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Guide to TNUoS Charging Methodology for Offshore Generation in GB

Information I **National Grid**

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TNUoS

The Transmission Network Use of System Charges (TNUoS) allows Transmission Owners to recover the costs of building, owning and maintaining transmission assets; be they located onshore or offshore. The underlying rationale behind Transmission Network Use of System charges is that efficient economic signals are provider to Users when services are priced to reflect the cost of supplying them (CUSC 14.14.6).

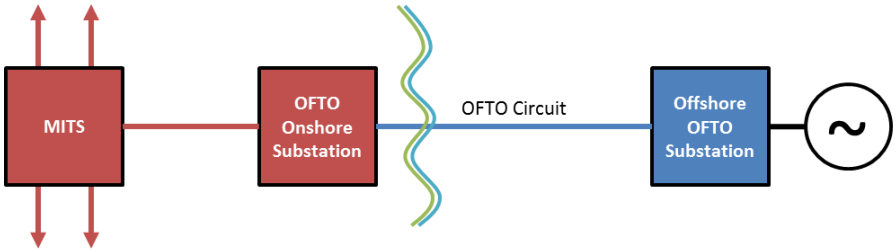
For offshore generation, TNUoS charges also recover the cost of building, owning and maintaining the transmission assets required to connect an offshore generator to the onshore transmission system. The TNUoS charge therefore recovers revenue for both the Offshore Transmission System Operators (OFTO) and for the onshore Transmission Owners (TO).

The **TNUoS Charging Methodology** is defined in Section 14 of the **Connection and Use of System Code (CUSC)**. The methodology applied to offshore generation is based on the methodology used for onshore generation; however, the specificities of the costs, design and regime for offshore generation is reflected in the charging methodology as detailed below.

Design of Offshore Connections

The criteria for offshore design are different to those for the onshore transmission network, and are defined in the (GB) Security and Quality of Supply Standard (SQSS). These criteria allow a lower level of redundancy for offshore projects. This difference seeks to partly offset the high costs of building and maintaining offshore circuits and substations.

In general under the Offshore Standard Design, an offshore generator will be connected to the transmission network via a single radial circuit, via an offshore and onshore OFTO substation:



The capacity of the OFTO circuit and the ratings of any of the equipment in the substations (e.g. transformers, switchgear) are chosen to support the connected generation, whilst generally being of standard sizes available on the market to reduce the additional costs of bespoke equipment. This can result in equipment, such as transformers, being installed that are of larger capacity than the TEC of the generator being connected.

In certain circumstances, the offshore generator will also be liable for an onshore circuit charge if the OFTO onshore substation is connected to the Main Integrated Transmission System (MITS) via a non-MITS substation. If the connection to the MITS is via a distribution circuit, then a distribution charge will also be levied.

A particular feature of the offshore single-circuit radial design is that there is no redundancy provided to the generator in the event of a circuit or other fault. As this is a known factor, and consistent with the approved position in the SQSS, the circumstances when an offshore generator is liable for compensation, known as interruption payments in the CUSC, are different to onshore generators.

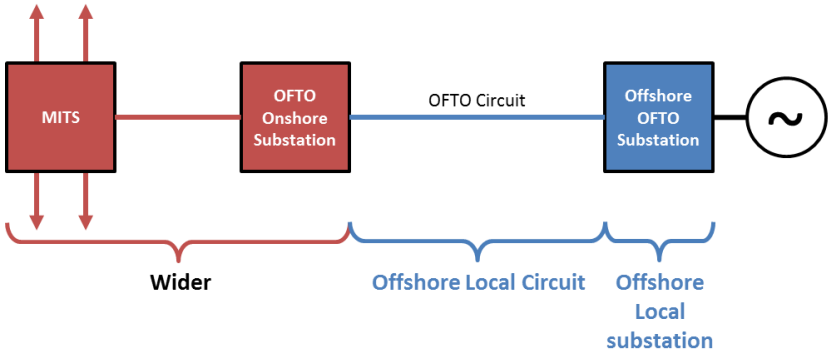
Charging Methodology for an Offshore Generator

The TNUoS tariff for an offshore generator is composed of several parts:

- The **offshore substation tariff** – related to the assets at the offshore substation, specific to the generator
- The **offshore circuit tariff** – related to the cost of the OFTO circuit, specific to the generator
- The **wider tariff associated** with the use of the Main Interconnected Transmission System

Depending on their type of connection, offshore generators may also pay for a local onshore circuit (if there is such a circuit prior to the MITS), and for connection via a distribution system.

In common with the onshore charging methodology an offshore generator only pays onshore substation charges associated with the first substation they are connected to. The costs of the OFTO Onshore substation are socialised into the wider tariff element of TNUoS.



