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Workgroup Report

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 (ALF) 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**
   12 May 2023 – 02 June 2023
3. **Workgroup Report**
   14 March 2024
4. **Code Administrator Consultation**
   03 April 2024 – 24 April 2024
5. **Draft Final Modification Report**
   23 May 2024
6. **Final Modification Report**
   17 June 2024
7. **Implementation**
   01 April 2025

Have 5 minutes? Read our Executive summary

Have 20 minutes? Read the full Workgroup Report

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

Status summary: The Workgroup have finalised the proposer's solution. They are now seeking approval from the Panel that the Workgroup have met their Terms of Reference and can proceed to Code Administrator Consultation.

This modification is expected to have a: High impact on 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**: Teri Puddefoot terri.puddefoot@nationalgrideso.com 07812 508708

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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, with a floor at zero.

Implementation date: 01 April 2025

Summary of alternative solution(s) and implementation date(s):
Two Alternative Requests were raised following the Workgroup Consultation. Both were deemed by the Workgroup to not be in scope of this modification, and the Proposer of the Alternative Requests subsequently withdrew them. These can be found in Annex 9.

Workgroup conclusions: The Workgroup concluded unanimously/by majority that the Original better facilitated the Applicable Objectives than the Baseline.

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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. However, Ofgem and the CUSC panel have determined that the two code modifications can proceed independently. CMP393 proposes to alter ALFs, while CMP405 proposes to alter demand charging. As such the two modifications propose distinct solutions to a similar defect.

CMP316 also proposes amends to the ALF section of the CUSC, however these changes can occur without impacting the intention of CMP393.

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What is the issue?

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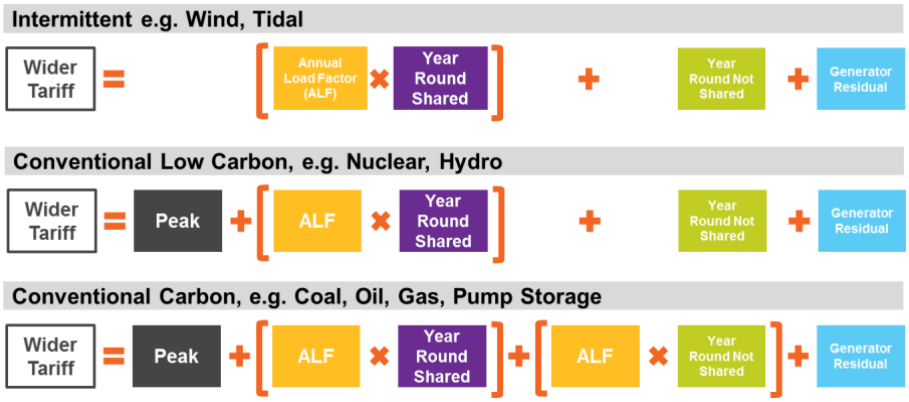

Figure 1: TNUoS Generation Classifications. See *TNUoS Guidance for Generators* (National Grid ESO, 2019), <https://www.nationalgrideso.com/document/138046/download>, p. 11.

For the purposes of transmission charging and ALF, battery storage was until recently treated the same as pumped storage.[1] Since 2023/24 battery storage has an assumed Generic ALF of 1.6%, while pumped storage has an assumed Generic ALF of 8.6%.[2]

Why change?

In the view of the Proposer, current TNUoS charging arrangements for electricity storage are inconsistent with the CUSC Applicable Charging Objectives (ACOs).[3] 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

[1] See *Final Annual Load Factors for 2022/23 TNUoS Tariffs* (National Grid ESO: 2022), <TNUoS Guidance for Generators>, pp. 10, 14, 17.
[2] Final Annual Load Factors for 2023/24 TNUoS Tariffs, January 2023, National Grid ESO, https://www2.nationalgrideso.com/document/275686/download
[3] By 'electricity storage' the Proposer refers to all storage that currently has booked Transmission Entry Capacity (i.e., pumped and battery).

charges take account of developments in transmission licensee business, as they do not reflect the increasing amount of storage connecting to the NETS.

