

Guidance Note: TNUoS charges for Offshore Generators

This note describes transmission network use of system (TNUoS) charging arrangements for offshore generators and brings together aspects of the transmission charging methodology; relevant industry codes; and the offshore transmission licence.

BACKGROUND

Offshore transmission owners (OFTOs) are responsible for providing transmission capacity for offshore users by building, operating, owning and maintaining transmission assets within a licensed area. The revenue that each OFTO is allowed to recover to fund its activities is determined by Ofgem through the offshore tender process. The allowed revenue is subsequently defined in the transmission licence awarded to the OFTO.

Each OFTO recovers its allowed revenue from National Grid under arrangements described in the SO-TO Code (STC) and OFTOs' Charging Statement, which are subject to regulatory oversight. National Grid sets TNUoS charges to recover the total allowed revenue of all onshore and offshore transmission owners from transmission users according to the TNUoS charging methodology and the Connection and Use of System Code (CUSC).

OVERVIEW OF TNUoS TARIFFS

The purpose of TNUoS tariffs is twofold: firstly to reflect the impact that transmission users at different geographical locations have on transmission costs; and secondly recover the total allowed revenue of the transmission licences. TNUoS tariffs are made up of four components. The sum of these forms the total TNUoS tariff for a generator. The table below describes each of these tariff components.

Table 1 – Description of the components of TNUoS tariffs

Component	Purpose
Wider Locational	A locational zonal tariff that reflects the cost of providing incremental capacity on the onshore transmission network.
Local Circuit	A locational nodal tariff that reflects the cost of the transmission circuits from the point of connection to the main interconnected transmission system.
Local Substation	A locational nodal tariff that reflects the cost of the transmission substation that the generator is connected to.
Wider Residual	A non-locational tariff that ensures the correct revenue is recovered from generation users.

Generators are liable to pay TNUoS charges once all transmission works to accommodate the generator have been completed. In the case of transitional offshore generators, National Grid expects this to be aligned with the transfer of the offshore transmission assets to the OFTO.

To determine a generator's annual TNUoS charge, each local TNUoS tariff component and the total wider component (locational + residual) is multiplied by a chargeable capacity. For positive tariff components, the chargeable capacity is the highest Transmission Entry Capacity (TEC) held within a financial year regardless of the generator's actual export. For negative tariff components, the chargeable capacity is based on the average of the generator's three peak exports between 1 November and 28 February each peak being separated by at least 10 days.

CALCULATION OF OFFSHORE LOCAL TARIFFS

The offshore local circuit tariff

The offshore circuit tariff recovers the cost of the transmission circuits and reactive equipment that is located onshore or offshore and owned by the OFTO. The marginal unit cost of the combined cable and reactive equipment (£/MWkm) is determined by considering the OFTO's annual revenue associated with this equipment; the export capability of the offshore transmission network; and the circuit length.

The marginal unit cost is adjusted, if necessary, by a *security factor* that reflects the electrical security provided by the specific design of the offshore network. The security factor is 1 for all offshore networks constructed with a single circuit, as the failure of this circuit will result in the deenergisation of the generator. Where additional security is provided by providing two or more transmission circuits, the security factor is determined from the relative rating of the offshore network and the generation capacity. This ratio is capped at 1.8, which is the current onshore security factor.

The marginal unit cost of the offshore network can also be expressed in terms of an *expansion factor*. This represents the marginal cost of the offshore network relative to the cost of 400kV overhead line. For example, if the expansion factor of the offshore circuit were 30, this would imply that the marginal cost of the offshore network was 30 times greater than that of an equivalent network constructed of 400kV overhead line.

The offshore local substation tariff

The offshore substation tariff recovers the cost of the offshore platform and the equipment installed upon it. The tariff is made up of three components: the platform, the switchgear, and the transformers. All assets on the offshore platform, including the platform itself, are expected to be allocated to one of these chargeable components. The unit cost (£/kW) for each component is determined by considering the OFTO annual revenue associated with that component and the rating of the component. The total substation tariff is the sum of the three components. A civils discount is finally applied, which is defined as £0.35/kW, and reflects the relative cost of civils onshore and offshore. The cost of any onshore substation owed by the OFTO is recovered through the residual tariff, except for those specific assets that are included in the offshore circuit tariff, for example, the reactive equipment.

Data used in the offshore circuit and substation tariff calculations

Information to calculate tariffs will be provided to National Grid by each OFTO for its network under arrangements described in the STC. The main data used in the offshore local tariff calculations are:

- the annual allowed revenue of each OFTO;

- ❑ the value of the assets that comprise the OFTO's network; and
- ❑ the thermal rating of assets that comprise the network.

