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Assessing the case for CMP405

Presentation to CMP405 working group

9 November 2023

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- The rationale for CMP405
- Quantitative assessment of benefits
- Credit design

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Context and overview

CMP405 HAS BEEN PROPOSED TO ADDRESS A DISTORTION THAT CURRENTLY EXISTS BECAUSE TNUOS DEMAND TARIFFS DO NOT REFLECT THE BENEFITS PROVIDED BY STORAGE IMPORTING DURING PERIODS OF NETWORK CONSTRAINTS

SSE as the proposer has submitted CUSC Modification CMP405

- CMP405 is seeking to pay a credit based on TNUoS “Year Round” costs to Storage in negative charging zones
- If accepted, the mod would be implemented by 01 April 2024

Frontier and LCP have been appointed to carry out an initial assessment of the case for CMP405:

- We set out the in principle case for CMP405, supported by quantitative analysis
- We consider the possible options for designing the demand credit
- Once a final design has been settled upon, a full CBA will be required, which is out of scope of this engagement

In this presentation, Frontier Economics and LCP set out a summary of our analysis, which is explained in more detail in our full report

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1. The rationale for CMP405

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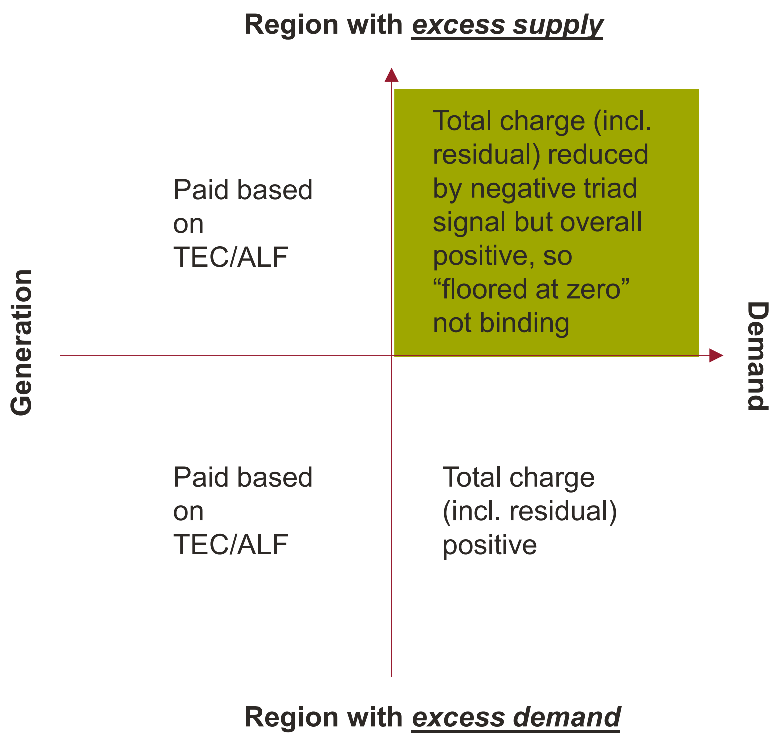
Pre-TCR, TNUoS sent consistent cost reflective operational and investment signals to both generation and demand



Motivation for “floored at zero” was to avoid inefficient consumption at peak. Pre-TCR it was never binding

Operational efficiency :

While total charge faced by demand in negative locational demand charge zone was lower than in a positive locational charge zone, given total charge was always positive, there was no inefficient incentive for increasing consumption at peak.

Investment efficiency :

Since demand in negative locational demand charge zones faced a lower total charge than demand in positive demand zones, there was an incentive to focus demand investment in those zones.

Post-TCR, there is a mismatch between cost reflective generation and demand signals

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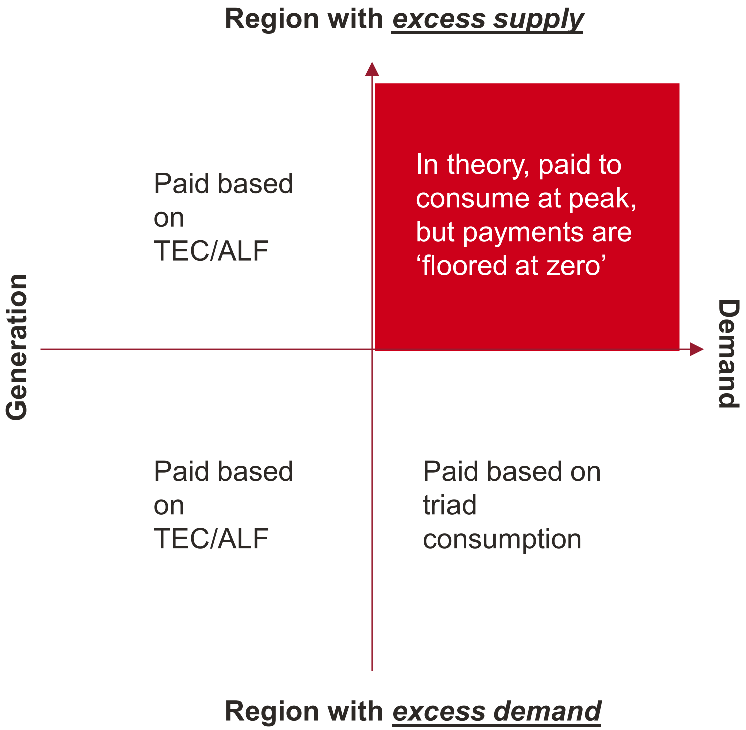

