ESO

Workgroup Consultation

CMP393: Using Imports and Exports to Calculate Annual Load Factor for Electricity Storage

Overview: This modification proposes to alter the definition of Annual Load Factor with respect to electricity storage, taking into account imports as well as exports. Here, 'electricity storage' refers to all storage that has booked Transmission Entry Capacity (i.e., pumped and battery).

Modification process & timetable

1. **Proposal Form** 09 June 2022
2. **Workgroup Consultation** 15 May 2023 - 06 June 2023
3. **Workgroup Report** 28 July 2023
4. **Code Administrator Consultation** 03 August 2023 - 01 September 2023
5. **Draft Final Modification Report** 21 September 2023
6. **Final Modification Report** 29 September 2023
7. **Implementation** 01 April 2024

Have 5 minutes? Read our Executive summary

Have 20 minutes? Read the full Workgroup Consultation

Have 30 minutes? Read the full Workgroup Consultation and Annexes.

Status summary: The Workgroup are seeking your views on the work completed to date to form the final solution(s) to the issue raised.

This modification is expected to have a: High impact Storage Operators, Generators, Transmission Owners, ESO, Parties Liable for TNUoS

Governance route	Standard Governance modification with assessment by a Workgroup	
Who can I talk to about the change?	**Proposer:** Robert Newton robert.newton@zenobe.com 07342 169677	**Code Administrator Chair**: Jessica Rivalland Jessica.Rivalland@nationalgrideso.com 07866 786143
How do I respond?	Send your response proforma to cusc.team@nationalgrideso.com **by 5pm on 06 June 2023**	

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Executive summary

What is the issue?

The Transmission Network Use of System (TNUoS) charging methodology currently includes battery storage and pumped storage in the ‘Conventional Carbon’ generation classification. As such, battery storage and pumped storage assets face the Conventional Carbon generation tariff: Peak + (Annual Load Factor [ALF] x year-round shared) + (ALF x year-round not shared) + generation adjustment.

In the proposer’s view, using only output to calculate ALF for pumped storage and battery storage does not reflect how storage assets can import power, as well as export it. Consequently, the proposer argues that the TNUoS methodology does not accurately reflect how storage assets interact with the National Electricity Transmission System (NETS).

What is the solution and when will it come into effect?

Proposer’s solution: This modification proposes to alter the definition of ALFs with respect to storage. All storage that has booked TEC would face a bespoke Storage ALF calculation, considering imports as well as exports. As other storage technologies connect to the NETS, it is anticipated that they too will be included.

It is proposed that the tariff will read: peak + (Storage ALF x year-round shared) + (Storage ALF x year round not shared) + residual.

Implementation date: 1 April 2024

What is the impact if this change is made?

The proposed amendments to the transmission charging methodology will better incentivise competition among storage operators. They will result in more cost-reflective charges and ensure that the transmission charging methodology responds to the accelerating deployment of storage in the NETS.

Interactions

There is a potential interaction with another current modification, ‘CMP405 - TNUoS Locational Demand Signals for Storage'. To find out more please the ESO website.

What is the issue?

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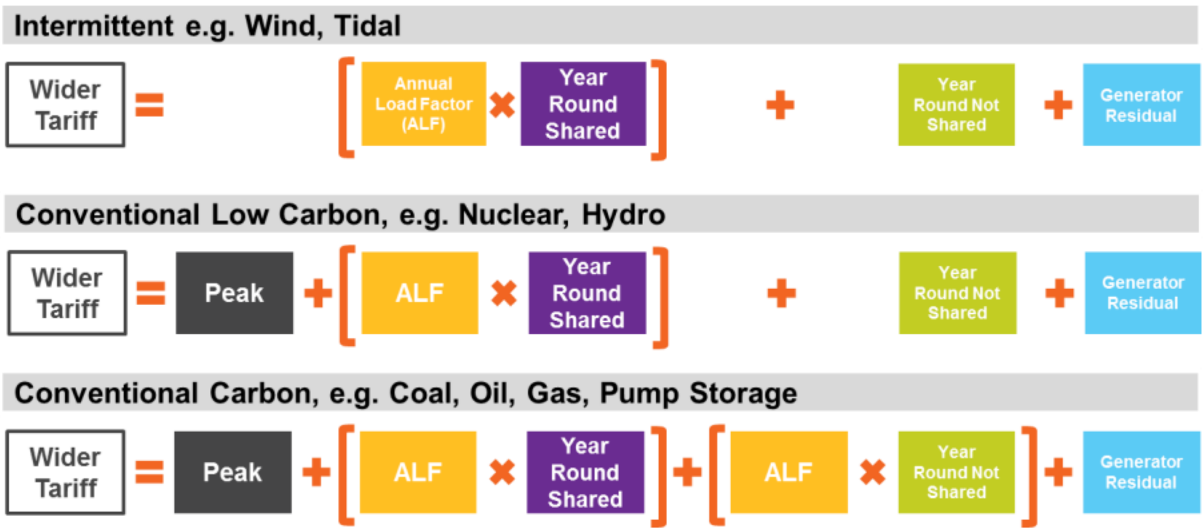

Figure 1: TNUoS Generation Classifications. See *TNUoS Guidance for Generators* (National Grid ESO, 2019), <https://www.nationalgrideso.com/document/138046/download>, p. 11.

