| CUSC Modification Proposal Form | At what stage is this document in the process? |
|---|---|
| # CMP315:<br>## TNUoS: Review of the expansion constant and the elements of the transmission system charged for | 01 Proposal Form<br>02 Workgroup Consultation<br>03 Workgroup Report<br>04 Code Administrator Consultation<br>05 Draft CUSC Modification Report<br>06 Final CUSC Modification Report |

The expansion constant is a key input in setting the value of the locational element of transmission network use of system charges. This modification proposal would review how the expansion constant is determined such that it best reflects the costs involved.

| | |
|---|---|
|  | **The Proposer recommends that this modification should be**<br>assessed by a Workgroup<br>This modification was raised 16 April 2019 and will be presented by the Proposer to the Panel on 26 April 2019. The Panel will consider the Proposer's recommendation and determine the appropriate route. |
|  | **High Impact**: Generators and suppliers paying locational TNUoS charges |
|  | **Medium Impact: -** N/A |
|  | **Low Impact**: -N/A |

 

## Contents



## Timetable

*The Code Administrator will update the timetable following prioritisation and the first WG meeting.*

| **The Code Administrator recommends the following timetable:** | |
|---|---|
| Initial consideration by Workgroup | dd month year |
| Workgroup Consultation issued to the Industry | dd month year |
| Modification concluded by Workgroup | dd month year |
| Workgroup Report presented to Panel | dd month year |
| Code Administration Consultation Report issued to the Industry | dd month year |
| Draft Final Modification Report presented to Panel | dd month year |
| Modification Panel decision | dd month year |
| Final Modification Report issued the Authority | dd month year |
| Decision implemented in CUSC | dd month year |

**Any questions?**


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## Proposer Details

| | |
|---|---|
| **Details of Proposer:**<br>(Organisation Name) | Nick Sillito<br>(PeakGen) |
| Capacity in which the CUSC Modification Proposal is being proposed:<br>(i.e. CUSC Party, BSC Party or "National Consumer Council") | CUSC Party |
| **Details of Proposer's Representative:**<br>Name:<br>Organisation:<br>Telephone Number:<br>Email Address: | Nick Sillito<br>PeakGen<br>+44 1926 336 127<br>nsillito@peakgen.com |
| **Details of Representative's Alternate:**<br>Name:<br>Organisation:<br>Telephone Number:<br>Email Address: | Grace Smith<br>UK Power Reserve<br>+44 7554 439 689<br>Grace.Smith@sembcorp.com |
| **Attachments (Yes/No): YES**<br>**If Yes, Title and No. of pages of each Attachment: "Proposed change to Transmission Network Charges" (LCP, April 2019)** | |

## Impact on Core Industry Documentation.

*Please mark the relevant boxes with an "x" and provide any supporting information*

| | |
|---|---|
| **BSC** | |
| **Grid Code** | |
| **STC** | |
| **Other** | |

(Please specify)

# 1 Summary

## Defect

The locational element of the Transmission Network Use of System (TNUoS) charge converts the “MWkm” figure calculated by the locational model and converts this figure into a locational cost (GBP/kW) for connecting generation and/or demand at a particular node. There are two potential issues with this process:

i. *Not all assets used by the transmission system are included in the calculation of the MWkm figure (for example 400/275 kV transformers are excluded); and*

ii. *The expansion constant (used to convert MWkm to GBP/kW) assumes that the life and capacity of and asset can be fully flexed to meet a connectee’s requirements (for example if a customer required 300 MW of capacity over 25 years, the TO may – as the most cost-effective solution – construct a 500 MW asset with a life of 55 years). Therefore, the connectee would only be charged a proportion of the costs actually incurred by the TO (the balance of the cost would be recovered through the residual)*

## What

The transport model needs to be reviewed to see if it is appropriate to include “Generic Expansion Factors” for elements of the transmission system other than overhead lines and underground cables. For example, a 400/275 kV transformer is cost equivalent to X km of 400 kV overhead line.