With residual removed from triad, "floored at zero" starts to bind in negative demand charging zones

Operational efficiency :

Locational charge is floored at zero, so no sources of demand receive a payment for consuming at peak, avoiding inefficient consumption

Investment inefficiency :

Sources of demand in negative locational demand charge zones do not receive a credit related to the benefit of being located in the that zone, as they pay the same total charge as sources of demand in zones with a zero locational charge. This reduces the incentive to invest in negative locational demand charge zones.

Key question: How can charges be designed to restore lost investment signal without causing operational efficiency?

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In principle, TNUoS charges should be cost reflective

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Minimising total system costs

- Market participants should face the costs that they impose on the system
- They then take these costs into account in all of their investment and operational decisions.
- In other words, charges should be *cost reflective*

Cost reflective network charges

- To internalise costs in the decisions of market participants:
  - *forward looking costs* must be reflected: these can be changed by future behaviour; and
  - *incremental or marginal* costs, not average costs
- No meaning to ‘cost reflectivity’ in relation to *historic* costs

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Project Transmit introduced the concept of Peak Security and Year Round costs, though limited consideration of implications for demand

2022/23 forecast tariffs*

Demand Zone		2022/23 April Peak (£/kW)	2022/23 April Year Round (£/kW)
1	Northern Scotland	-3.116462	-27.428739
2	Southern Scotland	-3.215416	-18.599220
3	Northern	-4.063048	-7.542140
4	North West	-1.585722	-4.140701
5	Yorkshire	-3.215572	-1.813832
6	N Wales & Mersey	-2.412292	-1.988324
7	East Midlands	-2.487282	1.150504
8	Midlands	-1.419253	1.634158
9	Eastern	1.249970	-0.069565
10	South Wales	-3.583402	5.305982
11	South East	3.790322	-0.265553
12	London	5.603960	1.059458
13	Southern	1.809885	3.419941
14	South Western	0.780133	6.380386

- Transmit focused on the implications of different generators for Year Round costs.
- Appeared to have no explicit consideration with respect to demand.

Project Transmit resulted in tariffs that separately recognised Peak Security and Year Round costs

- **Peak security charge** sends a signal to demand to locate close to generation in order to reduce network flows in peak hours
- **Year Round charge** sends a signal to demand to locate close to generation in order to reduce network flows throughout the year in periods that drive congestion, thus network investment.

Key questions: Should CMP405 focus on both TNUoS charges, or just one? Should it focus on all sources of demand?

* Source – Forecast TNUoS Tariffs for 2022/23, August 2021,Table 21

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Focus of CMP405 is to restore missing cost reflective investment signal for storage based on Year Round costs

FOCUS ON STORAGE…

- Distortion arising from “floored at zero” applies more broadly to demand
- As a result, while CMP405 addresses investment distortion between positive and negative charging zones, it potentially creates a new distortion between storage and other forms of demand in future
- It should therefore be considered a first step in addressing wider issue, reflecting the importance of ensuring efficient locational signals for the current pipeline of storage assets given BEIS’s commitment to implementing a policy to enable investment in long duration storage by the end of 2024

… AND YEAR ROUND COSTS

- Storage will not typically consume during triads and therefore, will face zero demand locational charges in respect of both Peak and Year Round elements
- For the Peak element of charges, this is reasonable because if storage is not charging in peak demand periods, it should face no demand charge (credit) for doing so
- However, for the Year Round element, its beneficial behaviour related to relieving of constraints during off-peak periods is not recognised

