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Executive Summary

This report explores the purpose of Static Var Compensators (SVCs) in power systems, their treatment in Transmission Network Use of System (TNUoS) charges and whether this is consistent with relevant Connection and Use of System Code (CUSC) objectives. SVCs play a vital role in maintaining voltage stability and providing dynamic reactive power compensation, ensuring the efficient operation of the National Electricity Transmission System (NETS).

Currently, the costs of SVCs are borne entirely by the generator, despite SVCs fulfilling reactive compensation requirements of benefit mainly to the Electricity System Operation (NGESO) rather than the wind farm itself. The current regulatory regime requires the developer to bear the cost of the SVC installed at the onshore substation. During the OFTO (offshore transmission owner) transaction, the SVC is transferred to the OFTO owner via the Final Transfer Value (FTV), which is the basis for the Tender Revenue Stream (TRS). The TRS, including the cost of SVCs, is fed into the TNUoS offshore local circuit tariff paid by the generator for the lifetime of the asset. However, an offshore wind farm's point of connection (POC) is offshore, and the SVC is not used for compliance at this POC. Consequently, the generator pays, via the TNUoS offshore local circuit tariff, for an asset located within the onshore transmission system that is used for wider network management rather than wind farm compliance. Given the high capital costs associated with SVCs, which can reach tens of millions of pounds, the existing allocation of capital costs and TNUoS charges is inconsistent with CUSC objectives and potentially detrimental to the investment level and growth of the renewable energy sector.

The report proposes to socialise the costs associated with SVCs, distributing the costs more equitably among all users of the power system. This approach would recognise the broader benefits that SVCs provide to the grid and encourage the further development and integration of offshore wind farms into the NETS.

Key findings from the report include:

- Reviews of SVC operation and the current market for reactive power services in Great Britain (GB), showing the lack of compensation provided to offshore wind farms despite the large investment in SVC-based reactive power capability.
- A review of the additional wider TNUoS costs and reduced offshore wind development costs as a result of this proposed change.
- A review of grid documents, highlighting that socialising SVC costs across the wider network is more consistent with guidelines.

Based on these findings, we recommend the following:

- Re-evaluate the allocation of SVC costs, with the recommendation to socialise these costs through the wider onshore TNUoS tariff, updating NGESO's "Offshore Local TNUoS Tariff Setting Template" accordingly.
- Amend the CUSC, according to a single modification, to enable the proposed cost allocation changes, ensuring a more equitable distribution of SVC costs that reflects their value to the entire power system.

Introduction and Purpose of this Report

The purpose of this report is to explore the purpose of Static Var Compensators (SVC), their treatment in Transmission Network Use of System (TNUoS) charging and whether this is consistent with relevant Connection and Use of System Code (CUSC) objectives. In this report, we focus on their role in providing reactive power services in the context of offshore wind farms and the CUSC, while we argue that socialising these costs through the wider onshore TNUoS tariff is not only more consistent with CUSC objectives but also beneficial for promoting renewable energy investments.

SVCs are indispensable components in power systems, especially for offshore wind farms, as they provide reactive power compensation and help maintain grid stability. Reactive power is crucial for ensuring voltage levels remain within acceptable limits and is required for the reliable and efficient operation of power systems. Currently, all HVAC-connected offshore wind farms require SVCs to meet grid code compliance concerning reactive compensation.

However, the costs of these crucial devices are high, with prices reaching tens of millions of pounds. Due to supply chain constraints and global factors, the costs of SVCs have recently seen significant further increase. At present, SVCs are considered part of the Offshore Transmission Owner (OFTO) asset and are included in the asset transfer process as part of the Final Transfer Value (FTV), which is the basis for the Tender revenue Scheme (TRS). Following asset transfer, the generator pays the OFTO for the SVCs through the offshore local circuit tariff.

It is crucial to emphasise that SVCs provide services to the grid rather than the generator or wind farm, given that an offshore wind farm's point of connection (POC) is offshore, and the SVC is not utilised for compliance at this POC. Despite the fact that these services provided by SVCs have a broader benefit to the power system, the wind farm still bears the financial burden of the SVC.

This situation raises questions about the fairness and efficiency of the current cost allocation approach. It is argued that since SVCs provide valuable services to the grid as a whole, the costs associated with these devices should be socialised and distributed among all users of the transmission network through the wider TNUoS tariff.

Moreover, the change in approach and socialisation of SVCs is consistent with CUSC objectives because it promotes a more equitable distribution of costs and benefits. By allocating SVC costs more equitably among all users of the National Electricity Transmission System (NETS), it facilitates effective competition in the generation of electricity while also encouraging the development of renewable energy sources, and potentially lowering energy prices. This aligns with the CUSC's objectives of fostering a competitive market, supporting the transition to a low-carbon energy system, having charges that accurately reflect the costs incurred by transmission licensees, lowering energy bills and carbon emissions, and providing UK jobs to facilitate the increased number of offshore wind projects. The remainder of this report analyses the operation of SVCs in offshore wind farms, the reactive power market in the context of offshore wind, and sets out the CUSC modification proposal to implement the proposed change.

OFTO Transfer Process

The OFTO transfer process involves several steps:

1. Development and Construction: The offshore wind farm developer designs, builds, and commissions the transmission assets necessary to connect the offshore wind farm to the onshore grid. These transmission assets typically include subsea cables, onshore and offshore substations, and converter stations if HVDC transmission is used.

2. OFTO Tender Process: Once the offshore transmission assets have been commissioned and are operational, the developer sells these assets. This is done through a competitive tender process which is administered by Ofgem, with the winning bidder becoming the OFTO for those assets. The aim of this process is to drive down the cost of offshore transmission and ultimately reduce the cost of offshore wind energy.
3. Transfer of Ownership and Operation: The OFTO takes over the ownership, operation, and maintenance of the transmission assets. The OFTO receives a regulated income via the TRS over a 25-year period for providing these services, subject to meeting certain performance requirements. The TRS drives the local circuit/substation TNUoS, which is borne by the generator.