The evaluation of the *expansion constant* needs to be reviewed to see if it properly reflects the “useful” life and capacity delivered to the transmission system. For example, if the average required capacity of an overhead line over its operational life is 50% of its rating then should the expansion constant be revised to reflect this?

For the avoidance of doubt, as part of the RIIO process, the Authority may review the rates or return used to calculate the expansion constant. This falls outside the scope of this defect.

## Why

The purpose of the change is to improve the cost reflectivity of the TNUoS locational charge so that it better reflects the actual costs imposed on the transmission system by locational decisions taken by generation and/or demand. An increase (or decrease) in the recovery of revenue through the locational charge results in a reduction (or increase) of the residual charge.

## How

The proposed solution would modify the derivation of the expansion constant so that the MWkw figure calculated by the charging transport model leads to a more cost reflective outcome in the final TNUoS tariffs. The actual structure of the TNUoS charge would not be changed so there should be no impact on the TSO’s or transmission system users’ TNUoS billing and settlement systems or the total revenue recovered by the Transmission Owners.

# 2 Governance

## Justification for Normal Procedures

This modification falls outside the scope of self-governance and should therefore go through normal procedures.

## Requested Next Steps

This modification should be assessed by a Workgroup

# 3 Why Change?

This modification proposal relates to the derivation of the *expansion constant*. The expansion constant is used to set TNUoS locational charges by converting the "MWkm" calculated by the DC Load Flow Investment Cost Related Pricing (DCLF ICRP) transport model into a price (expressed in GBP).

The expansion constant is defined in the CUSC starting at para 14.15.59 and is summarised as "The expansion constant, expressed in £/MWkm, represents the annuitized value of the transmission infrastructure capital investment required to transport 1 MW over 1 km. Its magnitude is derived from the projected cost of 400kV overhead line, including an estimate of the cost of capital, to provide for future system expansion."

In CUSC 14.14.5 it is noted that in 2005 modelling changes were adopted including "... (i) The application of multi-voltage circuit expansion factors with a forward-looking Expansion Constant that *does not include substation costs in its derivation.*" (emphasis added). The equipment in substations whose cost is not recovered includes:

i. Switchgear
ii. Protection
iii. Transformers between super grid voltages (eg 400 / 275 kV)[1]
iv. Quadrature boosters (to control flow on circuits)
v. Shunt reactors (to manage flow and limit short circuit duty)
vi. Reactive compensation (to manage voltage on the network)

In 2008 ECM-11 introduced local charging for certain elements of the transmission system relating to the connection of generation, including a local substation charge. This results in generation "local" charges covering some elements of the assets identified above local to generation.

The DCLF ICRP model estimates the flows on the system to meet peak demand under intact conditions. These flows are then scaled by a factor of 1.8 to approximate the required circuit capacity to secure the system (such that no circuit is overloaded during credible outages of transmission equipment)[2]. However, the average secured flow is typically only about 40% of the built circuit capacity, suggesting that the transmission owner has to build a higher capacity system than the secured flows suggest. To be properly cost reflective, the expansion constant should reflect the size of the assets that the transmission owners have to build rather than a smaller theoretical network.

[1] Transformers within the transmission system, not GSP transformers, recovered through DNO charging
[2] See CUSC 14.15.90.

Figure 1 shows how the current charging methodology splits a simple example network into two parts with the locational charge recovering only part of the cost of overhead lines and circuits; with the residual charge recovering the “unallocated” part of the overhead lines plus the costs of all other assets on the system, including busbars, switchgear, protection and reactive compensation etc. To illustrate the scale of the issue, for charging year 2018/19 (model release date 10 March 2018), the “chargeable” MWkm are about 40% of the physical MWkm constructed. In National Grid’s five-year TNUoS forecast of 14 September 2018, the locational charge accounts for GBP 660 million (23%) of the allowed revenue of GBP 2,880 million. This implies that the cost reflective elements in the TNUoS charging model under charge users for the costs they imposed on the system or under reward users for the benefits they bring to the system. An under recovery by the cost reflective part of the charges means that some of the transmission owners’ allowed revenue having to be recovered via the residual charge in a non-cost reflective manner.