For the purposes of transmission charging and ALF, battery storage is considered as pump storage.[1]

Why change?

In the view of the Proposer, current TNUoS charging arrangements for electricity storage are inconsistent with the CUSC Applicable Charging Objectives (ACOs).[2] The TNUoS methodology does not reflect how storage assets import, as well as export, power. As a result, the methodology provides storage operators with an inaccurate economic signal that creates a barrier to entry, inhibiting effective competition. Charges are not cost-reflective, as they do not fully reflect how storage interacts with the NETS. Nor do charges take account of developments in transmission licensee business, as they do not reflect the increasing amount of storage connecting to the NETS.

[1] See *Final Annual Load Factors for 2022/23 TNUoS Tariffs* (National Grid ESO: 2022), <bit.ly/3xzSwed>, pp. 10, 14, 17.
[2] By 'electricity storage' the Proposer refers to all storage that currently has booked Transmission Entry Capacity (i.e., pumped and battery).

In the view of the Proposer, storage operators should face a tariff that aligns more closely with the CUSC Applicable Charging Objectives. The tariff should incentivise effective competition in the storage sector, reflect the value of storage to transmission licensees, and take account of new strategic, market and technological developments.

The proposer have organised their responses for this section under the following subheadings:

1. Changes in Licensee Business
2. Effective Competition
3. Value to Transmission Licensees
4. Interaction with Wider Work on TNUoS

The Proposer has engaged Cornwall Insight to model the effects of increased storage deployment behind constraint boundaries on curtailment and network reinforcement costs. Cornwall Insight also modelled how the proposed Code Modification would affect generator TNUoS costs. The results of the modelling are summarised in an annex ('Annex 4').

1. Changes in Licensee Business

The last substantial updates to the transmission charging methodology took place in 2014, as part of Project TransmiT. Ofgem introduced a new 'Intermittent' generation classification for renewables, and split TNUoS tariffs into 'Peak' and 'Year Round' components. They chose to adjust the Year Round component by ALF to provide 'a proxy of the impact an individual generator has on the costs of a system when investment is planned to manage constraint costs'.[3] Here, ALF is calculated based on output, and no consideration is given to input. As a result, the methodology results in an inaccurate proxy of the impacts of individual storage assets on constraint costs.

Since 2014, the amount of intermittent renewable generation connected to the NETS has increased substantially, and the system need for storage has intensified. The market has responded to this need, with numerous storage operators working to integrate renewables into power networks. Other than the 2019/20 addition of battery storage to the Conventional Carbon generation classification, transmission charging regulation has not adapted to the accelerating deployment of storage.[4] As a result, tariffs are based on inaccurate and outdated assumptions.

In 2013, National Grid Electricity Transmission undertook modelling to provide quantitative evidence of the impacts of implementing the Project TransmiT proposals. The results of this modelling substantially influenced the decision to implement TransmiT. The modelling did not consider the possible impacts of battery storage deployment on the electricity system.[5] Since the Project TransmiT changes were implemented, the UK landscape for electricity storage has changed considerably. The 2014 T-4 Capacity

[3] *Project TransmiT: Decision on proposals to change the electricity transmission charging methodology* (London: Ofgem, 2014), p. 13.
[4] See *Final TNUoS Tariffs for 2019/20* (National Grid ESO: 2019), p. 13.
[5] See 'Project TransmiT: Impact Assessment of industry's proposals (CMP213) to change the electricity transmission charging methodology', Ofgem, (137/13, 2013), <bit.ly/3x4HNH2>.

Market auction saw 2699MW of awarded capacity for storage, with the majority provided by pumped storage.[6] The 2022 T-4 auction saw 2527MW awarded to pumped storage, and 1093MW awarded to battery storage.[7] In light of these changes, there is a need to update the charging methodology so that it more accurately reflects the system impacts of storage, and of battery storage in particular.

The ESO, Ofgem, and BEIS have all published strategies and scenarios emphasising the strategic need for flexibility in an increasingly non-synchronous power system. The ESO is amending its generation background, or Connection Planning Assumptions (CPA), modelling to take account of the net positive effects of storage in constrained renewable power systems in worst-case conditions. As part of REMA, DESNZ are considering a range of options (including but not limited to LMP) to provide storage with stronger operability signals, and ESO are considering how storage assets can be deployed to provide a wide range of system services. These signals and services will support accelerated decarbonisation and reduced consumer costs. In the view of the Proposer, the current generation transmission charging methodology is outdated and by creating unduly high charges for storage operators, it is creating a barrier to the achievement of strategic energy objectives. Strategic objectives around flexibility add to the case to fix the deficiency in the current charging methodology, while wider DESNZ and ESO policy work on creating stronger operational signals for flexibility continues.