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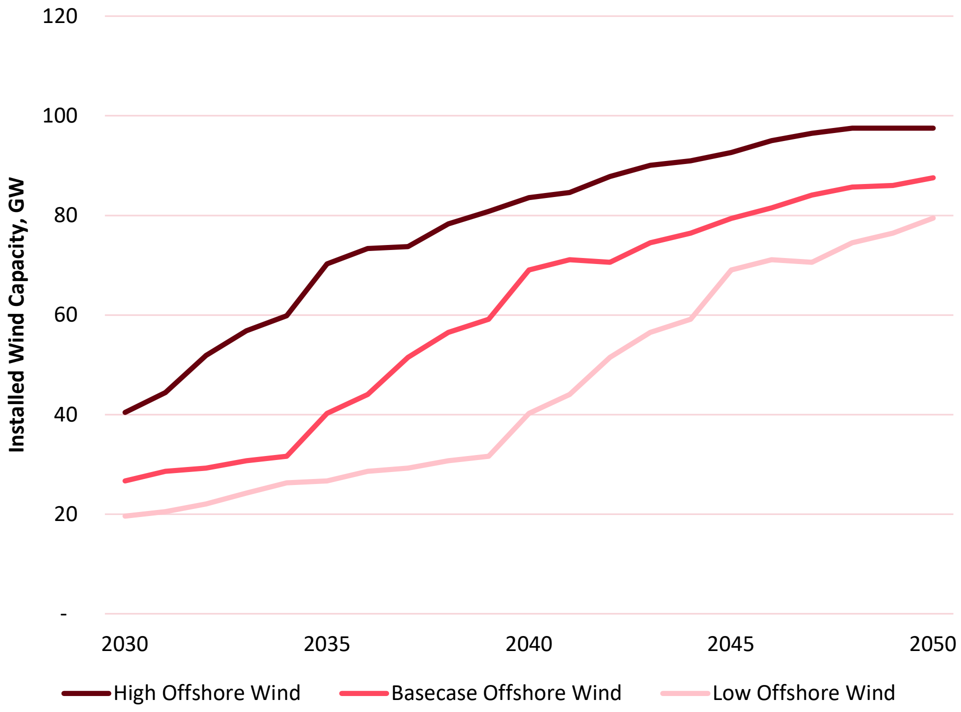
Modelling approach – high level overview

MODEL OVERVIEW

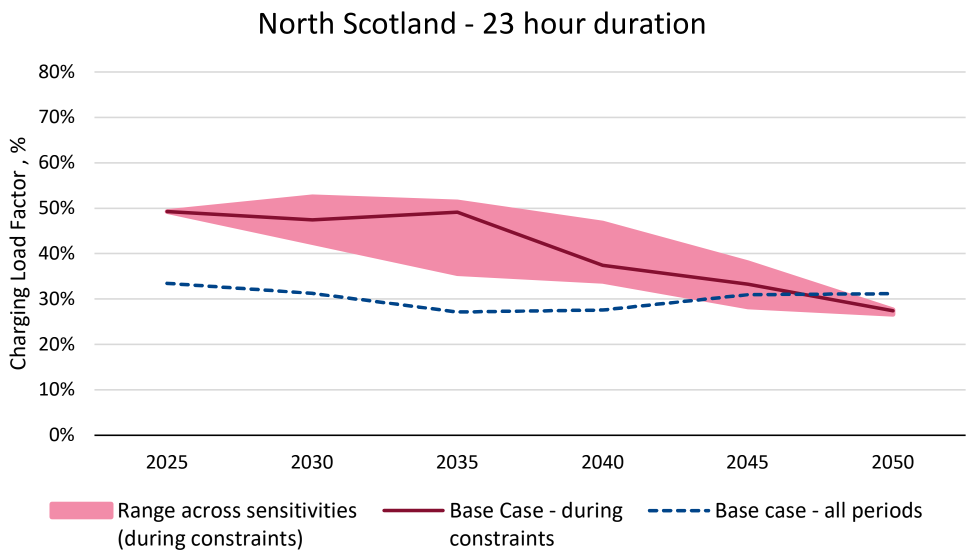
- We have used LCP Delta's EnVision model to demonstrate the benefits that storage assets located In Scotland can have through charging to relieve constraints on the B2 and B6 boundaries.
- The modelling assesses the potential benefits that storage of different durations may bring to the system in terms of constraint management. It therefore models the operational system cost savings relative to the counterfactual; it does not model the investment cost savings.
- We compare a counterfactual to two factual scenarios with a range of five background cases. The counterfactual has no new build LDES capacity, while the two factual scenarios assume additional storage (long duration (FS1) and short duration (FS2) respectively) resulting from CMP405 being deployed by 2050.
- National Grid ESO's FES 2022 'System Transformation' (ST) scenario is used as the basis for these five cases. The five cases vary by their network capacity and wind capacity.
- We have modelled 2025-2050 in five-year increments, with each year modelled under five different weather years. This was to show the extent to which storage typically charges during periods of constraints and thus the contribution its charging makes to relieving those constraints.

