss. It is proposed to use 1% of the fuel cost in the LCOE report to account for this, this corresponds to the **Converted LCOE fuel cost** in equation (4).

Converted LCOE fuel cost(0) to MVArh basis = LCOE fuel cost x 1% equation (4)

The justification for the proposed 1% is presented in the assumptions section.

The **Initial Unit Rate** is calculated for year 0, when the new mechanism will start. It is then indexed to account for inflation until the new LCOE report is released as per the equation (2).

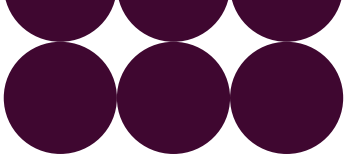
Why CPI?

In the existing ORPS methodology, RPI is used for the monthly unit rate adjustment. The forecast RPI rate is issued by the UK Government on a monthly basis.

In the LCOE report, DESNZ uses the Gross Domestic Product (**GDP) deflator,** which is issued by the UK Government typically on quarterly basis, to adjust the overall LCOE values across revisions of their LCOE reports.

However, for the new ORPS unit rate monthly adjustment, the **CPI index** is proposed.

- CPI is a weighted or geometric mean of a group of typical consumer goods and services, which more accurately represents variable O&M costs such as labour and wear and tear, while RPI is an unweighted or arithmetic mean of a group of consumer goods and services but also includes luxury products, mortgage interest payments, council tax, etc.
- GDP deflator focuses on domestic goods and services. It measures the whole economy change and is commonly used for infrastructure cost adjustments.



- The RPI and CPI are indexed monthly, whereas the GDP deflator is usually adjusted annually.

CPI is widely and increasingly adopted for the adjustment of the public utility services. NESO has adopted CPI indexing for some other network services. For the new ORPS unit rate, to reflect the variable O&M costs monthly adjustment, CPI index is more suitable.

In the equation (2), the CPI adjustment is based on the forecasted CPI index value at the month m divided by the CPI value at the year 0 set for the CPI indexation as per the UK Government calculation and as already used in some NESO services, such as Pathfinder Phase 3 as defined in Schedule D, section A.5[1].

2.4.2.3 Application of the formulae

To derive the new ORPS rate applicable for each technology at year 0, when the new mechanism will apply, a two-step conversion process is required.

- Stage 1: Conversion of the LCOE Variable O&M cost in £/MWh into £/MVArh
- Stage 2: Indexation of the new rates from the "real price" year used in LCOE to the starting year 0 of the revised ORPS.

The sequence in which the steps are applied does not affect the final outcome; indexation to year 0 (step 2) can be performed before converting to £/MVArh, and the result will remain unchanged.

These two processes are described in the following sections.

2.4.2.3.1 Stage 1: Conversion process for £/MVArh

The LCOE Variable O&M costs are based on the provision of MWh, while the reactive power generation MVArh is not explicitly included and needs to be estimated. To estimate the cost for MVArh, it is assumed that wear and tear is driven by total current i.e. apparent power.

The provision of reactive power (MVAr) increases the apparent power that would be used for the provision of active power (MW only), and therefore a direct alignment of the MW cost with the equivalent MVAr.

It has been assumed that the cost of the provision of reactive power is proportional to the variable O&M £/MWh cost, which can be done by adjusting the ratio of reactive power over apparent power.

For example, if Q increases from 0 MVAr to 20.3 MVAr that is equivalent to 0.98 lag power factor, the resulting reactive power to apparent power (Q/S) ratio is 19.9% as illustrated in Table 6. It is considered that the incremental cost to provide 20.3 MVAr is 19.9% of the original cost (which is the variable O&M MWh cost).

[1] 09.b Stability Phase 3 - General Terms Comparison v3 to v4.docx

To finalise the conversion process, it is proposed to consider the entire power factor range application to each technology.

In the Grid Code, non-synchronous SPs need to produce reactive power in the range of either 0.95 lead/lag, while for synchronous SPs, the power factor range is from 0.95 lead/0.85 lag (Synch)[2].

The average of the Q/S ratio is then calculated for each of the power factors as shown in Table 6.