The solution proposed by this modification is to revise the way that the expansion constant is calculated such that the locational charges better reflects the costs/benefits that a user imposes on the system.

Ofgem is currently undertaking a TCR/SCR looking at the treatment of the residual cost., whilst his modification proposal deals with improving the calculation of the cost reflective element of the charge. Any change in the revenue collected by the locational charge will be offset by an opposite and equal change in the revenue collected from the residual charge (since the transmission owners’ allowed revenue does not change). Whilst this proposal may change the amount collected be the residual charge it does not deal with the method of the collection and is therefore outside of the scope of the TCR/SCR.

The CUSC (14.14.6) states that “the underlying rationale behind Transmission Network Use of System charges is that efficient economic signals are provided to Users when services are priced to reflect the incremental costs of supplying them. Therefore, charges should reflect the impact that Users of the transmission system at different locations would have on the Transmission Owner's costs, if they were to increase or decrease their use of the respective systems. These costs are primarily defined as the investment costs in the transmission system, maintenance of the transmission system and maintaining a system capable of providing a secure bulk supply of energy.” This proposal is intended to better meet this rational.

To illustrate the potential impact, we have estimated the impact of doubling the expansion constant on the elements of the generation TNUoS charge (using National Grid’s forecast for 2020/21 as a reference). The doubling of the expansion constant is simply to show the sensitivity of the charges to the expansion constant and is not an assertion that the current expansion constant is understated by 50%. These estimates are presented in Table 1 (based on the current charging methodology). As part of its SCR, Ofgem is currently considering varying the reference node from distributed demand to distributed generation. Table 2 again shows the effect of doubling the expansion constant but against a base case of the reference node being distributed generation.

# 4 Code Specific Matters

## Technical Skillsets

Knowledge of design of transmission system and the charging model

## Reference Documents

CUSC

DCLF ICRP manual

# 5 Solution

Paras 14.15.59-69 of the CUSC which deal with the derivation of the *expansion constant* and *expansion factors*. The existing method would be modified to:

i. Modify the expansion constant such that the locational charge reflects the level of assets built and maintained to deliver the actual level of MWkm required by the transport model / SQSS (so if the identified requirement was X MWkm, but the transmission owners provided Y MWkm then the expansion constant would be scaled by Y/X)

ii. Introduce expansion factors to cover the cost of equipment such as quadrature boosters and 400/275 kV transformers; and

iii. Include in the cost of 1 MWkm of 400 kV overhead line the associated equipment alongside this (for example the average amount of reactive compensation, switchgear etc. per 1 MWkm of overhead line).

# 6 Impacts & Other Considerations

*i.* This modification proposal will affect all users who pay / are paid TNUoS charges by altering the distribution of the allocation of transmission system costs. Doubling the Expansion Constant doubles the locational elements of TNUoS tariffs, except where capped/floored.

*ii.* Although it will impact the process used to estimate the expansion constant it will NOT change the systems or processes for charge setting or invoicing.

## Does this modification impact a Significant Code Review (SCR) or other significant industry change projects, if so, how?

The Targeted Charging Review is looking at the allocation/recovery of the residual charge. If adopted this proposal will reduce the level of the residual charge but has no impact on how the charge is recovered.

It will affect the scaling of demand TNUoS charges but will not change the calculation or structure, so will not come under the scope of the Electricity Network Access SCR.

## Consumer Impacts

Adoption of this proposal will immediately impact the level of the TNUoS tariffs for all transmission system users (although not the total amount recovered under the charge). The variations in the locational charges will be expected to have a neutral short-term impact on consumers overall, though there will be individual winners and losers.