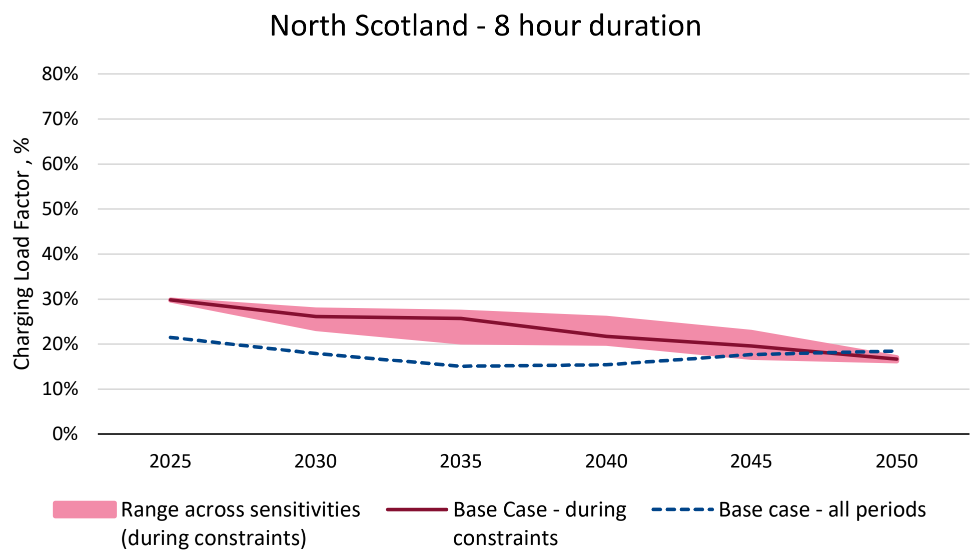
WIND SCENARIOS



Storage charging load factors during constraints – North Scotland

CHARGING LOAD FACTOR FOR 23 AND 8 HOUR STORAGE DURATION - NORTH SCOTLAND





Storage charging load factors during constraints – South Scotland

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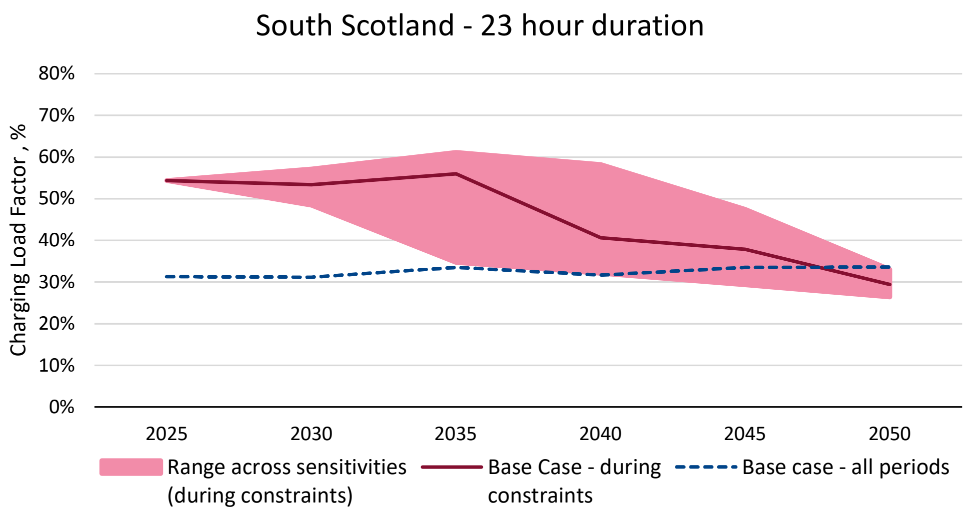
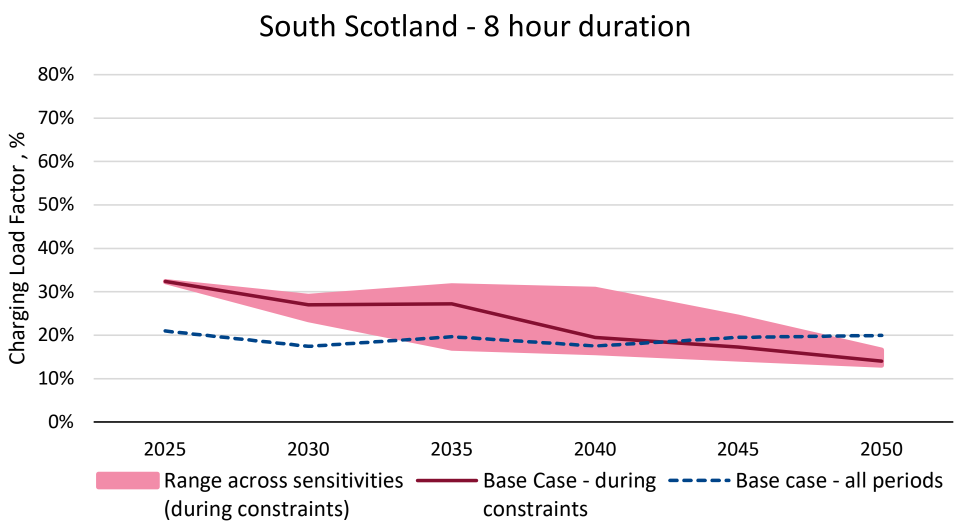
CHARGING LOAD FACTOR FOR 23 AND 8 HOUR STORAGE DURATION - SOUTH SCOTLAND





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By reflecting these system benefits into TNUoS charges, more efficient investment decisions will result

Storage assets behind a network constraint are able to capture energy that would otherwise be curtailed, and dispatch it in other unconstrained periods, thereby avoiding the need for some network investment. Based on our modelling, these benefits are higher for LDES than SDES capacity

By ensuring TNUoS charging accounts for the impact storage charging has on relieving network constraints, and associated CMP405 should lead to more efficient investment decisions by storage plants.