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%**

Table 6 Power factor Conversion Table

Due to the asymmetrical requirements of the power factor operational range in the Grid Code, differentiation between lead and lag volume is required. A 50:50 ratio has been

[2] This range is based on the CC clause, please see the assumptions section for discussion with the relevant ECC clauses

assumed between the lead and lag operation (see further detail in the Assumption section of this report).

For non-synchronous SPs with a symmetrical range (+/-0.95), the final conversion ratio is calculated as follows:

$$Non - Synch\ conversion\ ratio = 0.5\ \times 19.6\% +\ 0.5\ \times 19.6\% = 19.6\%$$ equation (5)

For example, for onshore wind that has a variable O&M cost of £6/MWh, the Converted LCOE Variable O&M cost to be used in equation (3) is £6 x 19.6% = £1.176 per MVArh.

For synchronous SPs with an asymmetrical range (+0.95 & -0.85), the final conversion ratio is calculated as follows:

$$Synch\ conversion\ ratio = 0.5\ \times 19.6\% +\ 0.5\ \times 34.9\% = 27.25\%$$ equation (6)

For example, a Combined Cycle Gas Turbine (CCGT) that has a variable O&M cost of £2 /MWh, the Converted LCOE Variable O&M cost to be used in equation (3) is £2 x 27.25% = £0.545 per MVArh.

2.4.2.3.2 Stage 2: Indexation of the new rates to Year 0

The LCOE cost values for each technology are established on the "real price" of a certain year (dependent upon when these costs are first introduced and adjusted by DESNZ). For example, in the latest report published in 2023, costs are based on 2021 prices, and the costs need to be indexed to the year 0.

LCOE cost values use the GDP Deflator as a means of indexation. In order to ensure consistency between the various LCOE variable costs for all technologies, it is proposed to index the original LCOE Variable O&M costs and the LCOE fuel cost up to the year 0 using the GDP Deflator.

For example, the nuclear LCOE costs were only published in a previous LCOE 2016 report using the 2014 real price. In order to align these nuclear costs with the other technologies published in the LCOE 2023 report using the 2021 real price, adjustment with GDP deflators on nuclear costs from 2014 to 2021 is needed, in order to calculate the nuclear LCOE 2021 real price. The calculation is shown in Table 7 below[3].

[3] GDP_Deflators_Spring_Statement_March_2022_update.xlsx

Year	GDP Deflator (2021 =100 base)	Year-on-year change (%)	Nuclear LCOE O&M cost (£/MWh)	Nuclear LCOE fuel cost (£/MWh)
2014 (2014 original Real Price)	87.295	1.6	5.00	5.00
2015	87.743	0.51	5.03	5.03
2016	89.407	1.9	5.12	5.12
2017	91.035	1.82	5.21	5.21
2018	92.855	2	5.32	5.32
2019	94.727	2.02	5.43	5.43
2020	100.01	5.58	5.73	5.73
2021 (2021 targeted Real Price)	100	-0.01	5.73	5.73

Table 7 Cost alignment for Nuclear

For example, if the new ORPS methodology is aimed to be introduced in Jan 2026, the latest LCOE variable O&M costs £/MWh or the converted £/MVArh, which are based on the 2021 real price, will need to be adjusted by applying the GDP Deflator from 2021 to Jan 2026, using equation (7) below.

$$Unit\ Rate(2026) = Unit\ Rate\ (2021)\ x \sum(1 + GDP\ Inflator\ i) \quad \text{equation (7)}$$

Where *i* is the GDP inflation % p.a. from year 2021 to 2026.

2.4.3 Update to the proposed mechanism

2.4.3.1 Indexation

As mentioned in section 2.4.2.2, after the year 0, it is proposed to use CPI indexation of the new ORPS unit rates monthly adjustment. It applies to both the converted Variable O&M costs and converted fuel costs in £/MVArh unit, until such time as the new LCOE report is published or DESNZ proposes updated costs & assumptions.