The ownership boundaries of the wind farm/generator, OFTO, and onshore network operator are shown in Figure 1.

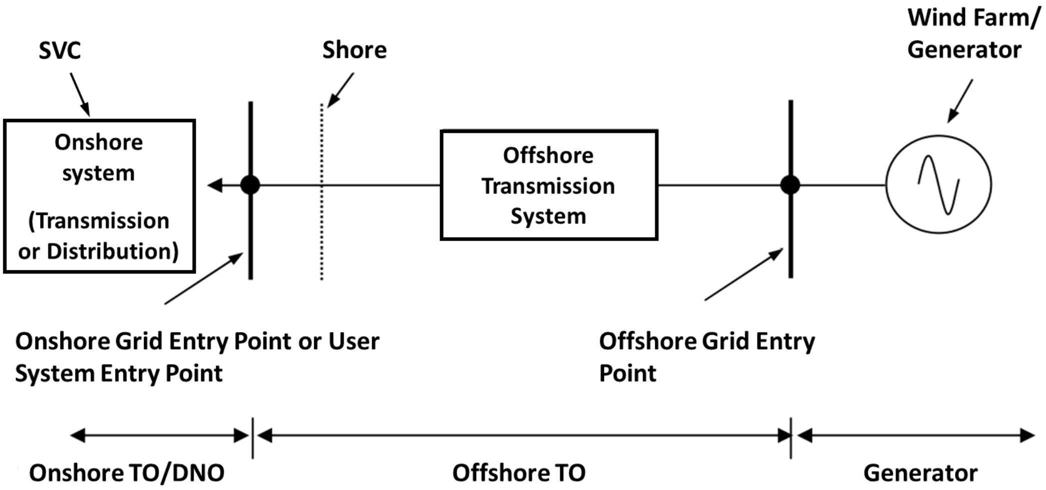

Figure 1 - Designation of offshore wind farm boundaries [1].

During the asset transfer process, assets are broken down into various categories, as shown in Table 1 below. The primary categories that are paid for by the generator are the local substation and local circuit tariffs. Currently, the SVC is included within "Reactive Equipment" as part of the Local Circuit Tariff. The proposal is that this would be moved into the "Onshore Substation" category, which is paid through the wider TNUoS tariff, and picked up by all users.

Table 1 - National Grid Offshore Asset Cost Allocation Guidance

Tariff	Asset Category	Description	Payments
LOCAL CIRCUIT TAR-IFF	Cable Assets	All electrical assets between the cable sealing ends of transmission voltage cables owned by the OFTO which run to/from a substation/plat-form, including jointing and the cable sealing ends, excluding assets defined as Reactive Equipment.	Generator
	Reactive Equipment	All Reactive Compensation Equipment and asso-ciated electrical and non-electrical equipment up to (but excluding) the last piece of switchgear prior to the connecting busbar, Cable Asset (as	

		defined below), or tertiary transformer winding. Currently, this includes the SVC. In the proposed modification, the SVC is excluded from this category.	
	Harmonic Filtering Equipment	All Harmonic Filtering Equipment and associated electrical and non-electrical equipment up to (but excluding) the last piece of switchgear prior to the connecting busbar.	
	HVDC Converter Station	HVDC Conversion Equipment and all connecting electrical assets between (but excluding) the adjacent AC disconnector and the connecting HVDC Cable Assets.	
LOCAL SUBSTATION TARIFF	Transformer Assets	Each transformer not classified as Reactive Compensation or Auxiliary Supply Equipment and all associated assets between (but excluding) the adjacent disconnectors. This includes items such as cooling equipment and bushings.	Generator
	Switchgear Assets	Any Circuit Breaker, Disconnector, or Earth Switch.	
	Platform	Any assets associated with or residing on the offshore platform, not specified in other asset/cost categories. These include the basic floating platform structure, housing of the electrical equipment, electrical equipment, protection equipment, buildings, fire prevention, transportation facilities (e.g., helipads), environmental protection equipment, and the cost of any associated civil works.	
	Auxiliary Supply Equipment	Any electrical equipment with the sole purpose of supplying power for the operation of the offshore platform or onshore substation	
ASSET DEPENDENT	Contingency	The level of contingency included within the asset transfer value in relation to each category and location of potential use (onshore/offshore) as individual entries.	Asset-Dependent
	Spares	Any spare equipment as a cost associated with the asset which it will replace	
	Other costs (for very limited use if at all)	The value of any assets/costs, with a transfer value in excess of £50k, which cannot be allocated to any of the categories listed.	
ETUoS	DNO Costs	Any payments made to DNOs included within the asset transfer value that relate to works on distribution networks to facilitate the offshore project including connection and deeper reinforcement works.	Generator
ONSHORE	Onshore Substation	Any assets associated with or residing within the onshore substation, not specified in other asset/cost categories. These include the cost of the substation structure, fencing, housing of the electrical equipment, electrical equipment, protection equipment, buildings, fire prevention,	All Transmission Users — payment split from ~ 77% demand & ~

		transportation facilities (e.g. roads), environmental protection equipment, and the cost of any associated civil works. In the proposed modification, this category will include the SVC.	23% generation

Operation of SVCs in Offshore Wind Farms

SVCs are essential components in wind farms, especially for offshore installations, as they provide dynamic reactive power compensation and contribute to the overall stability of the electricity network. Reactive power compensation is crucial for maintaining voltage levels within acceptable limits, ensuring the reliable and efficient operation of power systems. In the current status quo, the generator develops and builds the Offshore Transmission System, including financing power compensation devices such as SVCs, and transfers it to the OFTO following completion. The generator will then have to make payments throughout the lifetime of the offshore wind farm for use of the transmission assets, including the SVC.