This applies to investment in new and existing storage assets as well as to more efficient closure decisions

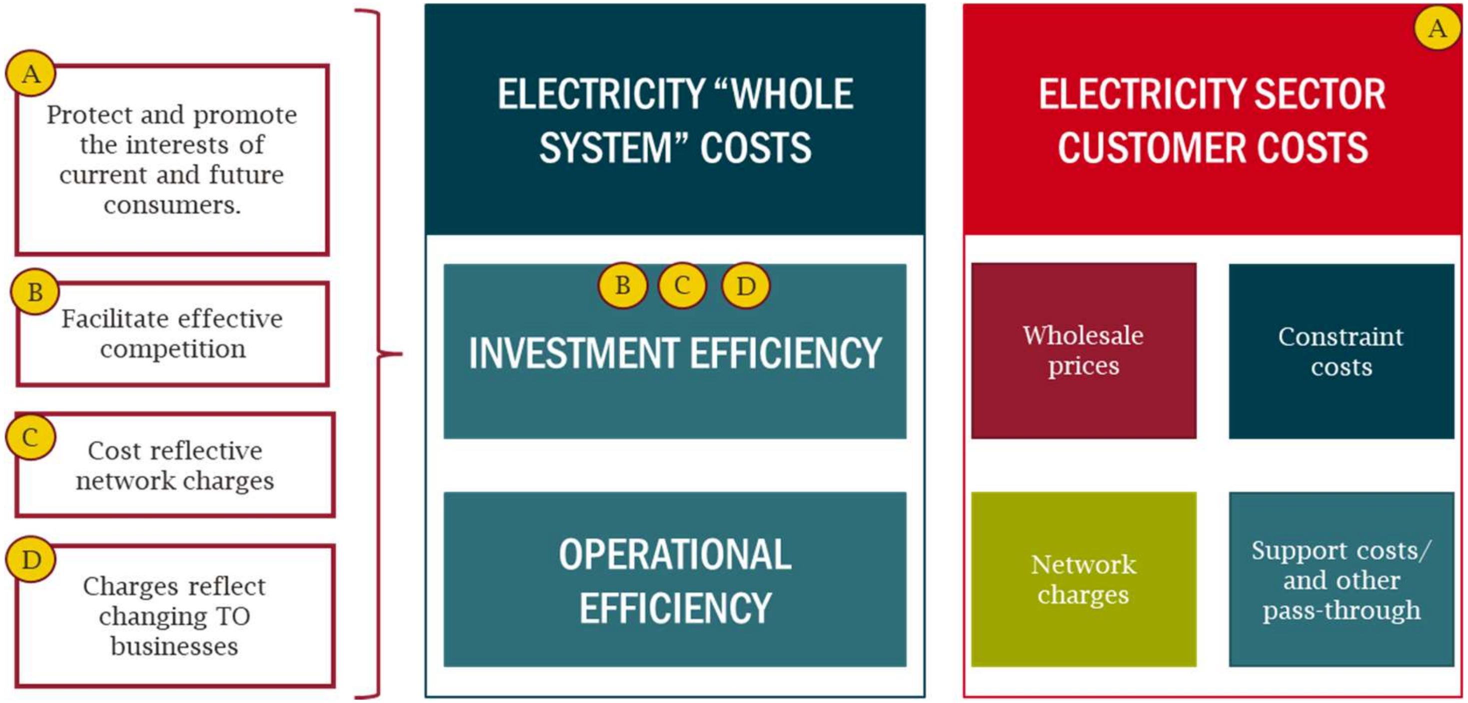
If network charges are cost reflective, market participants should internalise their impact on future network costs into their investment decisions, leading to a more efficient pattern of investment

Ultimately, it is difficult to identify the optimal level and location of investments by generation, demand and storage through modelling. Therefore, sound economic principles should form the basis of the final decision in relation to any changes to network charging arrangements, including minimising distortions, fairness, and practical considerations

CMP405 demand credit would better align the TNUoS charging framework with these principles and therefore it is appropriate for CMP405 to be taken forwards

