Public

Guidance on TNUoS onshore local circuit charges

Updated 21 November 2024

Contents

Disclaimer

In the event of any inconsistencies between this guidance note and the CUSC, then the latest CUSC will take precedence.

The latest CUSC can be downloaded from the National Energy System Operator website.

Introduction

For a transmission connected generator, its Transmission Network Use of System (TNUoS) charge consists of the following elements:

- **Local charges**: including onshore/offshore local substation charges and onshore/offshore local circuit charges. Local charges are designed to reflect the local infrastructure works needed to connect the generator into the wider transmission network.
- **Wider charges**: including the locational wider charges (the tariffs vary by zones, to send investment signals), and the non-locational adjustment charge (a flat rate across all zones to ensure compliance with relevant regulation)

The local charges for a generator may have two local components - local substation and local circuit charges. For an onshore generator, its local circuit tariff is designed to reflect its incremental impact on the infrastructure circuits that connect the generator to the wider transmission system.

The purpose of this guidance note is to provide detail about how the onshore local circuit tariffs are calculated.

Who pays the Onshore Local Circuit charges

A directly-connected generator (i.e. a generator holding a Bilateral Connection Agreement with the NESO) may or may not pay the onshore local circuit charge, depending on whether the substation it is connected to is a Main Interconnected Transmission System (MITS) node or not. If it is directly connected to a MITS node, it does not pay onshore local circuit charge, otherwise this charge applies. Embedded generators do not pay onshore local circuit charges.

What is a MITS node

The term “node” here can be viewed as a site, and in particular a site owned by a Transmission Owner (TO). According to CUSC 14.15.33, MITS nodes are defined as:

- Connections with more than 4 transmission circuits connecting at the site (see Figure 1). This category is also known as MITS substations; or
- Grid Supply Point connections with 2 or more transmission circuits connecting at the site (see Figure 2).

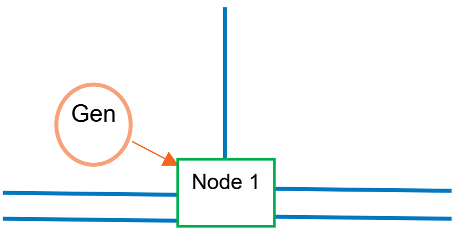

Figure 1 MITS nodes (category 1)

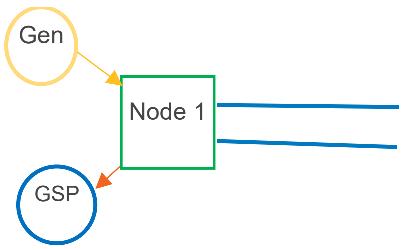

Figure 2 MITS nodes (category 2)

In Figure 1 and Figure 2, the generator which directly connects at Node 1, does not pay the onshore local circuit charge. Transmission-connected generators connecting to a non-MITS node will have a local circuit tariff. Local circuit tariffs can be positive or negative.

A transmission circuit is owned by one of the TOs and can be switched on or off via its circuit-breakers. This means that a circuit may have two or more circuit breakers (for example, three-end circuits are commonly seen in the transmission network). If a new site is tee-connected into an existing transmission circuit (see Figure 3 for the illustrative layout and the single line diagram), the existing transmission circuit will change from a 2-end circuit to a three-end circuit, however the number of circuits remains unchanged.

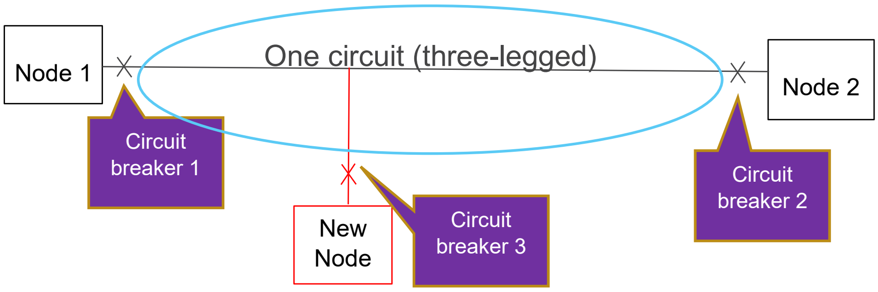

Figure 3 Tee-in of a new site into the existing 2-end circuit

If, however, a new site is "looped" into an existing circuit, and two sets of circuit breakers are added (see Figure 4), this will create two independent circuits.