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 believes that the reasons for the defect can be grouped 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 engaged the consultancy Lane Clark Peacock (LCP) to model the behaviour of battery and pumped storage during high network loads, and to consider whether the current methodology accurately reflects this behaviour. The LCP report is in Annex 11.

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 Generation 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'.[4] 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, and the recent addition of battery storage-specific Generic ALF, transmission charging regulation has not adapted to the accelerating deployment of storage.[5] 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

[4] *Project TransmiT: Decision on proposals to change the electricity transmission charging methodology* (London: Ofgem, 2014), p. 13.
[5] See *Final TNUoS Tariffs for 2019/20* (National Grid ESO: 2019), p. 13.

reinforcement of the electricity system.[6] Since the Project TransmiT changes were implemented, the UK landscape for electricity storage has changed considerably, with 3GW battery storage now connected to the system, in addition to the 3GW of pump storage already deployed. 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 does not publish transparent information on how it calculates the contribution of battery storage to network reinforcement. However, 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.

Based on conversations with ESO, the proposer and LCP believe that the approach to developing Connection Planning Assumptions is as follows:

- A GB-wide dispatch of the wholesale power market is carried out. There are
- stochastic simulations of different wind and demand conditions.
- Battery assets are assumed to participate in wholesale arbitrage, as this is
- their main long-term revenue stream.
- In the local area of the new connection, the level of constraint is calculated in each period and the results for the most constrained 5% of hours are kept. These will differ regionally depending on the capacity mix.
- Across these periods, the average generation of each technology is taken and provides the assumptions that are passed to the network operator for them to assess required reinforcements.
- Storage assets may be both charging and discharging across those periods, and so the assumption passed onto the ESO is based on their average position.
- The required reinforcements are therefore calculated to accommodate full import and export of a storage asset.

As set out in Annex A of LCP's supporting analysis, this has the following implications for the treatment of battery and pumped storage in TNUoS:

- During the most constrained periods, storage which is assumed to already connect may be importing or exporting and their average behaviour is considered.
- The network must be able to accommodate the maximum import and export of the additional storage, but each individual asset is understood to be a relatively minor contributor to the constraints in these periods.
- The TNUoS methodology aims to replicate these peak loading conditions on the network through two national backgrounds. The backgrounds could be considered a proxy for more granular connection planning assumptions.
- The CPA methodology provides a precedent for evaluating both storage imports and exports when considering system constraints in relation to network planning.

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[6] See 'Project TransmiT: Impact Assessment of industry's proposals (CMP213) to change the electricity transmission charging methodology', Ofgem, (137/13, 2013), < https://www.ofgem.gov.uk/sites/default/files/docs/2013/08/project_transmit_impact_assessment_of_cmp213_options.pdf >.

- Therefore, TNUoS charges should also represent the range of possible storage actions during constraint period. The proposed changes under CMP393 are consistent with ESO's approach to CPAs as of February 2024, which assumes an average position of 0MW for storage during constraints.

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Finally, national net zero commitments and Ofgem's statutory duty to regulate in support of net zero are a significant development in transmission licensee business. 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 decarbonisation objectives.

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'.[7]

ESO's CPAs assume storage has a different impact on the network from gas and coal. However, the current transmission charging methodology provides storage operators with a signal designed for coal or gas-fired generators, implicitly assuming it has the same impact on network reinforcement. This does not accurately reflect how storage interacts with the NETS and is inconsistent with ESO's approach to storage in network planning. As discussed above, while the storage deployment has increased since Project TransmiT, and while ESO have updated CPAs to reflect the impact of storage on network reinforcement, the charging methodology has not changed to reflect this.

As a result, in the view of the proposer 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-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

[7] *Project TransmiT*, p. 18.