2. Quantitative assessment of benefits

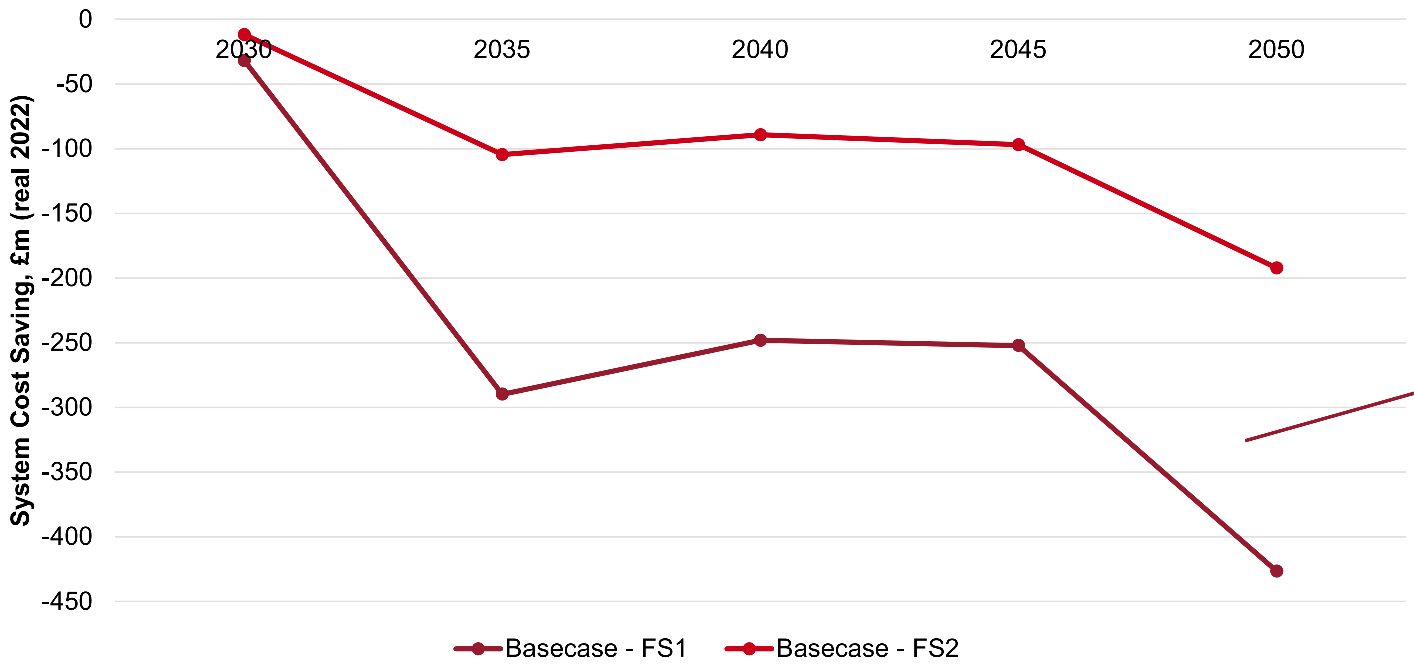
Assessing network charge reform needs consideration of both system and customer costs, and is consistent with Ofgem's primary duty



- We considered system costs:
  - Investment costs relate to all generator and network capex, cost of capital, other infrastructure costs e.g. IT.
  - Operational costs include fuel, VOM (variable operating and maintenance), carbon, and opex

Our modelling demonstrated a reduction in operational system costs across a range of scenarios

System cost saving (Base Case), Factual scenarios vs Counterfactual



The modelling shows system cost savings of between £250 m to £430 m per year between 2035 and 2050 in the long duration storage scenario, and between £90 m to $190 m per year in the shorter duration factual scenario

In the long-run we expect a more efficient system to feed through into aggregate customer cost savings