Making TNUoS charges more cost reflective will lead to “better” locational signals for both generation and demand. These should lead to more economically appropriate decisions leading to lower industry costs which will ultimately flow through to lower costs to consumers.

# 7 Relevant Objectives

### Impact of the modification on the Applicable CUSC Objectives (Charging):

| Relevant Objective | Identified impact |
|---|---|
| (a) That compliance with the use of system charging methodology facilitates effective competition in the generation and supply of electricity and (so far as is consistent therewith) facilitates competition in the sale, distribution and purchase of electricity; | Positive |
| (b) That compliance with the use of system charging methodology results in charges which reflect, as far as is reasonably practicable, the costs (excluding any payments between transmission licensees which are made under and accordance with the STC) incurred by transmission licensees in their transmission businesses and which are compatible with standard licence condition C26 requirements of a connect and manage connection); | Positive |
| (c) That, so far as is consistent with sub-paragraphs (a) and (b), the use of system charging methodology, as far as is reasonably practicable, properly takes account of the developments in transmission licensees’ transmission businesses; | Positive |
| (d) Compliance with the Electricity Regulation and any relevant legally binding decision of the European Commission and/or the Agency. These are defined within the National Grid Electricity Transmission plc Licence under Standard Condition C10, paragraph 1 *; and | Positive |
| (e) Promoting efficiency in the implementation and administration of the CUSC arrangements. | Neutral |

*Objective (d) refers specifically to European Regulation 2009/714/EC. Reference to the Agency is to the Agency for the Cooperation of Energy Regulators (ACER).

The purpose of this modification proposal is to refine the expansion constant so that it reflects the costs of all the assets used to construct the transmission system (rather than simply an idealised overhead line). This will improve the cost reflectivity of the locational element of the TNUoS charge allowing more cost reflective charging (b). More cost reflective charging helps facilitate a level playing field for competition (a) and provides a better match between allowed regulated revenues and actual costs so more properly takes account of developments to the transmission licences' business (c). Improving the cost reflectivity of charging also matches the objectives in SC C10.

The change has no impact on the efficiency of CUSC administration (e).

## 8 Implementation

The proposal could be implemented the first complete charging year following approval. Changes should be limited to the calculation of the expansion constant (this would form an input to the charging model) and to add expansion factors for assets such as 400/275 kV transformers.

## 9 Legal Text

Ideally this would be developed at the work group stage

## 10 Recommendations

### Proposer's Recommendation to Panel

Panel is asked to agree that Normal governance procedures should apply and refer this proposal to a Workgroup for assessment.