The wind farm must adhere to the Grid Code's technical, design criteria, and performance requirements (Issue 6, revision 16 – 5 January 2023) [2] concerning reactive power capability and both steady-state and transient voltage control. Specifically, ECC.6.3.2.5.1 sets out the requirement that the wind farm must:

- Maintain zero reactive power transfer at the Onshore Interface Point (IP) at all active power levels under steady-state voltage conditions, with a steady-state tolerance no greater than 5% of the Rated MW.

This requirement is met by using a combination of offshore generator reactive power capability and on load tap changer capability on the offshore platform.

ECC.6.3.2.4.4 sets out the requirement that the OFTO must:

- Supply the rated MW output between the limits of 0.95 power factor lagging and 0.95 power factor leading at the onshore interface point, with the former requiring absorption of Vars from the grid and the latter requiring the injection of Vars.
- The reactive power limits defined at rated MW at lagging power factor will apply at all active power output levels above 20% of the rated MW output as defined in Figure 2.
- The reactive power limits defined at rated MW at leading power factor will apply at all active power output levels above 50% of the rated MW output as defined in Figure 2.
- The reactive power limits will reduce linearly below 50% Active Power output as shown in Figure 2.
- These reactive power limits will be reduced pro rata to the amount of plant in service.

These requirements are met through the use of an SVC. In some configurations, wind turbine generators (WTGs) may provide some contribution to the onshore reactive power requirements in combination with the SVC.

Fixed shunt reactors (or potentially a combination of fixed shunt reactors and switched reactors) are used by generators to compensate for cable capacitance in offshore wind farms, with reactance switched in or out in configurations using switched reactors as the output from the WTGs changes.

The SVC is then used to achieve the ±0.95 p.f. Grid Code requirement at the Onshore Interface Point under steady state and dynamic conditions. The absorption or delivery of reactive power from the SVC is continuously adjusted to meet the Interface Point requirement for reactive power flow.

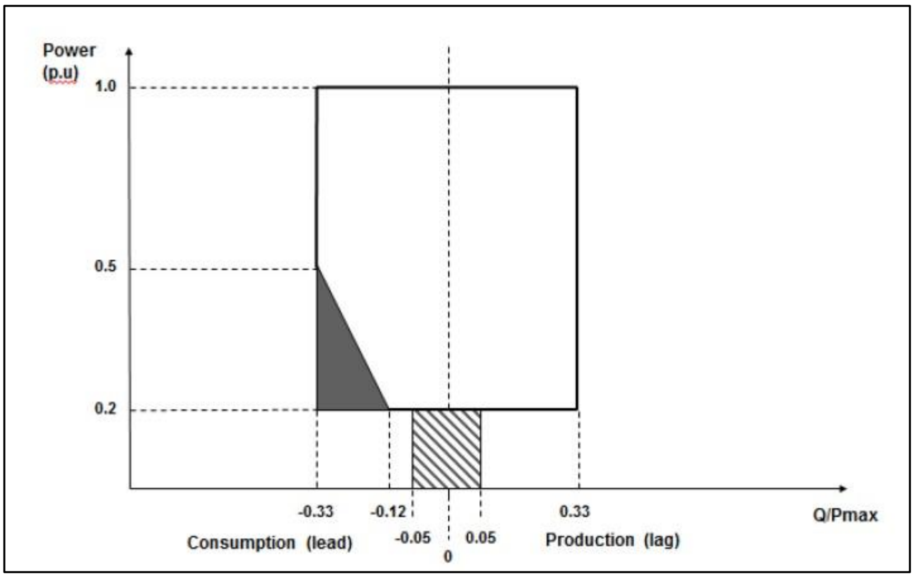

Figure 2 - Reactive power capability requirements of an offshore wind farm [2].

The onshore reactive power requirements are placed on the OFTO rather than the wind farm because it is not efficient for the wind farm to comply with the normal generator dynamic reactive compensation requirements offshore due to the long offshore export cable lengths. As the obligation for these reactive compensation requirements is onshore, there is no clear rationale as to why the charges for the required onshore reactive compensation equipment currently flow through to the generator.

Reactive Power Market in the Context of Offshore Wind

To provide further evidence for a more equitable distribution of costs associated with SVCs within offshore wind farm systems, we have investigated the reactive power market and the trend in requirement for reactive power services. This section provides technical evidence that highlights the inconsistency of the current approach with CUSC objectives, and the unfair burden currently placed on generators for paying for the SVC through the local circuit TNUoS, despite the lack of compensation received by the generator (and OFTO) and SVC utilisation for wider transmission network management rather than offshore wind compliance at the POC.

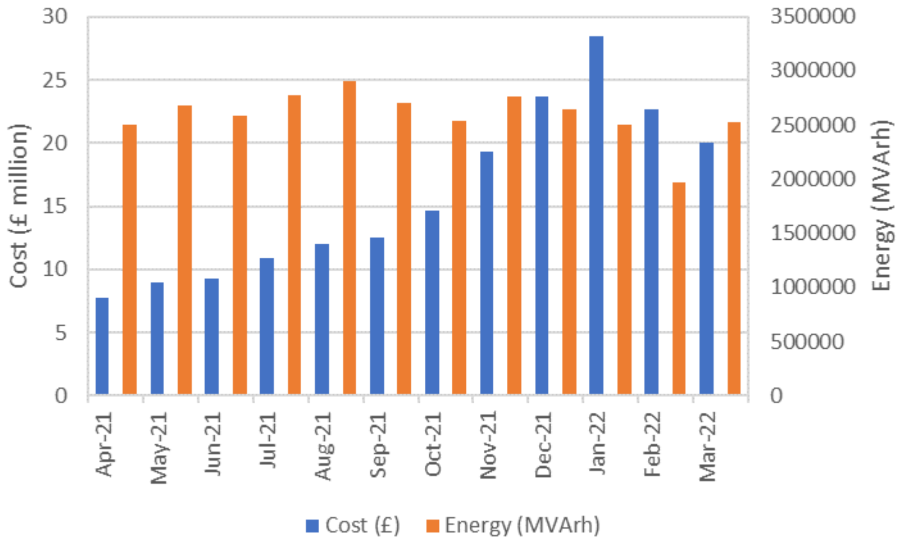

Figure 3 - Monthly cost and amount of reactive energy provision for the 2021–2022 financial year. Adapted from Monthly Balancing Services Summary report for March 2022 [3].