OFTO Allowed Revenue

The allowed revenue used in the local tariff calculation is **the total allowed revenue** of the OFTO. This represents the annuitised cost of owning, operating and maintaining the offshore network and feeds into all offshore tariff calculations. Special Condition J2 of the OFTO's licence defines this as $OFTO_t$. It therefore includes:

- ❑ the OFTO's base revenue (BR_t) allowance, including:
 - the annual tendered revenue stream (TRS_t) recovering the capital cost of the offshore assets and ongoing operating and maintenance costs;
 - any post-tender revenue adjustment ($PTRA_t$) that may be required following a post-tender assessment of the efficient costs of the offshore network;
 - the adjustment for part-year funding of the OFTO (PR_t) where the OFTO only becomes responsible for offshore transmission assets part-way through the year;
- ❑ the OFTO's forecast pass-through costs (PT_t), as defined in Special Condition J3 of the offshore transmission licence, for example Crown Estate fees, licence fees, business rates;
- ❑ the OFTO's forecast any revenue adjustment necessary under its network availability incentive (PA_t), set out in Special Condition J4; and
- ❑ an amount that corrects the allowed revenue for over / under revenue recoveries from the previous year (K_t), defined in Special Condition J2.

In the first year of the generator's connection, National Grid will use the OFTO's forecast of its allowed revenue for that year. Thereafter National Grid will use the OFTO's forecast of its average annual allowed revenue over the remaining years of the NETSO's onshore price control. This will require the OFTO to take a view of the costs considered to be pass-through items and its incentive performance over a number of future years.

Offshore asset values

To determine the OFTO revenue associated with each asset category used in the local tariff calculations, the total OFTO's annual revenue is split by pro-rating the total OFTO allowed revenue according to the value of the assets. Project overhead costs associated with the construction of the local assets, for example, project management and project development costs, are included in the asset values. Project financing costs are also included when pro-rating OFTO revenue between asset categories.

The following table illustrates how assets owned by an OFTO will be treated from a charging perspective. It seeks to link OFTO assets, to local tariff components, and finally to the local circuit and substation TNUoS tariffs.

Table 2 – Assets that comprise the offshore local tariff componets

Local tariff	Local tariff component	Assets included in tariff component
Circuit	Circuit	Cable
		HVDC Converter Stations
		Reactive (onshore + offshore)
Substation	Platform	Auxiliary Supply
		Platform
	Switchgear	Switchgear
	Transformer	Transformers
Subject to GB-ECM 24 ¹	TBC - Circuit	Harmonic Filtering
	TBC - Asset dependent	Spares
Asset dependent	Asset dependent	Contingency
	Asset dependent	Other costs (excluding onshore substation)

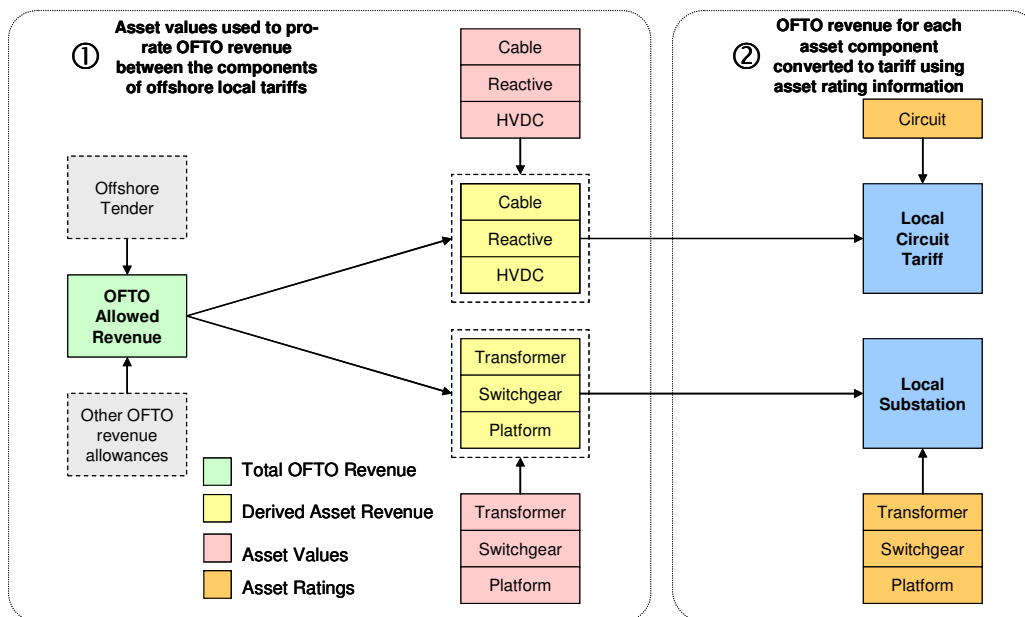
The value of the onshore substation, excluding reactive and HVDC equipment, is excluded from the determination of the offshore local tariffs and its cost is recovered through the wider residual tariff component.