| Generation zones | | Current Expansion Constant | | | | Doubled Expansion Constant | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zone No. | Zone Name | Peak Security (£/kW) | Year Round Shared (£/kW) | Year Round Not Shared (£/kW) | Residual (£/kW) | Peak Security (£/kW) | Year Round Shared (£/kW) | Year Round Not Shared (£/kW) | Residual (£/kW) |
| 1 | North Scotland | 3.31 | 27.85 | 15.07 | -4.79 | 6.61 | 55.70 | 30.15 | -9.85 |
| 2 | East Aberdeenshire | 2.26 | 16.78 | 15.07 | -4.79 | 4.53 | 33.56 | 30.15 | -9.85 |
| 3 | Western Highlands | 3.21 | 22.85 | 14.58 | -4.79 | 6.42 | 45.70 | 29.16 | -9.85 |
| 4 | Skye and Lochalsh | 3.20 | 22.85 | 19.87 | -4.79 | 6.40 | 45.70 | 39.75 | -9.85 |
| 5 | Eastern Grampian and Tayside | 4.33 | 18.43 | 13.68 | -4.79 | 8.66 | 36.85 | 27.37 | -9.85 |
| 6 | Central Grampian | 3.69 | 18.21 | 13.62 | -4.79 | 7.38 | 36.43 | 27.24 | -9.85 |
| 7 | Argyll | 4.08 | 14.98 | 25.04 | -4.79 | 8.16 | 29.97 | 50.09 | -9.85 |
| 8 | The Trossachs | 2.86 | 14.98 | 12.62 | -4.79 | 5.72 | 29.97 | 25.24 | -9.85 |
| 9 | Stirlingshire and Fife | 2.78 | 12.17 | 11.93 | -4.79 | 5.56 | 24.34 | 23.86 | -9.85 |
| 10 | South West Scotland | 2.82 | 12.21 | 11.94 | -4.79 | 5.65 | 24.43 | 23.88 | -9.85 |
| 11 | Lothian and Borders | 3.26 | 12.21 | 5.61 | -4.79 | 6.52 | 24.43 | 11.23 | -9.85 |
| 12 | Solway and Cheviot | 2.96 | 7.33 | 6.73 | -4.79 | 5.92 | 14.66 | 13.46 | -9.85 |
| 13 | North East England | 4.33 | 5.08 | 4.21 | -4.79 | 8.66 | 10.17 | 8.41 | -9.85 |
| 14 | North Lancashire and The Lakes | 3.06 | 5.08 | 1.05 | -4.79 | 6.12 | 10.17 | 2.11 | -9.85 |
| 15 | South Lancashire, Yorkshire and Humber | 4.91 | 0.46 | 0.00 | -4.79 | 9.82 | 0.92 | 0.00 | -9.85 |
| 16 | North Midlands and North Wales | 4.14 | -0.42 | 0.00 | -4.79 | 8.28 | -0.83 | 0.00 | -9.85 |
| 17 | South Lincolnshire and North Norfolk | 2.28 | -0.75 | 0.00 | -4.79 | 4.55 | -1.49 | 0.00 | -9.85 |
| 18 | Mid Wales and The Midlands | 1.61 | 0.35 | 0.00 | -4.79 | 3.22 | 0.70 | 0.00 | -9.85 |
| 19 | Anglesey and Snowdon | 3.69 | 3.25 | 0.00 | -4.79 | 7.37 | 6.51 | 0.00 | -9.85 |
| 20 | Pembrokeshire | 7.13 | -4.53 | 0.00 | -4.79 | 14.27 | -9.06 | 0.00 | -9.85 |
| 21 | South Wales & Gloucester | 4.01 | -4.33 | 0.00 | -4.79 | 8.02 | -8.65 | 0.00 | -9.85 |
| 22 | Cotswold | 0.70 | 2.66 | -6.81 | -4.79 | 1.39 | 5.32 | -13.63 | -9.85 |
| 23 | Central London | -5.87 | 2.66 | -7.59 | -4.79 | -11.74 | 5.32 | -15.18 | -9.85 |
| 24 | Essex and Kent | -3.93 | 2.66 | 0.00 | -4.79 | -7.85 | 5.32 | 0.00 | -9.85 |
| 25 | Oxfordshire, Surrey and Sussex | -2.49 | -1.53 | 0.00 | -4.79 | -4.99 | -3.06 | 0.00 | -9.85 |
| 26 | Somerset and Wessex | -2.00 | -1.43 | 0.00 | -4.79 | -4.01 | -2.85 | 0.00 | -9.85 |
| 27 | West Devon and Cornwall | -1.16 | -4.02 | 0.00 | -4.79 | -2.32 | -8.04 | 0.00 | -9.85 |

**Table 1: Illustrative impact of doubling expansion constant on TNUoS generation tariff for 2021/2 (current reference node). Assessment by Lane Clark & Peacock (LCP)**