2.4.3.2 When a new LCOE report is published

When new LCOE costs and assumptions are published, it is proposed to update the ORPS rates and fuel costs with the new variable O&M and fuel costs. This results in calculating the rates for a new Year 0 by applying the two-stage process presented in section 2.4.2.3.

This is illustrated below in Figure 2. In this illustration, it is assumed that a new LCOE report is published in Sept 2029 using 2027 real prices covering the LCOE figures for years 2030, 2035 and 2040. Then updated ORPS unit rates would be applicable from Jan 2030.

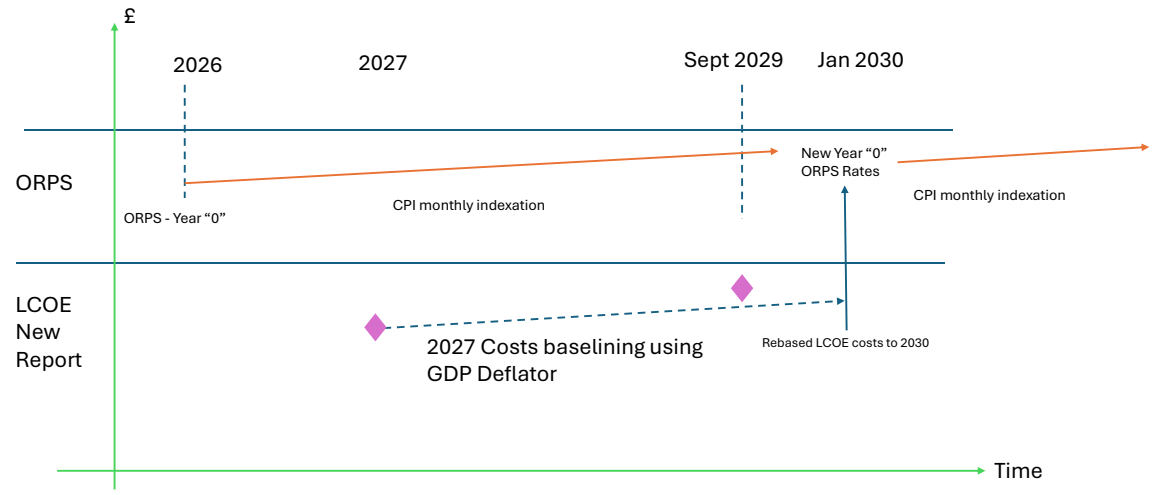


Figure 2 Illustration of ORPS rate re-baselining from new LCOE Data

2.4.3.3 Unit rate announcement

To assist SPs in forecasting their ORPS revenue for the month ahead, NESO will announce a forecasted CPI value prior to each month "m" used for indexation adjustment of the unit rate of each technology. Then, the announced unit rate of each technology will be adopted for the ORPS payment at month "m". The exact timeline of rate announcements and the settlement billing would be similar to the existing ORPS arrangement. This will be finalised at a later stage prior to implementation of the new methodology.

2.4.3.4 Managing new technologies

When new technologies begin providing mandatory reactive power services, a scenario may occur where a newly deployed technology is not listed in the payments table and/or LCOE data. Under this scenario, it is advised that this is managed through the code modification process.

2.4.4 Proposed new rates

The rates associated with the new mechanism (with 2021 price values) are presented below in Table 8 for synchronous generation technologies and in Table 9 for non-synchronous generation technologies.

Synchronous Generation Technologies								
Technology	**Unit (2021 real price)**	**Nuclear**	**Pumped Storage**	**Large Scale Hydro Storage**	**CCGT (H-Class)**	**OCGT (400MW, 500hrs)**	**Dedicated Biomass**	**Landfill Gas**
LCOE Variable O&M	£/MWh	5.730	12.730	7	2	1	7	10
LCOE Fuel Cost	£/MWh	5.730	34.370	0	43	68	38	0
New Unit Rate without Fuel	£/MVArh	1.561	3.469	1.908	0.545	0.273	1.908	2.725
New Fuel cost	£/MVArh	0.057	0.344	**0**	0.430	0.680	0.380	0
Initial Unit Rate (2021 price)	£/MVArh	**1.619**	**3.813**	**1.908**	**0.975**	**0.953**	**2.288**	**2.725**