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 result in 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'.[8] 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'.[9] 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 ran alongside the TNUoS Task Force, setting a direct precedent for the proposed approach.

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. Storage technologies will face a TNUoS tariff with a bespoke Annual Load Factor (Storage ALF) calculation, considering imports as well as exports, with a floor at zero. 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 = max (0, Gross Generation Volume (MWh) – Gross Demand Volume (MWh)) / TEC x 24 x 365

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

Workgroup considerations

The Workgroup convened 11 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 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 requested to withdraw CMP394 on 22 December 2022, as they considered CMP393 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. The modification was formally withdrawn following the CUSC Panel meeting on 27 January 2023. Further meetings focused exclusively on CMP393, and the Terms of Reference were modified at the CUSC Panel meeting on 25 August 2023 solely to reflect CMP393.

Consideration of the proposer's solution

Discussions in initial Workgroups focused predominantly on CMP394. The Workgroup discussed their initial observations including how the modifications offered a different resolution from CMP331; 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.
Note: CMP331 was later rejected by the Authority.

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

This analysis can be found in Annexes 4-5.

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.

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, which can be found in Annex 6. Instead of the baseline ALF calculation of aggregated energy output, the proposed new ALF uses aggregated energy **net** output. The resulting draft storage ALFs were negative, because storage assets import more electricity from the NETS 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.

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

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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, it is an improvement on the status quo, which does not reflect storage imports at all.

Concerns expressed by a Workgroup 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

Commented [ro11]: LCP analysis demonstrates that storage demand occurs at peak times, with storage tending slightly to import during constraints.

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Commented [ro13]: the TNUoS model already considers constraints - ALF is intended to be a 'proxy for the impact an individual generator has on the system when investment is planned to manage constraint costs'. This is described in the LCP modelling

Commented [ro14]: the mod is not about constraints, it is about adjusting ALF for storage to reflect the impact of storage on network investment

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, however this was not raised. -

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Proposer response to concerns

- The concerns in the first paragraph are addressed by the LCP analysis, which models storage behaviour at peak.
- The second paragraph refers to the Cornwall Insight analysis and is no longer relevant to CMP393.
- On paragraph three - we disagree that 'inclusion of Constraints in the TNUoS model will require a fundamental rework of the whole TNUoS model'. The TNUoS model already considers constraints - ALF is intended to be a 'proxy for the impact an individual generator has on the system when investment is planned to manage constraint costs'. This is described in detail the LCP analysis.
- The fourth paragraph again discusses storage and constraint management. CMP393 proposes to bring TNUoS ALF in line with net storage ALF and does not seek to turn TNUoS into a constraint management signal.
- The fisth paragraph again focuses on constraints and discusses peak load flow conditions. We note that storage will continue to face the peak element under 393.
- The final paragraph discusses a potential option to apply storage ALF to year-round not shared and year-round shared. The Workgroup member was free to raise this option as a WACM but chose not to.

The Workgroup discussed potential alternative solutions and defined Workgroup Consultation questions. The options referred to within the Workgroup Consultation and consideration of their potential effect on the year-round locational signal can be found in Annex 9.

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. 10

Workgroup consultation summary

The Workgroup held their Workgroup Consultation between 12 May 2023 – 02 June 2023 and received 7 responses. The full responses and a summary of the responses

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Zenobe to also add response

Commented [ro17R16]: These concerns are addressed in the LCP analysis. As far as I am aware no other WG members shared the concerns, except maybe ESO. We should clarify this in the next WG meeting and run through each point to consider collectively whether they have been addressed.

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can be found in Annex 8. Following the Workgroup Consultation, it was identified that there had been an error in part of the Proposer's solution section of the document. All respondents were contacted and given the opportunity to amend their response based on this. Out of the five respondents who replied to this, only one opted to change their response. Details of this can be found in Annex 8.