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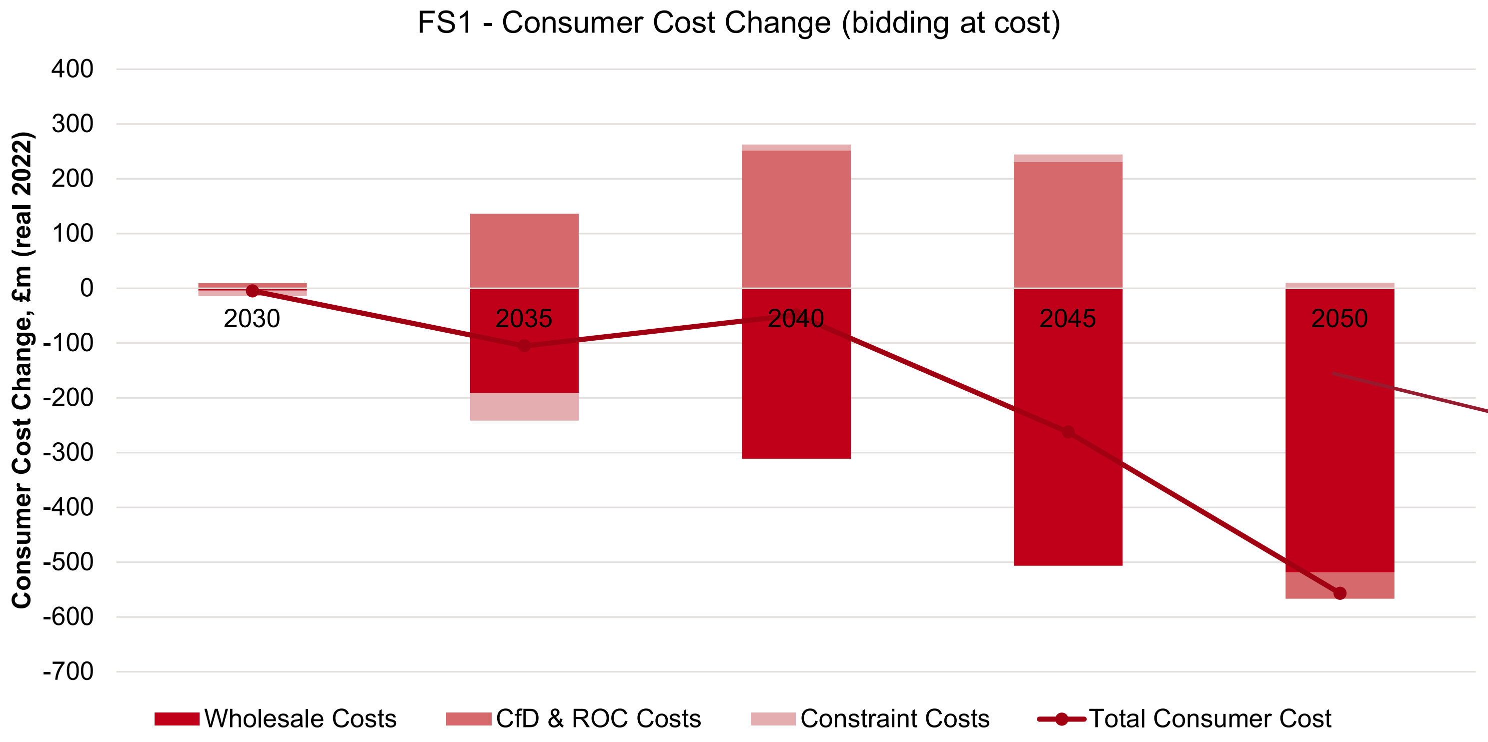
IN THE SHORT AND MEDIUM RUN, THE IMPACTS ON CONSUMER COSTS CAN BE MORE UNCERTAIN AND DEPENDENT ON MARKET STRUCTURE. OUR MODELLING SHOWS THAT IMPROVED OPERATIONAL EFFICIENCY FEEDS THROUGH INTO A SAVING IN CONSUMER COSTS IN THE FS1 VS COUNTERFACTUAL (BASE CASE). NOT ALL CONSUMER COSTS WERE MODELLED



- The consumer cost modelled here includes the wholesale cost, policy costs, and constraint costs. The impact of costs not modelled could be expected to increase or reduce customer savings.
- Policy costs include those from CfDs and ROCs
- The additional storage saves consumer costs in all years. Wholesale costs are reduced significantly, but policy costs increase as there is additional wind generation.

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3. Credit design

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Credit design

WE SUMMARISE BELOW THE KEY CONSIERATIONS FOR THE DEMAND CREDIT DESIGN

Year-round	▪ CMP405 applies only to the year round charge. Thus, the peak charge will continue to be levied on a triad demand basis whilst the locational demand credit only refers to the **Year Round element of charges.**
Avoid dispatch distortions	▪ The demand credit must avoid creating dispatch distortions. Therefore, it should not be based directly on the consumption of the PSH operator in demand mode, even at times of system constraint.
Capacity-based	▪ A **capacity-based** credit follows the principle of non-distortion. ▪ Generators already face capacity based TNUoS charges based on TEC, ALF and sharing factors. ▪ An analogous approach could be adopted for the CMP405 demand credit.
Reflective of benefits provided	▪ The size of a demand credit should reflect the extent to which PSH alleviates Year Round constraints (analogous to the setting of sharing factors for intermittent plants). ▪ If storage charging is expected to be **strongly correlated** with periods of locational constraints this **implies a high capacity credit.** ▪ If PSH charging is expected to be **weakly correlated** with periods of locational constraints this **implies a lower capacity credit.**