Table 8 Proposed new rated for Synchronous Generation technologies

The Nuclear and Pumped Storage values in the above table are the "aligned" rate to 2021 price (from the original LCOE data using the GDP Deflator rates in the Appendix B of the 2023 LCOE report). For Nuclear plant, the variable O&M cost was £5, and the fuel cost was £5 (2014 real price). For pumped storage the 2016 variable O&M was £41.10 but this included a £30/MWh for pumping water (2014 real price), that has been reallocated to reflect the "fuel cost", therefore the 2016 LCOE data is assumed to be £11.10 for variable O&M costs and £30 for the fuel costs(2014 real price), and then indexed to 2021 values.

Non-synchronous Generation Technologies						
Technology	**Unit (2021 real price)**	**Onshore Wind**	**Offshore Wind (excl OFTO)**	**Large Scale Solar**	**BESS**	**Interconnector**
LCOE Variable O&M	£/MWh	6	1	0^	NA	NA
LCOE Fuel Cost	£/MWh	0	0	0	NA	NA
New Unit Rate without Fuel	£/MVArh	1.176	0.196	1.176	1.176	1.176
New Fuel cost	£/MVArh	0	0	0	0	0
Initial Unit Rate (2021 price)	£/MVArh	**1.176**	**0.196**	**1.176^**	**1.176***	**1.176***

Table 9 Proposed new rates for non-synchronous Generation technologies

Note: * BESS and Interconnector technologies are not yet incorporated in the LCOE report. The rate of Onshore Wind is assigned to them (see the Assumptions section).
^ Variable O&M cost of large scale solar is set as zero in the LCOE report; to avoid zero payment, the rate of Onshore Wind is also assigned to Solar due to their similar inverter-based technology design (see the Assumptions section).
When these technologies included in LCOE data in the future, their associated rates would need to be re-baselined using this new data in order to ensure consistency.

2.4.5 Assumptions

The proposed payment mechanism is based on the following assumptions

- LCOE data
    - Pumped storage has high variable O&M costs (£41.1/MWh). It is proposed to split with £30/MWh (for pumping water) allocated to "fuel cost" and the remaining £11.1/MWh for the actual Variable O&M costs. Opportunities for refinement are being explored with DESNZ are in progress to ensure the split of pumping costs as fuel costs in the ORPS formula is cost-reflective.
    - Containerised Battery Energy Storage System (CBESS) and Interconnector cost not yet covered in the report. Similar to other renewable technologies, they are inverter based; therefore, they are assumed to have similar wear and tear, consequently it is recommended to adopt the value of O&M of Onshore Wind (£6/MWh).
    - Large Solar: £0/MWh for variable O&M. Having consulted with DESNZ, due to the lack of sufficient operational data for large scale solar in 2021, their variable O&M cost could be grouped into fixed O&M. it is proposed to adopt the Onshore Wind value (£6/MWh) as inverter-based technology, until DESNZ updates the data in the next LCOE report.
    - Onshore Wind (£6/MWh) Vs Offshore Wind (£1/MWh). Offshore Winds' Variable O&M cost is lower due to the grid interface substation (and export cable) already being part of the OFTO asset (which is beyond the metering point).
    - Nuclear - Figure not included in the latest LCOE 2023 report. Nuclear costs are in the 2016 report. No further costs have been updated in subsequent reports due to the long construction phase (c.10 years) for nuclear projects. It is proposed to do GDP adjustments to obtain the present value during implementation. NESO are engaging with DESNZ to clarify the assumptions used in this work, including whether refuelling and decommissioning costs are included in the LCOE costs.
- CPI indexation (monthly) of the initial converted unit rate (including both variable O&M and fuel costs) between LCOE report revisions
    - The non-synchronous SPs have a zero fuel cost, so CPI only applies to the adjustment of the variable O&M cost.
    - For synchronous SPs (e.g. CCGT, pumped storage) whose fuel costs may vary with the market situation, CPI monthly adjustment to the fuel cost is simple, reasonable and prudent. In case of extreme fluctuations of fuel costs (under exception events), the present code process can be used to raise a defect and propose a code change (see section 3). It is understood that DESNZ would update the LCOE report if there were any significant changes to the cost components (not just fuel cost).