2. Effective Competition

In the view of the Proposer, the current methodology unduly discriminates against storage. The Conventional Carbon generation classification is for technologies that are controllable, that can easily increase and decrease their output, and that are likely to be exporting at peak times. This description does not fully capture the capabilities of storage technologies, which can import as well as export power. As Ofgem observed in justification of their decision to introduce a new tariff for intermittent generation, discrimination can arise from ‘unjustifiably treating different cases alike’, and different asset classes should ‘be treated differently according to the impact they have on the network’.[8] The current transmission charging methodology provides storage operators with a signal designed for coal or gas-fired generators, with ALF calculated based on output and not input. This does not accurately reflect how storage interacts with the NETS. As discussed above, while the technology on the energy system has evolved since Project TransmiT, the charging methodology has not. TransmiT did not consider the system impacts of battery storage. As a result, the current charging methodology creates a barrier to entry that inhibits effective competition in the storage sector.

3. Value to Transmission Licensees

Battery storage technologies are modular and have relatively short lead times, and so can rapidly deploy in strategic locations with the right economic incentives. Transmission charging must respond to the development of this strategically important new sector. Basing storage ALF on imports and exports would ensure that the TNUoS regime responds to the changing needs of the NETS, providing storage with a more cost-

[6] *Final Auction Results: T-4 Capacity Market Auction 2014* (National Grid, 2014).
[7] *Final Auction Report: 2021 Four year ahead Capacity Auction (T-4)* (National Grid ESO, 2022).
[8] *Project TransmiT*, p. 18.

reflective signal and better incentivising competition among flexibility providers. This can help ensure that the deployment of storage keeps pace with the deployment of renewable generation. The proposed generation tariff for storage would also remove a disincentivise hindering operators from deploying in generation-constrained locations, where their assets can alleviate constraints, reduce curtailment, and provide stability services. While CMP393 is not primarily designed to provide a locational signal oriented towards constraint alleviation, in the view of the Proposer this outcome would provide significant value to transmission licensees.

4. Interaction with Wider Work on TNUoS

Work in this area could lead towards creating a separate generation classification for storage with respect to charging. That is not the purpose of this modification. Rather, the Proposer intends to focus on changing ALF calculation for storage within the current charging methodology.

Ofgem is conducting the TNUoS Task Force, charged with improving the present methodology and conducting a longer-term review of the purpose and structure of TNUoS charges. While there is some overlap between this modification and the Task Force, the proposed changes are not explicitly in scope of the Task Force. Ofgem stated in a call for evidence on the Task Force that 'it is possible that other changes to the charging methodology [will be] implemented […] outside of the Task Force processes'.[9] This modification is therefore intended to achieve targeted change outside the scope of the Task Force process and through the standard governance procedure, in line with Ofgem's intention to 'move quickly'.[10] Ofgem has already shown it is prepared to move forward with storage-related 'quick win' modifications (CMP280, CMP281) alongside Significant Code Reviews on transmission charging. Furthermore, CMP315 / CMP375 are running alongside the TNUoS Task Force, setting a direct precedent for the proposed approach. As set out in Annex 1, Cornwall Insight's modelling shows the primary benefits of the proposed modification are in early years (2025-30), supporting use of the Standard Governance Procedure to achieve a 2024 implementation date.

The Proposer considers that this modification proposal does not conflict with the existing modification proposal CMP331 'Option to replace generic Annual Load Factors (ALFs) with site specific ALFs'. CMP331 seeks to amend the methodology to resolve a defined issue faced by new generators. It does not mention issues associated with ALFs and storage. The Proposer sees no reason why CMP393 and CMP331 could not be progressed separately.

What is the solution?

Proposer's solution

This modification proposes to alter the definition of ALFs with respect to storage. All storage that has booked TEC (i.e., pumped and battery, as currently defined) would face an ALF calculation based on net system usage, and not export only. As other storage technologies connect to the NETS, it is anticipated that they too will be included.

[9] See Ofgem, 'TNUoS Call for Evidence: Next Steps', 25 February 2022, <bit.ly/3PShU5X>.
[10] See 'TNUoS Call for Evidence'.

Storage technologies will face a TNUoS tariff with a bespoke Annual Load Factor (Storage ALF) calculation, considering imports as well as exports. It is proposed that the tariff will read: peak + (Storage ALF x year-round shared) + (Storage ALF x year round not shared) + residual.

Baseline ALF = Gross Generation Volume (MWh) / TEC x 24 x 365

CMP393 Storage ALF = Gross Demand Volume (MWh) – Gross Generation Volume (MWh) / TEC x 24 x 365

Workgroup considerations

The Workgroup convened 4 times to discuss the perceived issue, detail the scope of the proposed defect, devise potential solutions, and assess the proposal in terms of the Applicable Code Objectives.