Local offshore circuit tariff

Unlike local circuit tariffs onshore, the offshore local circuit tariff is calculated using project specific costs relating to the OFTO revenue stream for that project. The amount of revenue attributed to the offshore local circuit tariff is the OFTO revenue multiplied by the ratio of the circuit capital cost to the total capital cost.

$$\text{local offshore circuit tariff} = \text{local security factor} \times \frac{\text{OFTO Revenue}}{\text{Circuit Rating}}$$

Below is a worked example for a fictional OFTO and generator. In this example there is an offshore generator connected via a single radial OFTO circuit. The generator has TEC of 400MW, and the single radial circuit has capacity of 420MW. The fictional OFTO has a revenue of £25M per annum. In the worked example the capital cost of the circuit is £116M and the total capital cost is £303.5M; the proportion of the capital cost of the circuit (to the total capital cost) is therefore 38%. The total revenue is £25M, so the proportion of the revenue associated with the circuit is therefore, 38% x £25M = £9.55M.

The local security factor (LSF) is a scaling factor included to represent the additional cost associated with the benefit of having redundancy in a design. If there is a single radial circuit (i.e. the standard offshore design), then the local security factor is 1. If there are multiple electrically connected circuits, then the local security factor is calculated as:

$$\text{LSF} = \frac{\text{Maximum Export Capacity of Circuits}}{\text{Generator TEC}}.$$

The Local Security Factor is capped at 1.8; the same as the onshore security factor. In the worked example, as we have a single circuit, the LSF is 1.

The local offshore circuit tariff = 1 x £9.55M / 420 MW = **22.750451 £/kW**.

Local offshore substation tariff

The offshore substation tariff is calculated to be representative of the cost of the Transformer, Switchgear and Platform at the offshore OFTO substation.The amount of revenue attributed to the offshore substation tariff, is the OFTO revenue multiplied by the ratio of the substation capital cost to the total capital cost. This calculation is performed for each element of the substation (Transformer, Switchgear and Platform).

In the worked example, for the Transformer element the capital cost is £10M and the total capital cost of the work is £303.5M; the proportion of the capital cost of the Transformer (to the total capital cost) is therefore 3%.

The proportion of the revenue associated with the Transformer is therefore, 3% x £25M = **£823k**.

Similarly the revenue associated with of each element of the offshore substation is calculated as a proportion of the total capital costs. The tariff is calculated by dividing the revenue for each item by its rating (MVA). This gives a tariff for each of the Transformer, Switchgear and Platform.

The local offshore substation tariff is the sum of the Transformer, Switchgear and Platform less the onshore civils cost adjustment. The onshore civil cost adjustment is a reduction to the offshore substation tariff. Onshore local circuit tariffs do not include civils cost, so this discount seeks to align the local circuit tariffs.

In the worked example, the local offshore substation tariff is **17.273804 £/kW**

Final Tariff

The final tariff for an offshore generator is the sum of (i) the local offshore substation tariff, (ii) the local offshore circuit tariff, (iii) any onshore local circuit tariffs[1], and (iv) the wider generator tariff. The wider tariff is applied based on which of the 27 TNUoS zones the generator is connected to and is detailed in the National Grid Charging Statements.

For this worked example, let us assume a connection in Zone 17 (South Lincs and North Norfolk) which has a wider generation tariff of **2.974367 £/kW.**

For this worked example the final tariff is therefore = 22.750451 + 17.273804 + 2.974367 = **42.998622 £/kW**

Therefore, the annual TNUoS charge to this hypothetical offshore generator with TEC of 400MW connecting in the South Lincs and North Norfolk zone is 400 MW x 42.998622 £/kW = **£17.2M**

[1] Not applicable in this worked example

Worked Example

In this example, the Total Revenue for the OFTO is £25M, and the Generator TEC is 400 MW connected in TNUoS Zone 17.

		Capital Cost	Percentage of Total Capital Costs	Amount of OFTOt	Rating / Capability	Local Security Factor	Tariff
		(£k)		(£)	(MVA)		(£/kW)
Circuit	Offshore cable	100,000					
	Harmonic filtering equipment	1,000					
	Reactive plant	15,000					
	Circuit	**116,000**	**38%**	**9,555,189**	**420**	**1**	**22.750451**
Substation	Transformer	10,000	3%	823,723	640		1.287068
	Switchgear	2,500	1%	205,931	680		0.302839
	Platform	125,000	41%	10,296,540	640		16.088344
	Onshore civils cost adjustment						-0.404447
	Substation	**137,500**	**45%**	**11,326,194**			**17.273804**
Other	Onshore substation	50,000	16%	4,118,616			Not Applicable
	Other	**50,000**	**16%**	**4,118,616**			Not Applicable
	TOTAL CAPITAL COST	**303,500**					

Total Local Tariff	40.024255
Wider Generator Tariff	2.974367
TOTAL TARIFF	**42.998622**

Disclaimer

In the event of any inconsistencies between this guidance note and the CUSC, the NGC Use of System Charging Methodology or the BSC, then the CUSC, the NGC Use of System Charging Methodology or the BSC will take precedence.

The CUSC all Code subsidiary documentation can be downloaded from the National Grid Website. The Statement of the Use of System Charging Methodology and the CUSC can be downloaded from the website.

For more information please contact the BSC Service Desk at bscservicedesk@cgi.com or call 0870 010 6950.