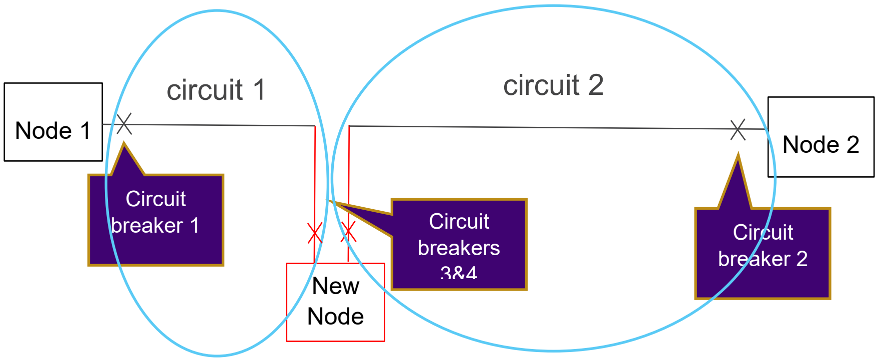

Figure 4 Loop-in of a new site into the existing 2-end circuit

For the avoidance of doubt, in CUSC 14.15.34 –
A transmission circuit is part of the National Electricity Transmission System between two or more circuit-breakers which includes transformers, cables and overhead lines but excludes busbars and generation circuits.

The "generation circuits" in the context of the CUSC means circuits that are owned by generators. This is not to be confused with the definition of "generation circuits" in the NETS SQSS which are designed and owned by TOs.

Local networks are part of the transmission infrastructure assets, and the associated charges are based on "incremental" signals, rather than the costs of individual assets (unlike transmission connection assets charges which are based on asset costs, and the methodology is not covered under the TNUoS).

How to calculate the Onshore Local Circuit tariff?

Onshore local circuit tariffs are calculated using the TNUoS Transport & Tariff model. The TNUoS model contains a simplified representation of the GB onshore transmission network that includes assets that are treated as "infrastructure".
For a non-MITS node, its associated onshore local network consists of the onshore transmission circuits connecting it to all adjacent MITS nodes (CUSC 14.15.36).

All generators connecting to the same non-MITS node have the same onshore local circuit tariff value. Onshore local circuit tariffs are designed to send signals that reflect generators' choice of the local network configuration, and in general are not for the purpose of asset cost recovery.

CUSC 14.15.36 specifies the approach to calculating local circuit tariffs –

Generators not connected to a MITS node will have a local circuit tariff derived from the local nodal marginal km for the generation node i.e. the increase or decrease in marginal km along the transmission circuits connecting it to all adjacent MITS nodes (local assets).

Onshore local circuit tariffs are designed to reflect the incremental impact on the local network of adding +1MW of generation capacity at the relevant non-MITS node. The incremental signals (local circuit tariffs), can be positive or negative.

CUSC 14.15.121 further explains the mathematical calculation –
Generation with a local circuit tariff is calculated by multiplying the Year Round nodal marginal km along the local circuit by the expansion constant and the relevant local security factor (whether onshore or offshore) and summing across local circuits to give the local circuit tariff.

$$\sum_{k} \frac{NLMkm^{L}_{Gj} \times EC \times LocalSF_{k}}{1000} = CLT_{Gi}$$

Where
k = Local circuit k for generator
$NLMkm^{L}_{G_j}$ *= Year Round Nodal marginal km along local circuit k using local circuit expansion factor*
EC = Expansion Constant
$LocalSF_k$ = Local Security Factor for circuit k
CLT_{Gi} = Circuit Local Tariff (£/kW)

It clarifies that all local circuit tariffs are calculated using the Year Round background.