Key points from the Workgroup Consultation are summarised below:

- CUSC Charging Objectives (a), (b) and (c) were deemed to be better facilitated by the Original by four respondents, one respondent believed that the Original better facilitated objective (d), and two respondents believed that the Original better facilitated objective (e).
- Four respondents supported the implementation approach, with one respondent not supporting the implementation approach, stating that it needs to be fully clarified by the Workgroup with enough time to make changes to the ALF calculation.
- Four respondents believed that storage ALF should be floored at zero, with one respondent opposing this. There were several concerns raised regarding the potential for a negative ALF having unintended consequences on TNUoS charging such as rewarding less efficient storage systems. The Proposer later updated their solution to floor ALF at zero.
- One respondent believed that CMP393 would disincentivise storage from locating in the South, with four respondents believing this would not occur.
- Four respondents believed that storage should have its own generation classification for TNUoS, but two respondents did not.
- Two respondents did not believe that CMP393 facilitates any of the CUSC charging objectives better than the baseline.
- One respondent noted that introducing a new methodology for calculating ALFs for one type of generator could be discriminatory and noted that no clear evidence has been produced as to why the current methodology presents a defect for storage operators.
- Some respondents noted that double charging could be caused by the proposed methodology. One respondent had the view that the use of network charge (i.e. TNUoS) should not be applied to the energy losses of storage.

Alternatives
Two Workgroup Alternative Requests were raised following the Workgroup Consultation. Both were deemed by the Workgroup to not be in scope of this modification, and the Proposer of the Alternative Requests subsequently withdrew them. These can be found in Annex 10.

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Post Workgroup Consultation Discussions

The Workgroup Alternative Requests were presented to the Workgroup, and after several discussions it was agreed that the two Alternative Requests were not in scope. The Workgroup expressed an interest in part of one of the Alternative Requests, which floored storage ALF at zero. The Proposer subsequently revised the Original solution to floor storage ALF to zero.

On review of the modification Terms of Reference, it was identified that some of the Terms of Reference were no longer relevant since they related to CMP394, which was withdrawn. The Terms of Reference were modified at the CUSC Panel meeting on 25 August 2023 to solely reflect CMP393.

The Authority Representatives queried the locational impact of CMP393 and requested some analysis on the behaviour of storage in respect to constraint management and benefits to the NETS. This analysis can be found in Annex 11.

The Workgroup reviewed the analysis, and it was noted that the B6 boundary constraint was the only constraint considered. The Proposer stated that this constraint was chosen as it shows storage balanced between charging and discharging, which is consistent with wider storage behaviour. This constraint also allowed pumped storage to be considered on both sides of the boundary. The Proposer noted that their historic analysis supports the case that the proposed storage ALF is more appropriate than the current one, and that it is a good representation of storage load factors during periods of constraint.

One Workgroup member ~~noted~~ questioned the potential for negative charging in some geographical areas, highlighting that this could be an incentive for some storage operators. The Proposer noted that batteries can increase load if importing at times of peak. However, a Workgroup member noted that price signals do not often lead to this happening.

The Authority representative asked whether there was modelling available for constraints other than the B6 boundary. The consultant noted that they had only considered B6, but noted that further analysis could be done to consider other constraints if required. The Proposer ~~noted~~ confirmed that B6 was chosen so that pumped storage could be considered on both sides of the boundary, and they did not feel that further analysis was needed, as they felt they had satisfied the Authority's request for analysis on behaviour of storage.

The Workgroup discussed and agreed the legal text, agreeing~~and agreed~~ to use the existing definitions in the CUSC for Electricity Generation Facility and Electricity Storage Facility, noting that the definitions apply to all electricity storage, rather than just batteries and pumped hydro.