Based on Monthly Balancing Services Summary (MBSS) reports [3] for the past 5 financial years (April 2018–Feb 2023), the total amount paid out in each financial year was £81.73m, £64.87m, £65.07m, £190.15m, £369.02m from oldest to most recent data respectively, while total reactive energy provided was 24.61, 23.60, 26,16, 31.07, 33.85 MVArh.

It is clear from the historic data that the value and amount of reactive power services are both substantial and quickly increasing in recent years, with a 37.5% increase in reactive power provided compared to 5 years ago, while the total payments have increased over four and a half times. Despite the fact that the cost for reactive power services was driven by geopolitical, pandemic, and weather factors, overall payments will remain high due to the increasing volume of services required [4].

Supporting this historic data is the System Operability Framework's "Operability Strategy Report" for 2023 [5], which defines the operational requirements and future system needs to achieve a zero carbon electricity system by 2035 and states "more reactive power capability and utilisation are required as the reactive power requirement continues to increase and available capacity decreases". The report identifies the following drivers of increasing reactive power needs:

- Transmission circuits, which are lightly loaded, are producing reactive power and increasing voltages.
- Transmission circuits are increasingly being installed underground, which due to their close proximity, have large capacitances — producing reactive power and increasing voltages.
- Reactive power was historically consumed by distribution networks but is now produced by them — also increasing voltages.

These three drivers of reactive power production have resulted in largely inductive (lead/absorption) utilisation in recent years, as shown in Figure 4.

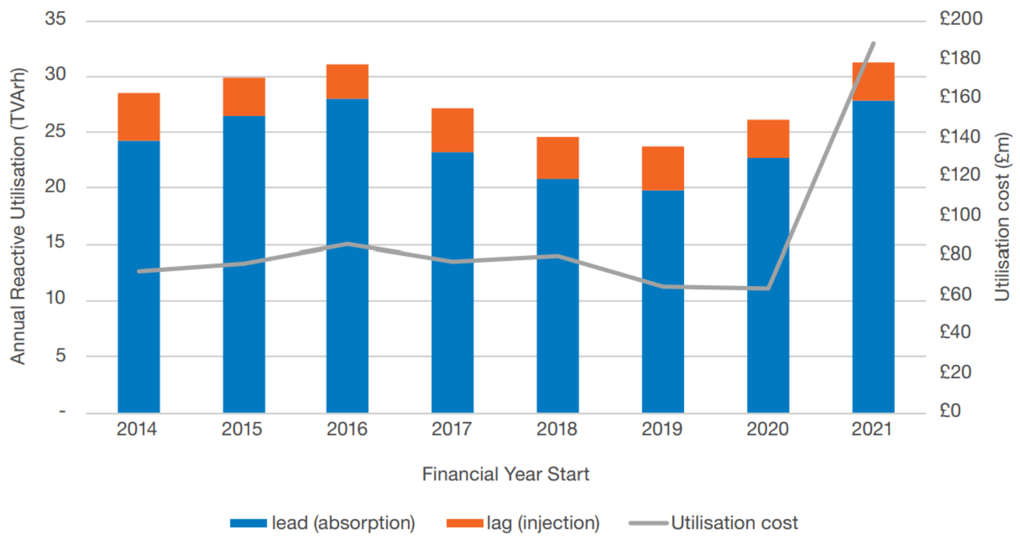

Figure 4 - Graph of annual mandatory (obligatory) reactive utilisation from 2014–2021 [5].

The mandatory/Obligatory Reactive Power Service (ORPS) is the required reactive power provision from generators above a certain size. The requirements of this for offshore wind are shown in Figure 2. The Enhanced Reactive Power Service is the additional service provided beyond the capabilities required by the grid code and are provided through tenders. Both of these services can be compensated with the payment mechanisms shown in Table 2 below.

Table 2 - Description of Obligatory and Enhanced Reactive Power Services.

	Service	Description	Payment Mechanism	Required by
Reactive Power	Obligatory /Mandatory Reactive Power	The Obligatory Reactive Power Service is the provision of mandatory varying Reactive Power output. At any given output the Generators may be requested to produce or absorb reactive power to help manage system voltages close to its POC. The provision of reactive power allows Power Factor Control and Voltage Control by the System operator.	Under the Default Payment Mechanism, National Grid pays all service providers for utilisation in £/MVArh.	Generally, all transmission connected generators over 46MW are required to have the capability to provide this service, as set out in the Grid Code
	Enhanced Reactive Power	Enhanced Reactive Power Service is the provision of: Voltage support which exceeds the minimum technical requirement of the Obligatory Reactive Power Service (including Synchronous Compensation); or Reactive Power Capability from any other Plant of Apparatus which can generate of absorb Reactive Power (including Static Compensation equipment) that isn't required to provide the Obligatory Reactive Power Service.	The Enhanced Reactive Power Service is procured via tenders. The tender allows the Generator to request: An Available Capability Price (£/Mvar/hr) and/or a Synchronised Capability Price (£/Mvar/hr) and/or a Utilisation Price(£/Mvarh). The choice of term from a minimum period of 12 months and thereafter in 6-month increments (12, 18, 24, 30, 36 months, etc,).	Any Generator of any size that can meet the technical requirements.