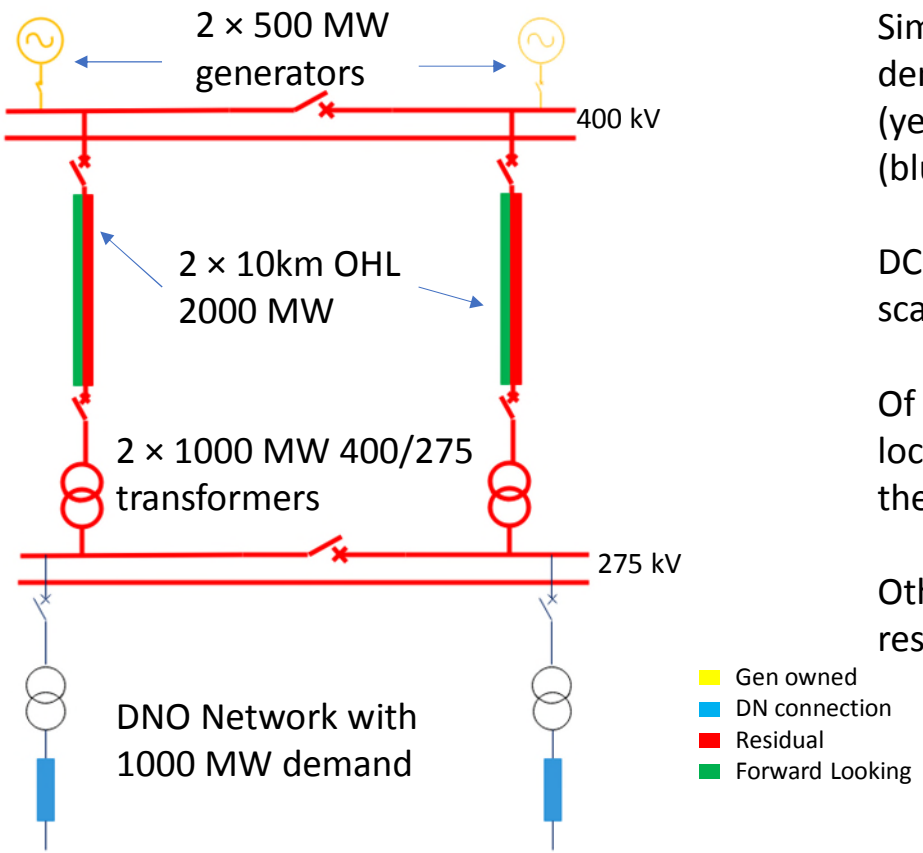
 

| Generation zones | | Current expansion constant | | | | Doubled Expansion Constant | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zone No. | Zone Name | Peak Security (£/kW) | Year Round Shared (£/kW) | Year Round Not Shared (£/kW) | Residual (£/kW) | Peak Security (£/kW) | Year Round Shared (£/kW) | Year Round Not Shared (£/kW) | Residual (£/kW) |
| 1 | North Scotland | 0.90 | 21.48 | 14.82 | -0.22 | 1.80 | 42.97 | 29.65 | -0.70 |
| 2 | East Aberdeenshire | -0.15 | 13.03 | 14.82 | -0.22 | -0.30 | 26.05 | 29.65 | -0.70 |
| 3 | Western Highlands | 0.80 | 18.61 | 14.54 | -0.22 | 1.59 | 37.22 | 29.08 | -0.70 |
| 4 | Skye and Lochalsh | 0.78 | 18.61 | 20.11 | -0.22 | 1.57 | 37.22 | 40.21 | -0.70 |
| 5 | Eastern Grampian and Tayside | 1.83 | 13.88 | 13.58 | -0.22 | 3.66 | 27.76 | 27.17 | -0.70 |
| 6 | Central Grampian | 1.27 | 14.16 | 13.67 | -0.22 | 2.55 | 28.32 | 27.33 | -0.70 |
| 7 | Argyll | 1.67 | 11.23 | 24.03 | -0.22 | 3.33 | 22.47 | 48.07 | -0.70 |
| 8 | The Trossachs | 0.44 | 11.23 | 12.76 | -0.22 | 0.89 | 22.47 | 25.52 | -0.70 |
| 9 | Stirlingshire and Fife | 0.36 | 8.10 | 11.99 | -0.22 | 0.73 | 16.21 | 23.98 | -0.70 |
| 10 | South West Scotland | 0.41 | 8.30 | 12.04 | -0.22 | 0.82 | 16.60 | 24.07 | -0.70 |
| 11 | Lothian and Borders | 0.85 | 8.30 | 5.28 | -0.22 | 1.69 | 16.60 | 10.55 | -0.70 |
| 12 | Solway and Cheviot | 0.54 | 3.18 | 6.57 | -0.22 | 1.09 | 6.35 | 13.14 | -0.70 |
| 13 | North East England | 1.97 | 0.30 | 3.34 | -0.22 | 3.94 | 0.61 | 6.68 | -0.70 |
| 14 | North Lancashire and The Lakes | 0.64 | 0.30 | 1.80 | -0.22 | 1.29 | 0.61 | 3.60 | -0.70 |
| 15 | South Lancashire, Yorkshire and Humber | 2.49 | -3.37 | 0.00 | -0.22 | 4.99 | -6.73 | 0.00 | -0.70 |
| 16 | North Midlands and North Wales | 1.73 | -4.80 | 0.00 | -0.22 | 3.46 | -9.59 | 0.00 | -0.70 |