This modification was originally joined with 'CMP394: Removing Generation Charges from Electricity Storage Operators in Positive TNUoS Zones'. Workgroup meetings 1-3 had a strong focus on CMP394. The proposer withdrew CMP394 on 22nd December 2022, as they considered 'CMP393: Using Imports and Exports to Calculate Annual Load Factor for Electricity Storage' to be a simpler solution to a defect identified in both code modifications – i.e., that current TNUoS charges reflect only exports, and not imports. Meetings 4-5 focused exclusively on CMP393.

Consideration of the proposer's solution

Discussions in Workgroups 1-3 focused predominantly on CMP394. The Workgroup discussed their initial observations including how the modifications offered a different resolution from CMP331: Option to replace generic Annual Load Factors (ALFs) with site specific ALFs; whether conventional carbon and conventional low carbon should be referred to instead as dispatchable and non-dispatchable assets; and whether the current TNUoS model is designed to reflect constraints.

The Workgroup agreed that additional analysis would be required to refine CMP394. This included:

- Further details of the methodology that Cornwall Insight used to arrive at their analysis
- The behaviour of storage at peak
- The impact of potential future incentives for storage to import during constraints (currently not in place)
- The influence of current high power prices
- ALF analysis

All analysis can be found in the Annexes.

The Proposer contacted Cornwall Insight to request further details of the methodology used to structure their analysis. Cornwall Insight reiterated their initial explanation of their methodology. The analysis and details of the methodology can be found in Annex 4.

ESO provided historic data on the behaviour of storage at peak, including data on recent high prices. The data can be found in Annex 5.

The Proposer withdrew CMP394 on 15 December 2022. They had come to the conclusion that CMP393 is a simpler solution to a defect identified in both code modifications – i.e., that current TNUoS charges reflect only exports, and not imports.

Workgroup meetings 4 and 5 turned to CMP393, which received less attention than CMP394 in the earlier meetings.

In meeting 3, the Workgroup agreed that in order to move forward with CMP393, they would require draft storage ALFs based on the proposed changes. ESO therefore conducted the necessary analysis ahead of meeting 4.

In meeting 4, the Workgroup reviewed the draft Storage ALFs presented by ESO. The draft Storage ALFs can be found in Annex 6. The draft storage ALFs are negative, because storage assets import more electricity than they export due to energy losses associated with round trip efficiency.

Several Workgroup members queried the value of negative Storage ALFs. They considered that negative ALFs would be counterintuitive to a generation tariff, and they suggested that Storage ALFs should be floored at zero. Workgroup members also considered whether the methodology should change to look at both importing and exporting Half Hourly capacity.

Subsequently, there was a lively discussion of CMP393. The Proposer emphasised that:

- Unlike CMP394, CMP393 is not primarily about creating a locational signal. The proposed change to ALFs would apply to all storage, irrespective of location. .

- The proposed change will bring TNUoS closer in line with the precedent set by DUoS. The DUoS methodology incentivises demand (including storage) to locate close to generation. In this way it rewards operators for importing and thereby avoiding reinforcement.

- The Proposer acknowledged that CMP393 is a simplified solution, as it does not distinguish between imports at peak and non-peak times. But crucially, they continued, it is an improvement on the status quo, which does not reflect storage imports at all. The Proposer stressed that they are open to suggestions on how to improve CMP393.

Concerns expressed by a working group member relating to the cost reflectiveness of the proposal and the inclusion of demand in the calculation of the ALF:

- The calculation of peak and year-round load flows are based on demand taken at peak. The TNUoS model recognises that the higher the annual load factor of a generator behind a shared boundary the lower the opportunity for sharing will be and hence it receives higher charges. The proposed solution mixed up the temporal nature of boundary flow sharing driven by the ALF calculation. This calculation seeks to represent sharing that is possible at during peak conditions. Storage demand occurs off peak so is not relevant to the peak calculation. There is thus no link between the volume of storage demand and the sharing of boundary flows at peak as such it would be inappropriate to adjust ALF.

- The analysis presented by the proposer suggests that by reducing storage charges it will encourage the growth of storage behind boundaries and as a result reduce constraint cost. Storage in the current market arrangements is incentivised to export during high priced periods and import during low prices periods adjusting TNUoS rates will not change this position. In fact it may make the position worse as it could encourage storage to locates further from demand centres than it might otherwise do with the market incentive to export at peak time but be constrained off by the ESO in real time.

- The TNUoS model does not recognise constraints, only boundary sharing and distance from demand centres at times of peak demand and assumes the TO's have built the optimum network. The TNUoS model will deliver the same charge irrespective of the number of circuits across a boundary. If there is 1 or 100 circuits across a boundary the TNUoS mode will deliver the same tariff. Much of the proposes indicated value relates to minimising constraint costs but as the TNUoS model has no knowledge of constraints it follows that adjusting the ALF will not deliver the required response and is equivale to just reducing storage tariffs by an arbitrary [50% say] amount. The inclusion of Constraints in the TNUoS model will require a fundamental rework of the whole TNUoS model, changes to ALF include storage demand taken off peaks will not deliver a cost reflective solution or address the constraints issue.