However, neither the offshore wind farms nor the OFTOs receive reactive power payments from SVCs, despite the heavy investment in this equipment and the significant value reactive power services provide to the electricity network. This current situation, which fails to meet the CUSC objective of charges accurately reflecting the costs incurred by transmission licensees, further highlights the necessity for a fairer approach that is more consistent with CUSC objectives when allocating SVC costs within the power system.

Proposed CUSC Modification

The cost allocation of SVCs is neither codified nor specifically mentioned in the CUSC document, and implementation of costs is thus an interpretation applied by NGESO. In order to identify the necessary modifications to the CUSC to reflect this proposed change, we have reviewed the full CUSC for any paragraphs relating to reactive power services as well as the CUSC Section 14 "Charging Methodologies" section. We have subsequently examined their relevance to this proposed change. Due to the lack of codification of SVC cost allocation, only one required change has been found. There are no other obvious changes to the CUSC other than the change proposed for the charging statement (paragraph 14.15.80). We additionally provide rationale for why changes are not required for a further ten paragraphs associated with SVC operation.

The improved facilitation of CUSC objectives arising from this change in interpretation of cost allocation includes positive impacts related to facilitating a competitive market, supporting the transition to a low-carbon energy system, having charges that accurately reflect costs incurred by transmission licensees, lowering energy bills and carbon emissions, and generating employment opportunities in the UK to accommodate the growth in offshore wind projects. However, the full description of the impact on CUSC objectives will be contained in the associated CUSC Modification Proposal Form.

Impact on Wider TNUoS Charges

The UK has set an ambitious target of reaching 40 GW of offshore wind capacity by 2030 [6]. To achieve this goal, it is necessary to add approximately 3.5 GW of offshore wind capacity each year. The number of SVCs has been estimated by considering that each SVC is assumed to cost £17.9m for 100 MVar [7], which is capable of supporting roughly 300 MW of offshore wind. This cost was arrived at by using the mid-range 100MVar SVC cost from ETYS 2015 – Appendix E [7] and inflating to pre-Covid prices in 2020 [8].

With a 3.5 GW annual increase in offshore wind capacity, 1155 MVAr of SVC capacity will be needed each year to support this expansion. As a result, the total cost of these SVCs will be around £207m per year.

To calculate the increase in the wider TNUoS tariff to recover the cost of £207m worth of SVCs, a net present value calculation has been carried out, using similar financial assumptions to those used in the CUSC for Gross Asset Value (GAV) calculations.

It is assumed that the assets have an expected lifetime of 45 years [9], and the discount rate (rate of return) is 4.00% per year [10]. Additionally, it is assumed that there are no ongoing operating and maintenance costs for simplicity. In this case, the annuity formula can be used to determine the annual payment that would recover the cost of the assets over their lifetime:

$$Annuity\ Due\ Payment\ = \frac{(Asset\ Cost\ \cdot\ Discount\ Rate)}{(1\ -\ (1\ +\ Discount\ Rate)^{-Lifetime})\cdot(1+\text{Discount Rate})}$$

$$Annuity\ Due\ Payment\ = \frac{(£207m\ \cdot\ 0.04)}{(1\ -\ (1\ +\ 0.04)^{-})\cdot(1+0.04)} = £9.6\text{m}$$

Under these assumptions, the wider TNUoS charges would increase by ~£9.6m per year, compared with the revenue base of £4.08bn for 2023/2024 [11], to recover the cost of the £207 million worth of SVCs over their 45-year lifetime. Of this £4.08bn, £3.16bn is due to be recovered by demand and 0.92bn is due to be recovered by generation. This amount will result in step increases for the next 7 years. It should be noted that this is a simplified example, and the actual calculation may involve additional factors such as ongoing costs, inflation adjustments, and regulatory considerations.

Table 3 - Estimated increase in revenue base due to SVC reallocation

Year	**Increase in revenue base**			**Increase (on £4.08bn forecasted for 2023/2024)**
	Total	Generation	Demand	
2024	£9.6m	£2.2m	£7.5m	0.24%
2025	£19.2m	£4.3m	£14.9m	0.47%
2026	£28.8m	£6.5m	£22.4m	0.71%
2027	£38.5m	£8.7m	£29.8m	0.94%
2028	£48.1m	£10.8m	£37.3m	1.18%
2029	£57.7m	£13.0m	£44.7m	1.41%
2030	£67.3m	£15.2m	£52.2m	1.65%

If the average generation and demand tariffs, as forecasted for 2023/2024, increased by the 1.65% estimated by 2030 to cover additional costs of SVCs, these tariffs would increase 20p from £11.91/kW to £12.11/kW for generation, by 9p from £5.28/kW to £5.37/kW for half-hourly metered (generally commercial), and non-half-hourly metered would remain constant at £0.25/kW (generally domestic, or smaller premises that do not have a smart meter). In terms of cost to the average end consumer, an extra 66p would be required annually, increasing the total payable due to TNUoS from £40.09 to £40.75. It should be noted that these calculations do not include any interactions with the EU Generation Cap of €2.50/MWh since the EU Limiting Regulation states that "transmission charges paid by producers for physical assets required for connection to the system or the upgrade of the connection" should be excluded from the calculation of the range, and SVCs are considered physical assets [12].

Impact on Wind Farm Development Costs

If we assume all connecting offshore wind generation up until 2030 does not pay for SVCs, the annual saving to generators for each 3.5GW connection per annum is as follows:

$$Annuity\ Saving = \frac{(£207m \cdot 0.075)}{(1 - (1 + 0.075)^{-45}) \cdot (1 + 0.075)} = £15.0\text{m}$$

Since offshore wind projects participate in the Contracts for Difference (CfD) scheme, which provides a long-term guarantee on price per MWh, these savings have the potential to reduce the CfD price by an amount equal to the annual saving. Assuming 24.5GW of offshore wind generation is added by 2030 (3.5GW a year), this is equivalent to £105.3m annual saving. Across 8760 hours in a year and assuming a 45% load factor, this annual saving is equivalent to 1.09 £/MWh. This is compared to current offshore wind CfD prices in the latest allocation round of 37.35 £/MWh.