| 17 | South Lincolnshire and North Norfolk | -0.14 | -4.82 | 0.00 | -0.22 | -0.28 | -9.64 | 0.00 | -0.70 |
| 18 | Mid Wales and The Midlands | -0.80 | -4.57 | 0.00 | -0.22 | -1.60 | -9.13 | 0.00 | -0.70 |
| 19 | Anglesey and Snowdon | 1.27 | -0.76 | 0.00 | -0.22 | 2.54 | -1.52 | 0.00 | -0.70 |
| 20 | Pembrokeshire | 4.72 | -8.54 | 0.00 | -0.22 | 9.44 | -17.07 | 0.00 | -0.70 |
| 21 | South Wales & Gloucester | 1.60 | -8.51 | 0.00 | -0.22 | 3.20 | -17.02 | 0.00 | -0.70 |
| 22 | Cotswold | -1.72 | -2.29 | -5.87 | -0.22 | -3.44 | -4.57 | -11.74 | -0.70 |
| 23 | Central London | -8.28 | -2.29 | -6.65 | -0.22 | -16.56 | -4.57 | -13.30 | -0.70 |
| 24 | Essex and Kent | -6.29 | -2.29 | 0.00 | -0.22 | -12.58 | -4.57 | 0.00 | -0.70 |
| 25 | Oxfordshire, Surrey and Sussex | -4.91 | -5.95 | 0.00 | -0.22 | -9.81 | -11.90 | 0.00 | -0.70 |
| 26 | Somerset and Wessex | -4.42 | -5.29 | 0.00 | -0.22 | -8.84 | -10.59 | 0.00 | -0.70 |
| 27 | West Devon and Cornwall | -3.58 | -8.03 | 0.00 | -0.22 | -7.15 | -16.06 | 0.00 | -0.70 |

**Table 2: Illustrative impact of doubling expansion constant on TNUoS generation tariff for 2021/2 (based on a generation weighted distributed reference node). Assessment by Lane Clark & Peacock (LCP).**

# Current asset charging allocation




Simplified network connecting 1000 MW of generation and demand. Generator bays are owned by the generator(s) (yellow). DNO connection assets are charged separately (blue).

DCLF model results in 500 MW flow on each circuit. This is scaled up to 900 MW for security (1.8×).

Of the 2000 MW circuit capacity, 900 MW allocated to the locational charge (green stripe) and 1100 MW is allocated to the residual charge (red stripe) .

Other assets (switchgear, transformers) are fully allocated to residual (shown in red) .

**Figure 1: Simplified network to illustrate the allocation of assets between the forward looking and residual charge**