- Storage is free to follow market price it is unlikely that storage will provide any relief to managing constraint via traded market arrangements. In the real time in the BM the ESO will be able to adjust storage generation or any other type generation that is scheduled over peak price periods but again there is no link between the ALF and this ability.

- Whilst it is the case that increased levels of storage will be helpful in low wind conditions to help meet demand and also to absorb surplus wind behind constraints the TNUoS methodology dealing with peak load flow conditions is simple not the correct vehicle.

- The proposer acknowledged that the proposed solution does not resolve certain year-round system impacts. However, the workgroup agreed that the split between year-round shared and not-shared was out of scope of the modification. A potential alternative was discussed where the net ALF is applied to the Year Round Not Shared tariff and the baseline ALF applied to the Year Round Shared tariff.

The Workgroup then discussed potential alternative solutions and defined consultation questions. These options have been included below as 'Potential alternative solutions' in the interest of transparency. Please note these are not the only options and there is potential for other solutions. For example, one Workgroup member suggested applying the proposed changes only in zones with a positive year-round tariff.

After the Workgroup meeting, the Proposer conducted analysis of TNUoS prices using ESO's five-year forecast, using baseline and CMP393 cases. This analysis can be found in Annex 7.

The Proposer also modelled the impacts of the potential options summarised below. Using ESO's TNUoS forecast for 2023/24, with ALF set at 9%, they forecasted impacts across all zones and derived average values. CMP393 averaged at £1.42/kW. Option 1 averaged at £1.47/kW, and Option 2 averaged at £1.98/kW. Options 3 and 4 averaged at £2.02/kW, and Option 5 averaged at £2.47/kW.

Potential alternative solutions

1. ***Floor Storage ALF at zero***

Draft tariff: peak + (Storage ALF floored at zero x year round shared) + (Storage ALF floored at zero x year round not shared) + Adjustment Element.

As discussed above, several Workgroup members queried the value of negative Storage ALFs. Negative ALFs, they argued, would introduce demand considerations into a generation tariff. They therefore proposed flooring Storage ALFs at zero. Flooring Storage ALF at zero would avoid negative non-shared and shared numbers.

2. ***Apply storage ALF to non-shared element only***

Draft tariff: peak + (ALF x year round shared) + (Storage ALF x year round not shared) + Adjustment Element.

A Workgroup member suggested that using Storage ALF as the solution across all storage would create a differential in the treatment of storage between the north and south. The workgroup noted that the revised TNUoS tariff would reduce incentives for storage to locate in areas dominated by synchronous generation, while increasing incentives for storage to locate in areas dominated by non-synchronous generation.

The Workgroup member therefore suggested a potential alternative: using the baseline methodology for year round shared, and using the proposed Storage ALF for year round not shared.

The year-round shared component of the Conventional Carbon tariff refers to areas dominated by synchronous power, which are mostly located in the south. The year-round not-shared element refers to areas dominated by non-synchronous power, which are mostly located in the north. Under Option 2, Storage ALF would only apply in zones where non-synchronous generation predominates. This would prevent the code modification from reducing the current incentive for storage to locate in the south, in areas dominated by synchronous plant.

The Proposer noted that the intention of CMP393 is for all storage to be more accurately represented in the methodology, regardless of location. CMP393 proposes to fix an inaccuracy in the TNUoS methodology for all storage, by taking imports and exports into account. In the view of the Proposer, this change would make the TNUoS methodology more cost-reflective, as it would better reflect storage's impact on the NETS; it would reduce barriers to competition, as storage TNUoS charges would be more closely related to storage behaviour; and it would ensure the TNUoS methodology better reflects changes in licensee business, given that more storage is connecting to the NETS. The Proposer observed that applying Storage ALF to the non-shared element only, and so allocating Storage ALF differentially according to location, would arguably reduce these benefits. Even so, in the view of the Proposer this option would improve on current arrangements.

3. Apply storage ALF to non-shared element only and floor at zero

Draft tariff: peak + (ALF x year round shared) + (Storage ALF floored at zero x year round not shared) + Adjustment Element.

This approach combines Options 1 and 2. The Workgroup's debates about these approaches are outlined above.

4. Remove non-shared element for storage

Draft tariff: peak + (ALF x year round shared) + Adjustment Element.

This alternative would have the same end result as Option 3. It would achieve this end result by simply removing the non-shared element for storage, rather than by using a Storage ALF floored at zero.

This option would reduce the complexity of implementation for ESO. Option 3 would result in a need to calculate two ALFs for all storage operators. Option four would reduce this administrative complexity.

5. Split out ALF into demand and generation components within the year-round not-shared element

Draft tariff: peak + (ALF x year round shared) + (ALF x year round not shared) – (Storage Demand ALF x year round not shared) + Adjustment Element.