In addition, the applicable discount rate for National Grid is significantly lower than that for wind farm developers, which leads to a net consumer saving. National Grid has a discount rate of 4.00% [10], while wind farm developers typically have a discount rate of around 7.5% [13]. Due to the difference in discount rates, it can be seen that the total saving to generators is £105.3m whereas the total increase in wider TNUoS revenue base is £66.8m. The net consumer saving could therefore be of £105.3m - £66.8m = £38.5m. This is equivalent to £1.57/kW saving per year.

CUSC Modification Analysis

The table below provides the list of CUSC clauses that have been analysed for potential required amendments.

Table 4 - CUSC Modification Analysis

Proposed CUSC Modifications			
Paragraph Number	**Potential changes (highlighted with red text)**	**Rationale**	**Change Required?**
4.1.2.3	In respect of **Generating Unit(s)** located **Offshore** where the **Obligatory Reactive Power Service** is provided to **The Company** by an **Offshore Transmission Licensee** in accordance with the **STC**, the **Mandatory Ancillary Services Agreement** shall detail the payments that **The Company** shall make to the **User** (not withstanding that the **Obligatory Reactive Power Service** is provided to **The Company** by an **Offshore Transmission Licensee.**	This paragraph is regarding provision at the offshore interface only. Thus, no modifications are required.	No.
4.1.2.9	It is acknowledged by **The Company** and each **User** that the provision by that **User** of the **Obligatory Reactive Power Service** in accordance with the terms of the **CUSC** and the **Mandatory Services Agreement** shall not relieve it of any of its obligations set out in the **Grid Code** including without limitation its obligation set out in **Grid Code CC** 8.1 to provide **Reactive Power** (supplied otherwise	Cost allocation changes will have no impact on technical requirements and the user will still need to fully adhere to	No.

	than by means of synchronous or static compensators except in the case of a **Power Park Module** where synchronous or static compensation within the **Power Park Module** may be used to provide **Reactive Power**) in accordance with **Grid Code CC** 6.3.2.	the grid code requirements. Thus, no modifications are required.	
14.15.80 (charging statement)	Offshore expansion factors (£/MWkm) are derived from information provided by Offshore Transmission Owners for each offshore circuit. Offshore expansion factors are Offshore Transmission Owner and circuit specific. Each Offshore Transmission Owner will periodically provide, via the STC, information to derive an annual circuit revenue requirement. The offshore circuit revenue shall include revenues associated with the Offshore Transmission Owner's reactive compensation equipment (excluding SVC), harmonic filtering equipment, asset spares and HVDC converter stations.	This is where we exclude SVC from TRS calculation. Potentially requires discussion of optimal definitions of equipment.	Yes
Schedule 2, exhibit 4, 3.1	The provisions of this Clause 3 implement the terms of Paragraph 2 of Schedule 3, Part I to the **CUSC** ("**CUSC Schedule**") with respect to the payments to be made by **The Company** to the **User** for the provision by the **User** from the **BM Units** of the **Obligatory Reactive Power Service**, and in accordance with Paragraph 2.1 thereof the **Parties** hereby agree to make all necessary amendments to this **Mandatory Services Agreement** so as to give effect to the provisions of the **CUSC Schedule** as amended or modified from time to time.	This paragraph is irrelevant, since it is talking about the generator. Thus, no modifications are required.	No.
Appendix 1 — Data Section A(Reactive Power)	See section for relevant tables.	This section is irrelevant, because it is for the offshore grid entry point, while the SVC is located onshore. Thus, no modifications are required.	No.
Schedule 3, Part 1, 1.1	For the purpose of this Part I and the Appendices, "**Obligatory Reactive Power Service**" means the **Mandatory Ancillary Service** referred to in **Grid Code CC** 8.1 which the relevant **User** is obliged to provide (for the avoidance of doubt, as determined by any direction in force from time to time and issued by the **Authority** relieving a relevant **User** from the obligation under its **Licence** to comply with such part or parts of the **Grid Code** or any **Distribution Code** or, in the case of **The Company**, the **Transmission Licence** as may be specified in	The referenced Grid Code CC 6.3.2 states " Offshore Power Park Modules must be capable of maintaining: "…" the Reactive Power capability (within an associated steady state tolerance) specified in the Bilateral Agreement if any	No.

	such direction) in respect of the supply of **Reactive Power** (otherwise than by means of synchronous or static compensation except in the case of a **Power Park Module** where synchronous or static compensation within the **Power Park Module** may be used to provide **Reactive Power**) and in respect of the required **Reactive Power** capability referred to in **Grid Code CC 6.3.2.** This **Mandatory Ancillary Service** shall comprise, in relation to a **Generating Unit**, **DC Converter** or **Power Park Module** compliance by the relevant **User** in all respects with all provisions of the **Grid Code** applicable to it relating to that supply of **Reactive Power** and required **Reactive Power** capability, together with the provision of such despatch facilities (including the submission to **The Company** of all relevant technical, planning and other data in connection therewith) and metering facilities (meeting the requirements of Appendix 4), and upon such terms, as shall be set out in a **Mandatory Services Agreement** entered into between **The Company** and the relevant **User**. For the avoidance of doubt, "**Obligatory Reactive Power Service**" when used in this Part I and the Appendices excludes provision of **Reactive Power** capability from **Synchronous Compensation** and from static compensation equipment (except in the case of a **Power Park Module** where synchronous or static compensation within the **Power Park Module** may be used to provide **Reactive Power**, and the production of **Reactive Power** pursuant thereto.	alternative has been agreed with the GB Generator, Offshore Transmission Licensee and The Company". The required provision of reactive power can therefore be specified in the Bilateral Agreement and does not need to be specified here. Thus, no modifications are required.	
Appendix 8, Part 3	In accordance with the terms of the **Mandatory Services Agreement**, where applicable the formulae in Section 1 of this Part 3 will be used by **The Company** to convert **Reactive Power** capability of a **Power Park Unit** at the generator stator terminals to the capability at the HV side of the **Generating Unit** step-up transformer, and the formulae in Section 2 of this Part 3 will be used to calculate the **Reactive Power** capability of the **Power Park Module** at the **Commercial Boundary**.	Commercial boundary and technical capabilities/requirements would be unchanged. Thus, no modifications are required.	No.