- Use of the GDP Deflator to align LCOE costs up to the starting year 0.
- Conversion of LCOE cost from (£/MWh) to (£/MVArh) using power factor.
- Conversion of LCOE cost from (£/MWh) to (£/MVArh) – evenly operate lead and lag – relevant for Synchronous unit.
- Estimation of fuel costs for the production of 1 MVArh that is 1% of the cost of producing 1 MWh. This is based on experimental work carried out by DNV with the generator for a TSO in Europe, where losses were measured for various power factors and different levels of active power. The losses measurements ranged from 0.2 to 0.6 %. Therefore, in the proposed methodology, 1% of the fuel cost (MWh) is assumed as the additional cost is associated with the heat loss to produce a MVArh rate.
- The volume of lead and lag reactive power varies over time, and the compensatory unit rate is the same for both, hence an arbitrary equal ratio of 50% lead and 50% lag has been assumed. It is proposed that lead and lag are treated in the same manner because ORPS is a mandatory requirement, which therefore requires equal access to both the lead and lag capability, and the design reflects this. Additionally, as a mandatory service, ORPS should reflect the cost-of-service provision and not the needs of the system. This assumption is used for calculating the MWh to MVArh conversion rate, particularly for technologies with an asymmetrical power factor range, such as synchronous machines. For these technologies, since the lagging capability requirement exceeds the leading capability requirement in grid code, this 50:50 ratio is beneficial to SPs as the conversion ratio (%) of the variable O&M costs is based on the maximum power factor value of these ranges. For non-synchronous SPs, the lead/lag ratio does not influence the calculation, since the sum remains at 19.6%. In all cases, using the power factor boundaries of the grid code requirements for converting MWh to MVArh is considered a conservative approach for SPs, as they are usually dispatched at a power factor closer to unity, with some reserve reactive power capability to support potential fault scenarios.
- NESO will continue to produce, publish and monitor its monthly Reactive Default Payment Rate report. If any inconsistencies are flagged, NESO will amend as required.

2.5 Validation by PLEXOS model

2.5.1 Purpose of PLEXOS modelling

Following the selection of the most suitable option, the multiple rate one per technology, a PLEXOS model was built in order to provide an illustration of this new mechanism as a form of validation of the proposed payment methodology for a sample network. This illustration was based on a simplified network model incorporating some projections of

reactive power demand and generation mix up to 2030. These projections were extrapolated from existing GB network data. Due to the level of simplifications considered as part of this model, the results of these simulations were only considered for internal consideration and not for evaluation purpose.

This model incorporates the 11 unit rates. These figures were put into the PLEXOS model together with the historical ORPS utilisation data and the energy market projection from Future Energy Scenarios (FES) report to simulate the forecasted system reactive power requirements. The reactive power volumes were shared among each technology based on a generation mix that aligns with NESO projection by 2030.

Two variants of that multiple rate option were further considered as part of this modelling exercise:

- Multiple rate: one rate per group. In this variant, two groups of technologies and associated rates were considered: synchronous and non-synchronous SPs
- Multiple rate: one rate per technology. In this variant, it is proposed to adopt one rate per each of the eligible technologies.

2.5.2 Modelling strategy

The PLEXOS simulations forecasted the potential compensation that could be incurred from 2026 up to 2030 using the new schemes and benchmarked against the current ORPS mechanism. This analysis was conducted in stages, as shown in Figure 3.

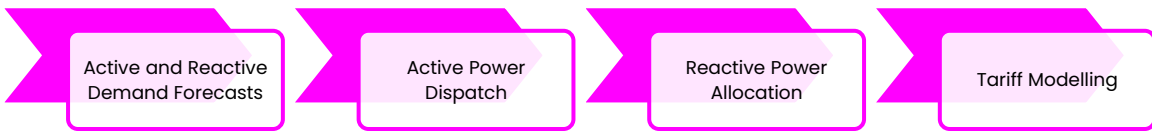


Figure 33 PLEXOS Modelling Approach

The above steps are defined as follows:

- Step 1: Active Power and Reactive Power Forecast
    - In the first phase, a standard economic dispatch was performed in PLEXOS using the underlying generation mix, active power demand, and load profiles based on the FES scenario “Energy Engagement”. A projection of

both leading and lagging reactive power was generated, as illustrated in Figure 4.