Ratings of offshore transmission assets

The ratings of the offshore transmission assets are the post-fault winter continuous rating of the assets operating at nominal voltage with a unit power factor. In the case of the platform the rating is considered to be the highest of either the switchgear rating or transformer rating although this is subject to the outcome of GB-ECM 24¹.

Calculation summary / overview

The diagram below provides an overview of the information flows required to calculate offshore local tariffs.

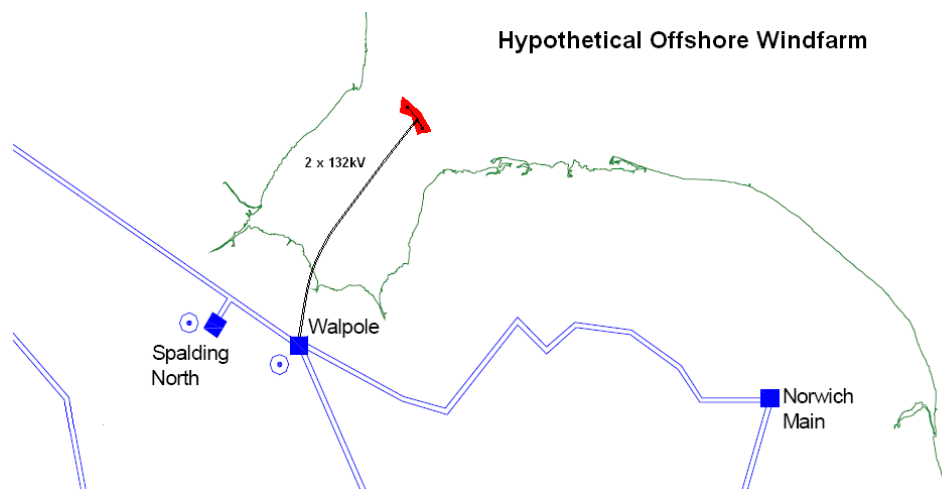


¹ GB ECM-24 proposes a number of changes to the charging methodology that, if not vetoed, will impact the local tariff calculation.

WORKED EXAMPLE

This example uses a hypothetical 230MW generator, located in the Wash, 27km from the point of onshore connection at Walpole substation, which is in generation TNUoS Zone 13. The offshore project developer is expected to transfer the offshore transmission assets worth £120m to the OFTO partway through the year on 1 October.

The connection is via a double circuit with each circuit having a rating of 130MVA. There is a single offshore platform on which the offshore substation is located. The substation comprises two 33/132kV transformers, each rated at 130MVA, and switchgear rated at 475MVA. It is also necessary for the OFTO to install reactive compensation both offshore and onshore in an onshore substation owned by the OFTO. The developer has not incurred any DNO costs.



In order to fund the purchase of these assets and the associated ongoing operating and maintenance costs, the tendered revenue stream awarded to the OFTO is £19.2m per annum². It has total pass through costs of £3.0m per annum and expects to meet is availability incentive requirements. The value of OFTO_t, representing the total annual revenue requirement of the OFTO, is:

- ❑ **£12.6m** in the first year of operation, as only half the annual tendered revenue is required when asset transfer occurs mid-year, and the pass through costs are assumed to be fixed annual costs; and
- ❑ **£22.2m** the all subsequent years, assuming that the OFTO's assumption about the availability of its network does not change.

As the annual revenue will only be revealed by the tender process, the revenue numbers presented here are purely illustrative.

The asset values used in this example are based on typical values provided to National Grid by offshore project developers following informal data requests.

² In order to determine the tendered revenue stream **prior** to the tender results being known, National Grid has estimated the annual revenue based on the total value of the offshore assets; an annuity factor of 11% (based on a 20 year asset life and a 9% return) and an allowance of 5% per annum for O&M.

The value of the assets that comprise each category of asset owned by the OFTO are described in the following table.

Table 3 – Values of offshore assets

	Value (£m)				% of total OFTO value
	Asset	Finance	Project	Total	
Cable	40.0	4.0	6.0	50.0	41.6
Reactive	5.0	0.5	1.0	6.5	5.4
Transformer	10.0	1.0	1.0	12.0	10.0
Switchgear	3.0	0.3	0.5	3.8	3.2
Platform	23.0	2.3	4.0	29.3	24.4
Onshore substation	15.0	1.5	2.0	18.5	15.4
Total	96.0	9.6	14.5	120.1	100.0

Calculation of the offshore local circuit tariff

The cable and reactive assets represent 47.0% of the total offshore asset value and therefore this proportion of the annual OFTO revenue is allocated to these assets in the calculation of the offshore local circuit tariff. In this case, £5.9m and £10.3m in the first and subsequent years respectively (i.e. in the first year 47.0% of £12.6m).