References

[1] Offshore Transmission Expert Group — Great Britain Security and Quality of Supply sub-group, "Recommendations for the coverage of offshore transmission networks in the Great Britain Security and Quality of Supply Standard," 2006.

[2] National Grid ESO, "The Grid Code," 2023.

[3] National Grid ESO, "Monthly Balancing Services Summary (MBSS)," 2018–2023.

[4] European Central Bank, "Energy price developments in and out of the COVID-19 pandemic – from commodity prices to consumer prices," 2022.

[5] National Grid ESO, "Operability Strategy Report 2023," 2022.

[6] UK Government, "Biggest Ever Renewable Support Scheme Opens," 2021.

[7] National Grid ESO, "ETYS 2015 - Appendix E," 2015.

[8] Bank of England, "Inflation Calculator," 2023.

[9] OFGEM, "RIIO-2 Framework Decision," 2018.

[10] National Grid, "Statement of Transmission Owner Charges," 2023.

[11] National Grid ESO, "August Forecast of TNUoS Tariffs for 2023/2024," 2022.

[12] NGESO, "Calculation of the Generator TNUoS Adjustment Tariff for the purposes of the Limiting Regulation — Guidance for 2023/24," 2023.

[13] Grant Thornton, "Renewable energy discount rate survey results — 2018," 2018.

Appendices

Appendix A: Monthly Costs and Provision of Reactive Energy for 2018—2023

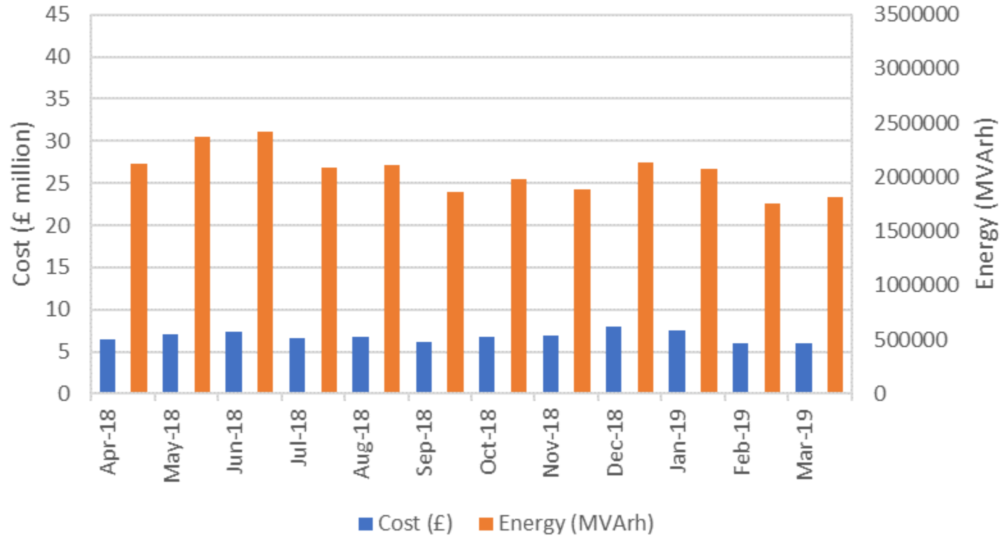

Figure 5 - Monthly cost and amount of reactive energy provision for the 2018–2019 financial year. Adapted from Monthly Balancing Services Summary report for March 2019 [3].

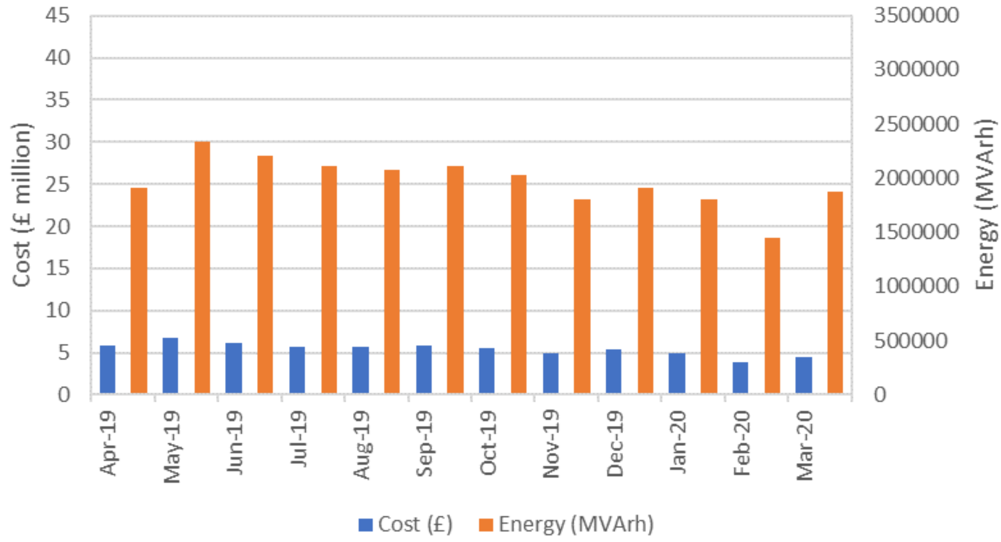

Figure 6 - Monthly cost and amount of reactive energy provision for the 2019–2020 financial year. Adapted from Monthly Balancing Services Summary report for March 2020 [3].