- Technical parameters for power stations and storage systems were derived from the European Network of Transmission System Operators for Electricity (ENTSO-E) standard data.
- Commodity and CO_2 prices were sourced from the FES database.

- Step 2: Active power dispatch in a simplified network (single node)
  - The active power dispatch was carried out for the entire period from 2025 to 2030, with a half-hourly resolution.
  - This dispatch data was then used across all three tariff schemes (the existing ORPS and the two variants of multiple rates mentioned above) to constrain the reactive power capabilities of the various technologies.
- Step 3: Reactive power dispatch among all technologies
  - According to each technology active power P to reactive power Q (P/Q ratio) curve minimum capability requirement in the ORPS regime:
    - +/- 0.95 for non-synchronous generations,
    - -0.85 (lag) and +0.95 (lead) for synchronous generations.
  - Set the volume boundaries of leading or lagging reactive power provision based on the total active power allocation to individual technology type.
  - Set caps the monthly reactive power contribution of each technology based on historical data from 2023–2024.
- Step 4: ORPS tariff modelling
  - Input the initial unit rate of each technology and apply the monthly adjustment formula for the projection of unit rates from 2026-2030.
  - Summarize the annual total payments to individual technology and overall payments.

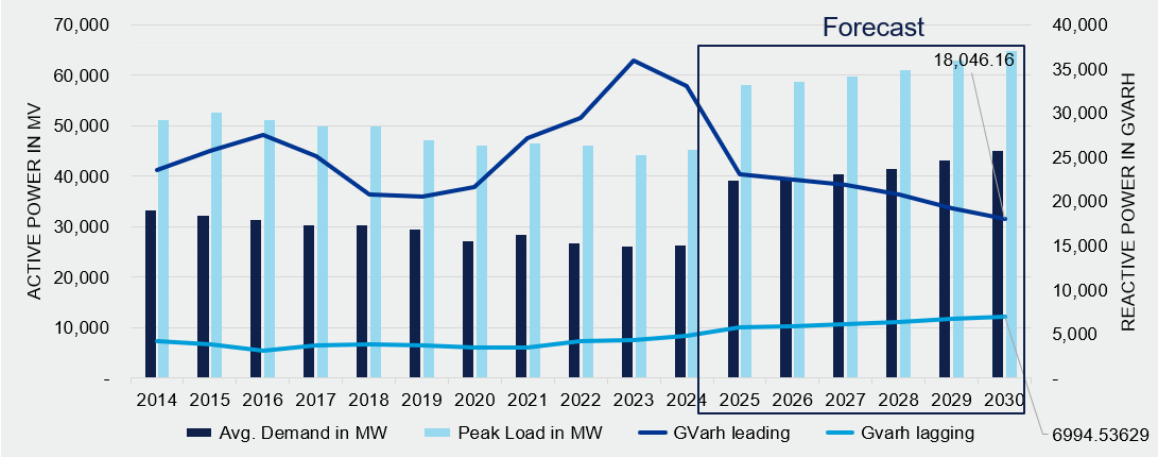


Figure 4 Projection of Reactive Power up to 2030

The reactive power demand projection in Figure 4 is based on the FES[4] which has predicted that there will be noticeable increase in energy demand (MW) that consequently is expected to reduce the requirement on leading reactive power. Adjustments have been made to ensure a reasonable portion of reactive power demand is allocated to the based load generation (e.g. Nuclear) according to their historical active and reactive power (P/Q) ratio. These model limitations were believed to be acceptable for estimating the reactive power volumes through 2030 across various technologies since the purpose of this modelling is to provide an indicative illustrative baseline for comparing compensation under two proposed options and the existing ORPS mechanism.