The components that make up this formula are described below:

Input	**Description**
Year Round nodal marginal km along the local circuits using the local circuit expansion factors	This calculation uses the expansion factor(s) and circuit lengths for the components that make up the local circuits, plus a locational element based on modelled system flows. This is calculated in the Transport & Tariff model that we use to calculate TNUoS tariffs.[1] See below for more information on the expansion factor and circuit lengths.
Expansion constant (£MWkm)	This is the inflation-indexed cost of 1MWkm of 400kV overhead line. As this is the cheapest circuit type to transmit power per MW, this is used as the reference cost for all GB transmission circuits. The latest charging statement will tell you the current expansion constant; the expansion constant for a future charging year is inflated from the current year's value using CPIH.
Expansion factor (£MWkm)	This is the ratio by which the specific type of circuit in the calculation is more expensive than the expansion constant. For example, if 275kV overhead line is roughly 20% more expensive than 400kV, the expansion factor for 275kV is around 1.20.
Local security factor	This relates to whether or not the local circuit is single or double (i.e. if it is redundant or not). The security factor for a single circuit is 1, for double circuits is 1.76.

[1] See https://www.neso.energy/tnuos for more information on the Transport and Tariff (DCLF ICRP) model.

A worked example – a radial local network

Figure 5 shows a simple local network where LC1 is the only local circuit that connects the non-MITS node to its nearest MITS node. The TNUoS methodology will identify the incremental impact by adding an extra 1MW at the non-MITS node,and quantify the impact by assessing the incremental costs on the local network (measured in MWkm).

In this simple network, the additional 1MW will flow across the entire length of the local circuit. The “incremental” cost is therefore 1MW * 10km. The local circuit tariff associated with this non-MITS node and this local network, is therefore 10MWkm, for 1MW of additional capacity at the non-MITS node. We then apply the expansion constant (EC) which is essentially the “unit cost” in £ for each MWkm. If there are multiple circuits connecting the non-MITS node to MITS nodes, the onshore security factor (SF) also applies.

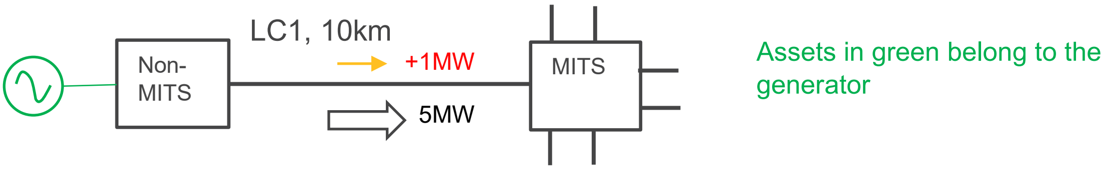

Figure 5 A simple radial network

A worked example – a local network with wider flows

In Figure 6, the generator connects to a non-MITS node, and the lines in red form the local network. The lengths in km and circuit flows in MW are show in Figure 6. This represents the base case flows. The aggregated MWkm within the local network is thus the base case “cost” (measured by MWkm). In this diagram, the base case cost is (5km X 20MW + 3km X 40MW + 1km X 48MW) = 268MWkm