Rather than using a unified Storage ALF, this approach would use a separate demand ALF and generation ALF for storage. This approach to ALF would apply only in the year-round not shared element of the TNUoS tariff. The end result would be likely to be the same as in Option 2 (i.e., applying storage ALF to non-shared element only).

In discussions of this option, a Workgroup member noted that final demand tariffs are based only on peak demand. Final demand has a similar effect on flows to storage demand, but it is subject to different charges and a different charging basis (peak + year round x triad demand floored at zero). By contrast, the proposed solution and the potential alternative solutions would take storage demand into account only in the year-round part of the tariff. The Workgroup member suggested that CMP393 therefore risks creating a distortion between different types of demand. They proposed that a key challenge with CMP393 and the potential alternative solutions is to ensure that there is no undue discrimination between final demand and storage demand.

The Proposer accepted that the modification would result in different treatments of final demand and storage demand. They also pointed out that current arrangements already treat storage demand and final demand differently, in that they do not recognize storage demand at all. They argued that while the proposed changes would not result in a fully consistent regulatory treatment of storage demand and final demand, they would improve on the status quo.

The work group noted that any of these solutions may have an impact on CMP405, which seeks to address locational demand TNUoS signals for storage.

6. *Classification*

Any of the options above within a new Generation Classification for storage

Rather than creating an additional tariff within Conventional Carbon, this option would create a new Storage generation classification. The proposed name of this generation classification is **Storage Generators (energy storage).**

Storage has a history of being identified as a subset of generation in the UK. The Government has committed to enshrining storage as a subset of generation in legislation, when parliamentary time allows. They also commit to allowing 'flexibility for treating storage differently to other forms of generation where it is appropriate to do so'.[11] A Generation Classification for storage would be consistent with this legislative direction of travel, recognising energy storage as a distinct type of energy asset capable of both importing and exporting.

Effect of CMP393 and potential options of potential alternative solutions on year-round locational signal

CMP393 uses an aggregated 'Storage ALF'. For all types of storage this is likely to be slightly negative, principally driven by round-trip efficiency. For a perfectly efficient storage facility, the ALF would be zero. Effectively then, by applying Storage ALF to the year-round element of the TNUoS tariff, CMP393 would remove the year-round locational signal for storage. Workgroup members reflected on the justification for this change, considering the principles behind ALFs and the year-round elements.

A Workgroup member highlighted that the original principle behind ALFs was to quantify the likelihood of generation exporting power at the same time, constraining networks and thus requiring reinforcement. Some workgroup members argued that storage importing is lowering that likelihood, meaning the proposed solution is consistent with the original principle behind ALFs. As set out in Project TransmiT, the year-round element of the TNUoS tariff is multiplied by ALF to provide 'a proxy of the impact an individual generator has on the costs of a system when investment is planned to manage constraint costs. Plant that operates more frequently would pay charges reflecting their increased likelihood of triggering (or avoiding) constraint costs'.[12]

The year-round locational signal is broken into two parts: shared and not-shared. In areas where there is a high degree of 'Conventional Carbon' generation, the shared signal is high. In areas where there is a high degree of 'Intermittent' generation, the not-shared signal is high. In the view of some Workgroup members, the key characteristic of 'conventional carbon' generation is not carbon emissions, but dispatchability. This generation type (coal, gas, etc) can be bid down to manage constraints caused by a lack

[11] Energy Security Bill Factsheet: Defining electricity storage', *GOV.UK*, <bit.ly/3KlyeeA>.
[12] *Project TransmiT*, p. 13.

of network capacity and low-carbon flexibility to accommodate inflexible (primarily wind) generation.

In areas where intermittent renewable generation has replaced dispatchable fossil-fuelled generation, the non-shared element is high. In part, this is because there are limited opportunities to balance system flows by turning down fossil generation. In these circumstances, storage demand and final demand have an important role to play in managing boundary flows by increasing demand at times of high intermittent generation output.

A key challenge with CMP393 and the optional solutions would be to ensure that there is no undue discrimination between final demand and storage demand. Final demand has a similar effect on flows to storage demand, but is subject to different charges and a different charging basis (peak + year round x triad demand floored at zero). The Proposer acknowledges this imperfection but observes that the proposed changes improve on the status quo, in which storage demand is not recognised at all.

If CMP393 is implemented, then in some areas there would be a negative non-locational charge. Workgroup members suggested that in order to implement CMP393, there would need to be a good understanding of what system conditions would lead to this negative charge, and whether it would be appropriate to continue to apply the negative non-locational charge to storage. As discussed above, there is a range of options to prevent CMP393 from resulting in negative charges, which could be adopted as WACMs by Workgroup members.

A workgroup member also stated that it is also important to understand if timing storage demand corresponds to low power prices and high power flows in the areas of the transmission system that have a high non shared charging element. This would provide evidence to support this solution. If this link can be made there may be merit in either bringing forward an alternative on this basis.

Specific Workgroup consultation question: Do these potential options better facilitate the charging objectives than the original proposal and if so, why?