The projection of volume per group of technologies and specific technologies are presented in Figure 5 and Figure 6 respectively.

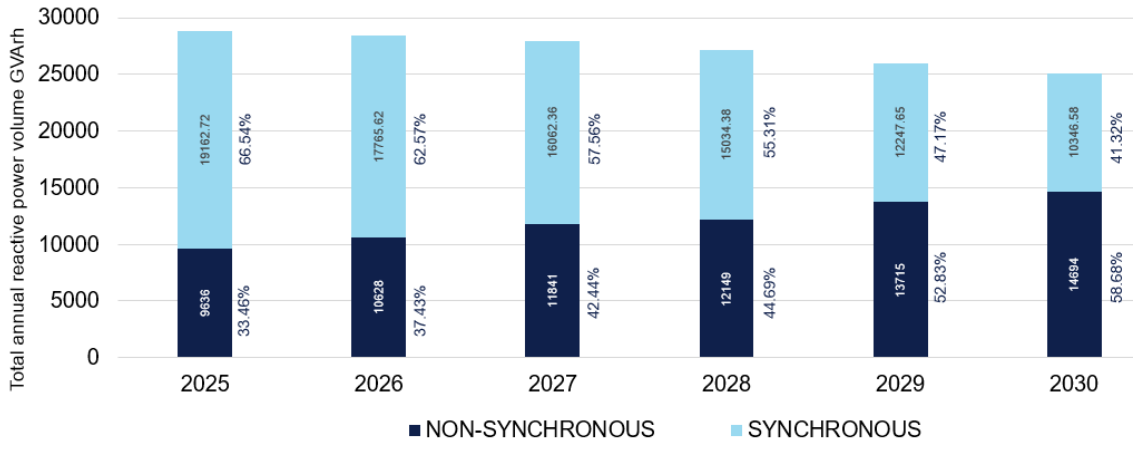


Figure 5 Projection of volume for Synchronous and non-synchronous technologies up to 2030

[4] Future Energy Scenarios (FES) | National Energy System Operator

Note: network development and availability of reactive power supplied from potential passive / static reactive equipment across the network, i.e. Transmission owner reactive power assets, are not considered in the PLEXOS simplified model.

The level of synchronous generation considered in these simulations is derived from historical GB value for 2025. For the following years, the maximum reactive power contribution of each technology is derived in a proportional manner to its active power share which is based on arbitrary dispatch participation, and may result in a slightly more inflated share of synchronous generation units than may be expected, but this modelling is indicative and based on a simplified model.

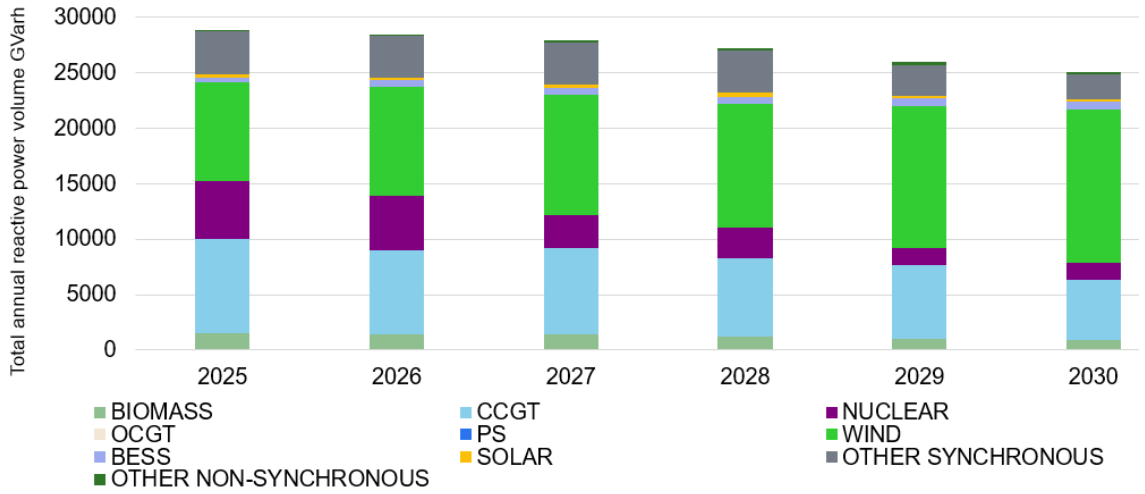


Figure 6 Projection of volume for different technologies up to 2030

In the above graphs, the "Wind" type includes both onshore and offshore, "Other Synchronous" includes diesel, gas reciprocating engines, waste, gas CHP and hydrogen CHP, and "Other Non-Synchronous" includes interconnectors and marine.