The Proposer subsequently met the Authority bilaterally and discussed boundary analysis and connection planning assumptions. The Proposer explained that B6 was chosen to enable both historic and forward-looking analysis of storage behaviour. Pumped storage facilities flank the B6 boundary. There is no historic data of the network impacts of transmission-connected batteries trading in wholesale markets and the

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Balancing Mechanism. The Authority accepted this explanation as sufficient to render unnecessary further analysis of other boundaries.

The Proposer also summarised to the Authority their conversation with the ESO about connection planning assumptions, which is captured earlier in this report and in Annex A of the LCP analysis. The Authority noted the need for more detailed information from the ESO about how they assess reinforcement for a) battery storage and b) pumped storage.

The ESO presented their revenue analysis (Annex 12) to the Workgroup, noting that this was based on the draft tariffs. The ESO Revenue representative identified that less revenue would be collected from storage generators and therefore this would need to be collected from the adjustment tariff. The impact here being to increase the adjustment tariff across all areas as this is not reflected regionally, with differences being seen in storage types.

A Workgroup member noted that whilst the change in this modification is to look at how storage is charged a future modification may be needed to look at how storage is modelled. One Workgroup member noted that the analysis reflects that the modification is not cost reflective, highlighting that it will increase storage costs in the South. The Ofgem representative requested further examples to show tariff changes on an annual basis for pumped hydro sites.

Commented [LT(25]: Update this based on discussions on further examples in Workgroup 11.

The ESO provided an update on implementation costs of CMP393. The ESO representative noted that this would be a BAU activity, meaning there would be no additional IT costs for implementation.

Commented [LT(26]: @Stephen Dale (ESO) are you happy with this wording?

Legal text

The legal text for this change can be found in Annex 3.

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 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.

Workgroup vote

The Workgroup met on 27 February 2024 to carry out their workgroup vote. The full Workgroup vote can be found in Annex 13. The table below provides a summary of the Workgroup members view on the best option to implement this change.
The Applicable CUSC charging Objectives are:

CUSC charging objectives

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;
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);
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;
d) Compliance with the Electricity Regulation and any relevant legally binding decision of the European Commission and/or the Agency *; and
e) To promote efficiency in the implementation and administration of the system charging methodology

*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.

The Workgroup concluded unanimously/by majority that the Original better facilitated the Applicable Objectives than the Baseline.

Option	Number of voters that voted this option as better than the Baseline
Original	

When will this change take place?

Implementation date
01 April 2025

Date decision required by
30 September 2024

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

Interactions

Commented [LT(27)]: ToR (d)

☐Grid Code	☐BSC	☐STC	☐SQSS
☐European Network Codes	☐ EBR Article 18 T&Cs[10]	☒Other modifications	☐Other

[10] 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

There is a potential interaction with another current modification, CMP405. However, Ofgem and the CUSC panel have determined that the two code modifications can proceed independently. CMP393 proposes to alter ALFs, while CMP405 proposes to alter demand charging. As such the two modifications propose distinct solutions to a similar defect.

CMP316 also proposes amends to the ALF section of the CUSC~~, however these changes can occur without impacting the intention of CMP393~~.

Commented [LT(28]: Need to add more here regarding legal text interaction.

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.

ESO

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

Annexes

Annex	Information
Annex 1	Proposal Form
Annex 2	Terms of Reference
Annex 3	Legal Text
Annex 4	Cornwall Insight modelling results
Annex 5	ESO data analysis on behaviour of storage at peak
Annex 6	ALF Storage analysis
Annex 7	TNUoS prices using ESO's five-year forecast analysis
Annex 8	Workgroup Consultation Responses and Summary
Annex 9	Alternative options discussed prior to the Workgroup Consultation
Annex 10	Proposed Workgroup Alternative Requests
Annex 11	LCP Analysis on behaviour of battery and pumped storage during high network loads
Annex 12	ESO Revenue Analysis
Annex 13	Workgroup Vote
Annex 14	Workgroup Attendance Record

Commented [LT(29]: Do we need to reference this somewhere in the report? E.g. note that it was done but is no longer relevant due to … ?