Following discussions within the within the workgroup it was raised that using ALF as the solution across all storage creates a differential in the treatment of storage between the North and South. This may reduce incentives for storage to locate in more synchronous-dominated areas.

A potential alternative was suggested of using the baseline methodology when year round tariffs are negative and that would preserve the signal for Storage in the South, but use the proposed methodology for the ALF where the year round tariffs are positive.

Specific Workgroup consultation question: Should Storage ALF be floored at zero?

It was suggested reviewing original ALF principles are as it does not support Storage methodology. A workgroup member highlighted that the original principles behind ALFs where to quantify the likelihood of generation exporting power at the same time, thus requiring reinforcement. Some workgroup members felt that storage importing is lowering that likelihood, meaning the proposed solution is consistent with the original principle.

Specific Workgroup consultation question: Would CMP393 disincentivise storage from locating in the south?

Given that using a different ALF calculation methodology could lead to 0% or even negative ALFs, this would severely impact storage's year-round shared and non-shared TNUoS tariffs in particular, and could potentially lead to perverse incentives. Instead, would a separate storage generation classification with its own TNUoS wider tariff be a more appropriate solution to the defect identified by this mod?

Specific Workgroup consultation question: Should storage have its own generation classification for TNUoS?

Currently the proposal is that the new ALF calculation methodology only applies to the storage generation class given its import and export capabilities. Work group would welcome industry's views on whether and why such differentiation between users is justifiable and create different ALF methodologies for different users, or whether the same methodology should be extended to all other generation classifications.

Specific Workgroup consultation question: Should CMP393 apply only to storage or to all generation?

Through the proposed methodology of taking both generation and demand into account in the ALF calculation, the generation TNUoS charge will to some extent also reflect generators' demand behaviour. The Workgroup would welcome views from industry on whether and how they think this might or should impact demand TNUoS charges, and whether it could potentially lead to double charging or double discounts for users.

Specific Workgroup consultation question: How, if at all, does the proposed methodology interact with demand TNUoS charging?

Throughout the work group, the proposal has largely been considered from a battery perspective. Some of the analysis has also looked at the role of pumped storage in constraint management. When considering the importing and exporting capabilities/behaviour of both battery and pumped storage, the ALF methodology analysis showed (Annex 6) that pumped storage would typically have a more negative ALF than the battery operators used in the analysis. Work group would welcome views from industry on how the different characteristics of pumped storage and batteries might need to be taken into account in making sure the solution is an accurate reflection of how storage operates.

Specific Workgroup consultation question: Does the proposed solution have any materially different impact on battery storage compared to pumped storage that should be considered (While taking into account the proxy nature of TNUoS)?

Draft legal text

The draft legal text for this change can be found in Annex 3 once drafted after consultation.

What is the impact of this change?

Proposer's assessment against CUSC Charging Objectives	
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** Our proposed amendments to the transmission charging methodology for battery storage and pumped storage will ensure that the charging methodology better reflects how storage assets interacts with the NETS. This will remove a barrier to entry, better incentivising storage operators to compete to connect and provide system services. This will facilitate competition in the generation of electricity.
(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** This modification will result in more cost-reflective charges. It will ensure that the transmission charging methodology reflects how battery storage and pumped storage assets import power from the NETS, as well as exporting it. As a result, charges will better reflect the impacts of electricity storage on the NETS. The methodology was last updated in 2014, and was not designed with battery storage specifically in mind. As a result of this, it does not fully reflect the way electricity storage

	interacts with the NETS. The modification will help to rectify this.
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** This modification will ensure that the transmission charging methodology responds to the accelerating deployment of storage in the NETS. The methodology was last updated in 2014, and was not designed with battery storage specifically in mind. Since 2014, the amount of electricity storage, and in particular battery storage, connecting to the NETS has increased substantially. The modification will help to ensure that energy storage is better represented in the transmission charging methodology.
(d) Compliance with the Electricity Regulation and any relevant legally binding decision of the European Commission and/or the Agency *; and	**Neutral**
(e) Promoting efficiency in the implementation and administration of the system charging methodology.	**Neutral**
*The Electricity Regulation referred to in objective (d) is Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast) as it has effect immediately before IP completion day as read with the modifications set out in the SI 2020/1006.	

Proposer's assessment against Code Objectives

Proposer's assessment of the impact of the modification on the stakeholder / consumer benefit categories	
Stakeholder / consumer benefit categories	**Identified impact**
Improved safety and reliability of the system	**Positive** Removing barriers to entry for storage operators will make the network more balanced and secure, and less wasteful and carbon intensive. It will also reduce