After simulations and review with the NESO team, the "multiple rate - one rate per technology" was identified as the selected option over the variant of one rate per group. It was found that within the group, there are different generation types and the costs associated with providing ORPS vary. That means one rate per group cannot be cost reflective as some generation types would be over-compensated, and some would be under-compensated if the payment rate were set by the average across them. This will result in unfairness to some SPs that could end up being compensated less than their estimated costs.

2.5.3 PLEXOS Model Limitation and Constraints

- It is a simplified network modelling with single node of demand and supply
- The model does not consider

- Regional voltage constraints that increase the reactive power demand in some specific part of the network is not represented as the model has a single node
- Interdependencies with neighbouring countries
- Potential network development and increase of static reactive compensation assets from transmission asset owners
- DNO embedded generations' contribution to voltage stability
- "Wind" in model represents both Offshore and Onshore wind and use the LCOE offshore wind price
- Interconnectors are included in "Other generations" in the ORPS Utilisation Data.

2.6 Public engagement

On 25 September 2025, during the industry engagement webinar, the proposed mechanism was presented followed by a Questions & Answers (Q&A) session. The Q&A have been published on the NESO website[5].

The key points from this engagement are listed below:

- Power factor requirements vary by technology, project location, size, and compliance demonstration (i.e. European Connection Conditions (ECC) User or the Connection Conditions (CC) User in Grid Code). For example, the reactive power capability requirement in the Grid Code differs for projects in Scotland and for Type B projects under 10MW.
- Dispatch process: Compensation depends on both unit rate (£/MVArh) and metered volume (MVArh). This project addresses only new unit rates for the ORPS payment methodology, and current dispatch management is outside this project's scope. However, any areas that have been identified in the course of the project as potential areas for improvement, and which are outside its scope, will be considered as appropriate.
- Opportunities to refine the LCOE data (highlighted in this report) are being addressed by NESO through ongoing engagement with DESNZ. Any changes to the mechanism will be addressed as part of the Business-As-Usual (BAU) code modification process. Some zero MW technologies, for example synchronous condenser/compensator, are not currently considered in the revised ORPS

[5] https://www.neso.energy/about/innovation/our-innovation-projects/alternative-approaches-orps-methodology

payment methodology. NESO will undertake further analysis to consider these technologies in the new mechanism.

3. Next Steps



Next Steps

This report is the first public release with details of the proposed new ORPS payment methodology recommended by this project to supersede the existing methodology. The proposed methodology is multiple rates, with a single rate per technology type and using the LCOE data to set the initial unit rate of each technology. This differs from the existing ORPS payment mechanism which is a single rate for all technologies.

With regard to the LCOE data and assumptions, and the opportunities to refine some of the LCOE data highlighted above, continuous engagement with DESNZ and relevant parties on their processes for updating the LCOE data is needed. This will ensure the LCOE data is cost reflective. Initial industry feedback received during webinar held as part of this project, is also discussed in this report.

The final recommendation will be integrated into the CUSC modification process which provides plenty of opportunities to discuss the proposed solution further with industry representatives and refine the proposed new mechanism if required. During this process, the feasibility of implementing the proposed new ORPS payment methodology will be further investigated.

Alongside the new mechanism, a review point is already built into the design of the proposed methodology, that being the refreshed LCOE data from DESNZ. This will serve as an opportunity to reconsider the impact of the new LCOE data, and the rates can be adjusted accordingly.

Additionally, any areas that have been identified in the course of the project as potential areas for improvement, and which are outside its scope, will be considered as appropriate.

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