The security factor is 1.13 since there are two circuits and the total rating of these is 260MVA compared to the TEC of the generator of 230MW (i.e. 260 MVA / 230MW).

These values are subsequently used, as set out below, to determine the local offshore circuit tariff for the generator.

Table 4 – Calculation of offshore circuit tariff

		1st Year	Following Years
Circuit + Reactive Revenue (£m)	<i>A</i>	5.9	10.3
Circuit Rating (MW)	<i>B</i>	260	260
Marginal Cost (£/MW)	$C = A \times 10^6 / B$	22,764	39,807
Length (km)	<i>D</i>	27	27
Marginal Cost per km (£/MWkm)	$E = C / D$	843.1	1474.3
Expansion Constant³ (£/MWkm)	<i>F</i>	10.6	10.6
Expansion Factor*	$G = E / F$	79.3	138.7
Security Factor	<i>H</i>	1.13	1.13
Circuit tariff (£/kW)	$G \times H \times F \times D / 1000$	25.73	45.00
Circuit tariff (£/kW) (Simplified)	$C \times H / 1000$	25.73	45.00

* deriving the expansion factor is only necessary when including offshore transmission circuits within the transport and tariff model.

³ The expansion constant is reviewed at the start of each onshore price control. In all other years it is subject to an annual increase to reflect inflation. The impact of inflation is not shown in this example.

Calculation of the offshore substation tariff

The substation tariff is calculated by considering the apportioned annual revenue and rating of each substation component, namely the transformer, switchgear and platform assets. The calculation of the transformer element of the substation tariff is shown below for the first year:

$$\begin{aligned}
 &= \text{total annual revenue} \times \text{transformer cost proportion} / \text{transformer rating} \\
 &= \text{£12.6m} \times 10.0\% / 260\text{MVA} / 1000 \text{ (to convert from £/MW to £/kW)} \\
 &= \text{£4.83/kW}
 \end{aligned}$$

Similar calculations are performed for the switchgear and the platform, which are shown in the table below. To derive the final local substation tariff, the three offshore substation components are summed and the civils discount is applied.

Table 5 – Calculation of offshore substation tariff

Component	% of OFTO value	Rating (MVA)	Revenue (£m)		Tariff (£/kW)	
			1 st Year	Following Years	1 st Year	Following Years
Transformer	10.0	260	1.3	2.2	4.83	8.52
Switchgear	3.2	475	0.4	0.7	0.84	1.48
Platform	24.4	475	3.1	5.4	6.46	11.38
Sub-Total					12.13	21.38
Less discount for civils					0.35	0.35
Substation tariff					11.78	21.03

Final offshore local tariff

The final local tariff applied to the offshore generator is the sum of the circuit and substation local tariffs:

Table 6 – Calculation of final offshore local tariff

	1 st Year	Following Years
Circuit tariff	25.73	45.00
Substation tariff	11.78	21.03
Final Local tariff	37.52	66.02

Charges to the offshore generator

The onshore wider TNUoS tariff for generation Zone 13 is £3.59/kW, which includes the generation residual tariff. Accordingly, in year 1, the total tariff used to determine the offshore user's annual liability is £41.11/kW (local + wider). Based on a TEC of 230MW, this will result in an annual charge of £9.45m.

In subsequent years, the offshore local tariff is subject to an inflationary increase (through an annual adjustment to the circuit expansion constant and RPI adjustment to

local offshore substation tariff) and the onshore wider tariff (including the residual) is subject to an annual update.

FURTHER INFORMATION

National Grid has a range of information about TNUoS tariffs on its website:

- ❑ **Charging methodologies and statements of charges**
<http://www.nationalgrid.com/uk/Electricity/Charges/chargingstatementsapproval/>
- ❑ **Use of System charging methodology consultations**
<http://www.nationalgrid.com/uk/Electricity/Charges/modifications/uscmc/>
- ❑ **Forecast of onshore tariffs up to 2014/15 (Condition 5 Report)**
<http://www.nationalgrid.com/uk/Electricity/Charges/gbchargingapprovalconditions/5/>
- ❑ **Requests for the transport and tariff model**
<http://www.nationalgrid.com/uk/Electricity/Charges/transportmodel/>
- ❑ **Contact the charging team**
 - phone – 01926 654633
 - email – charging.enquiries@uk.ngrid.com