	operational costs by enabling more efficient management of intermittent electricity flows in constrained regions. Storage assets provide a range of stability services, such as reactive power, short circuit level, and inertia. The proposed modification will enable more targeted and effective provision of these services, resulting in a safer and more reliable energy system.
Lower bills than would otherwise be the case	**Positive** The evolving nature of the electricity system is incentivising the ESO to provide a flexible transmission system, particularly as the move towards net zero will continue to locate renewable generation in areas of low demand. By ensuring transmission charges better reflect all the system impacts of storage, this modification proposal would remove a barrier to entry facing storage operators. This will support the integration of renewable generation, protecting consumers from volatile fossil gas prices. The code modification may also have the effect of supporting deployment of energy storage in constrained regions, where storage operators can reduce costs associated with curtailment. This aspect of the code modification should be considered in light of ongoing work by DESNZ and ESO on operational signals for flexible assets.
Benefits for society as a whole	**Positive** Government policy requires an electricity system that will help to deliver net zero. Encouraging the deployment of energy storage will facilitate the move to net zero, helping to integrate intermittent renewables and deliver a secure, decarbonised power system. This modification supports long-term Government aims to provide cheap, abundant renewable electricity. It will facilitate Government's legally binding move to net zero, supporting national climate crisis mitigation goals. By removing a barrier to the development of flexibility, it will also assist efforts to protect consumers from volatile fossil gas prices.
Reduced environmental damage	**Positive** This modification will result in reduced environmental damage by:

	Accelerating the decarbonisation of the GB energy system, mitigating climate crisis and driving progress to legally-binding net zero goals. Enabling the more efficient use of renewable energy by supporting the development of flexibility in the GB power system.
Improved quality of service	**Positive** This modification would better incentivise investment in electricity storage. This would support the uptake of renewable energy by balancing intermittent power flows, and by providing sources of essential system services (e.g., reactive power, inertia, frequency). This will ensure low-carbon, affordable electricity can reliably be delivered to consumers.

Standard Workgroup consultation question: Do you believe that CMP393 Original proposal better facilitates the Applicable Objectives?

When will this change take place?

Implementation date
1 April 2024

Date decision required by
1 October 2023

Implementation approach
There are ESO process impacts in tariff setting and potential system impacts on the Transport and Tariff model.

Proposer's justification for governance route
Governance route: Standard Governance modification with assessment by a Workgroup
The Proposer has selected the Standard Governance route as the proposed modification is likely to have an impact on parties connecting to the NETS.

Standard Workgroup consultation question: Do you support the implementation approach?

Interactions

☐Grid Code	☐BSC	☐STC	☐SQSS
☐European Network Codes	☐ EBR Article 18 T&Cs[13]	☒Other modifications	☐Other

How to respond

Standard Workgroup consultation questions

1. Do you believe that CMP393 Original proposal better facilitates the Applicable Objectives?
2. Do you support the proposed implementation approach?
3. Do you have any other comments?
4. Do you wish to raise a Workgroup Consultation Alternative request for the Workgroup to consider?

Specific Workgroup consultation questions

5. Do these potential options better facilitate the charging objectives than the original proposal and if so, why?
6. Should Storage ALF be floored at zero?
7. Would CMP393 disincentivise storage from locating in the south?
8. Should storage have its own generation classification for TNUoS?
9. Should CMP393 apply only to storage or to all generation?
10. How, if at all, does the proposed methodology interact with demand TNUoS charging?
11. Does the proposed solution have any materially different impact on battery storage compared to pumped storage that should be considered (While taking into account the proxy nature of TNUoS)?

The Workgroup is seeking the views of CUSC Users and other interested parties in relation to the issues noted in this document and specifically in response to the questions above.
Please send your response to cusc.team@nationalgrideso.com using the response pro-forma which can be found on the CMP393 modification page.
In accordance with Governance Rules if you wish to raise a Workgroup Consultation Alternative Request, please fill in the form which you can find at the above link.

[13] If the modification has an impact on Article 18 T&Cs, it will need to follow the process set out in Article 18 of the Electricity Balancing Regulation (EBR – EU Regulation 2017/2195) – the main aspect of this is that the modification will need to be consulted on for 1 month in the Code Administrator Consultation phase. N.B. This will also satisfy the requirements of the NCER process.

If you wish to submit a confidential response, mark the relevant box on your consultation proforma. Confidential responses will be disclosed to the Authority in full but, unless agreed otherwise, will not be shared with the Panel, Workgroup or the industry and may therefore not influence the debate to the same extent as a non-confidential response.

Acronyms, key terms and reference material

Acronym / key term	Meaning
ALF	Annual Load Factor
BSC	Balancing and Settlement Code
CMP	CUSC Modification Proposal
CUSC	Connection and Use of System Code
EBR	Electricity Balancing Regulation
ESO	Electricity System Operator
NETS	National Electricity Transmission System
STC	System Operator Transmission Owner Code
SQSS	Security and Quality of Supply Standards
T&Cs	Terms and Conditions
TEC	Transmission Entry Capacity
TNUoS	Transmission Network Use of System charges

Reference material

Annexes

Annex	Information
Annex 1	Proposal Form
Annex 2	Terms of Reference
Annex 3	Draft Legal Text
Annex 4	Cornwall Insight modelling results
Annex 5	ESO data analysis
Annex 6	ALF Storage analysis
Annex 7	TNUoS prices using ESO’s five-year forecast analysis