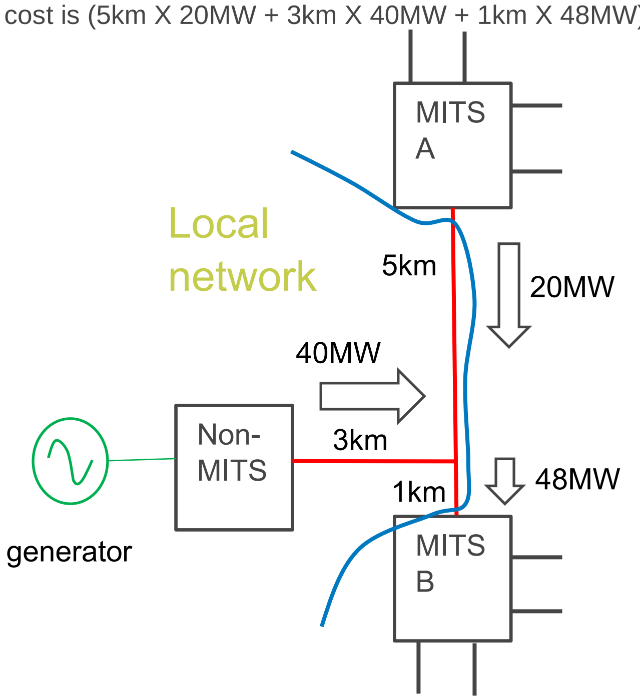

Figure 6 A local network with wider flows – base case

Figure 7 shows the “incremental” situation, where an additional 1MW is added at the non-MITS node, and the MW loading on all the lines have been re-calculated. The red arrows in Figure 7 show the incremental changes to the base case circuit MW loading figures. For example, the new line flow value (in MW) from the non-MITS node to the tee point (where the 3km of line meets the 5km and 1km lines) is now 41MW.

The incremental case cost is thus [5km X (20MW -0.3MW) + 3km X (40MW + 1MW) + 1km X (48MW + 0.7MW)] = 270.2MWkm
By comparing the costs in the "incremental" case and the base case, we get the incremental cost of the local network = 270.2 – 268 = 2.2MWkm
The next step is to convert the incremental cost from MWkm (for each 1MW of additional capacity at the non-MITS node) to tariffs in £/kW. In this example, the local security factor is 1, as there is only one (three-end) circuit that connects the non-MITS node to all adjacent MITS nodes.
Assuming the expansion constant is £15/MWkm, and the expansion factor is 10, the local circuit tariff is therefore (2.2MWkm/MW X £15/MWkm X 1 X 10) = £330/MW = £0.33/kW

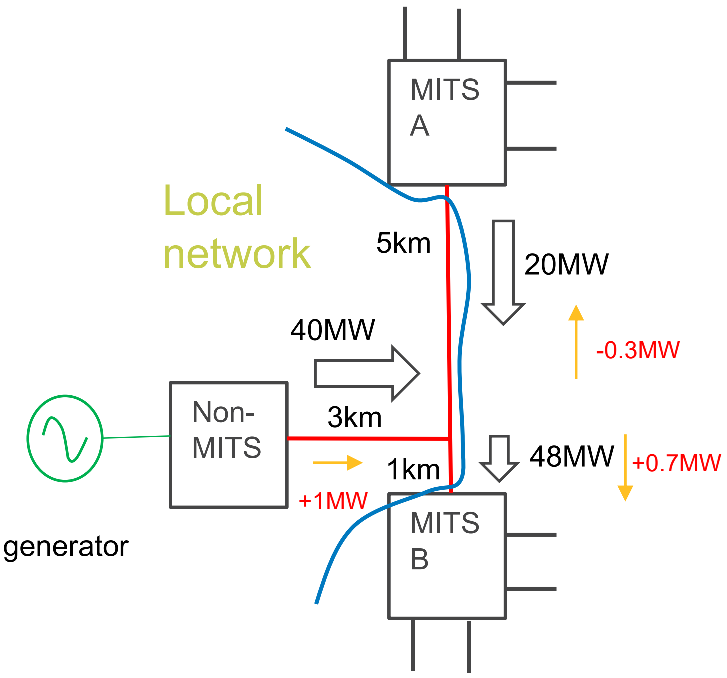

Figure 7 A local network with wider flows – calculating the local circuit tariff

Contact us

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