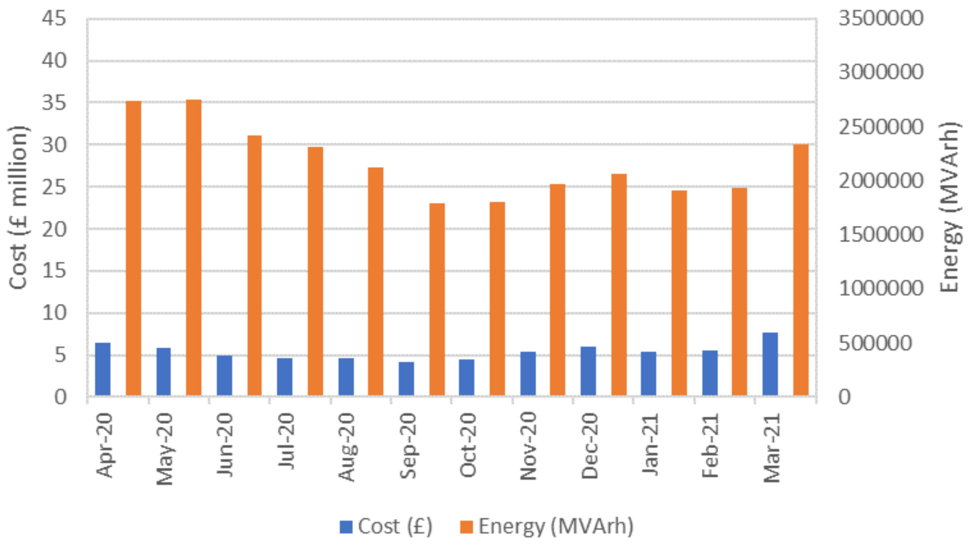

Figure 7 - Monthly cost and amount of reactive energy provision for the 2020–2021 financial year. Adapted from Monthly Balancing Services Summary report for March 2021 [3].

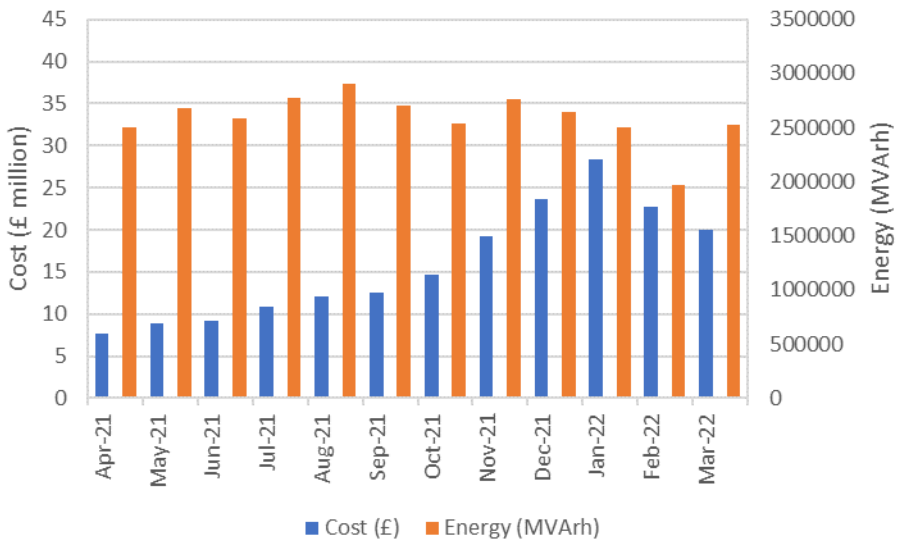

Figure 8 - Monthly cost and amount of reactive energy provision for the 2021–2022 financial year. Adapted from Monthly Balancing Services Summary report for March 2022 [3].

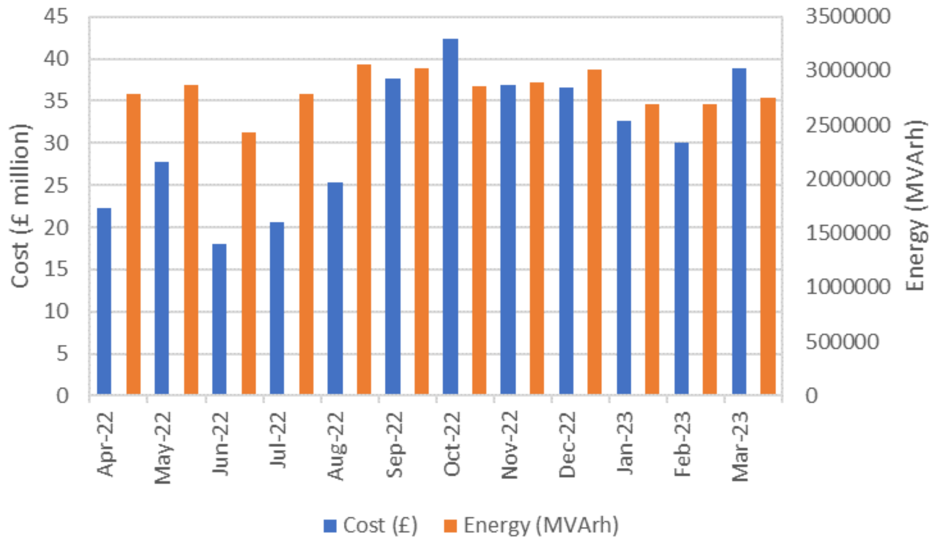

Figure 9 - Monthly cost and amount of reactive energy provision for the 2022–2023 financial year. Adapted from Monthly Balancing Services Summary report for February 2023, and March values were forecasted [3].