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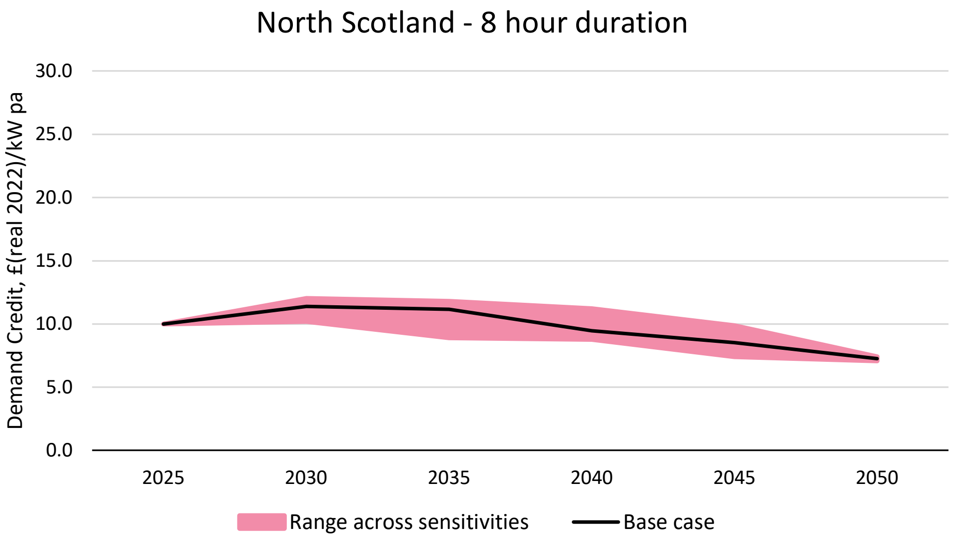
Credit design

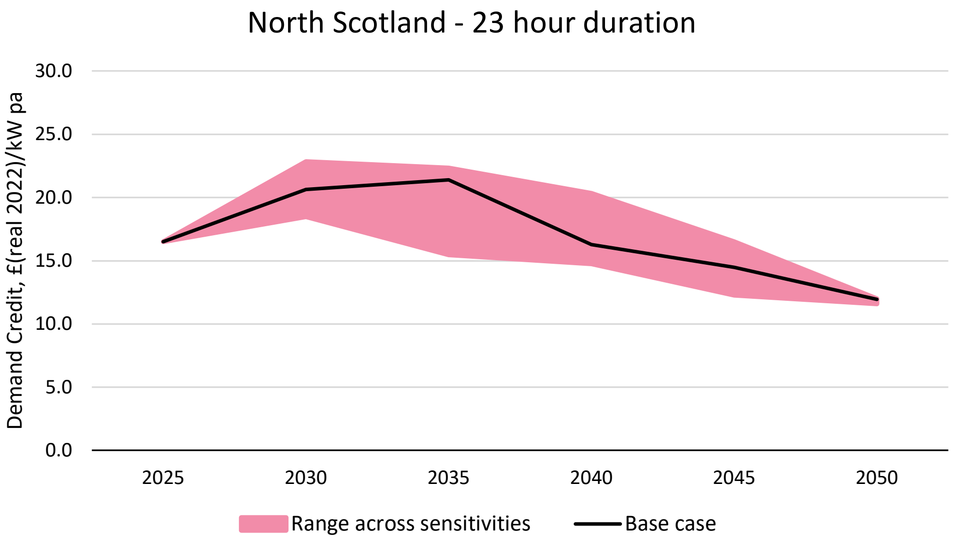
WE SUMMARISE THE DIFFERENT DESIGN OPTIONS WITH THEIR ADVANTAGES, AND THEIR DISADVANTAGES

Option	Disadvantages	Advantages
Volume-based credit (set ex-post based on annual pumping volume, MWh)	▪ Volumetric-based charges could distort dispatch. ▪ Need to convert a £/kW Year Round charge into £/MWh charges	▪ Simple to implement, including for new ▪ Annual volume likely to have some relationship with contribution to relieving constraints
Capacity-based credits		
MIL (set based on MIL)	▪ Does not reflect the impact of different types of storage plant on constraints and avoided network costs	▪ Simple to implement for new plant. ▪ No obvious distortion risk
ALF (set based on MIL x ALF)	▪ Differentials in charges may inaccurately reflect the contribution to avoiding network costs and therefore may distort investment in different storage assets	▪ Is similar to the TNUoS Year Round generation charge methodology for Conventional Low-carbon plant and is relatively simple. ▪ No obvious distortion risk.
Constrained ALF (set based on MIL x ALF during constraints)	▪ Practically, difficult to set the value for new plant ex ante. ▪ May require modelled values until observed data available and modelling an optimised constrained ALF.	▪ Consistent with approach to application of sharing factors for Intermittent plant generator TNUoS charges. ▪ Better reflects the contribution of different storage plant to avoiding network costs.

Illustrative demand credit based on a constrained ALF approach

WE ILLUSTRATE THIS CONSTRAINED ALF APPROACH TO THE DEMAND CREDIT USING THE MODELLING RESULTS FOR 2025-2050





- The illustrative demand credit calculated for the Base Case ranges from only £1-2/kW for 1 hour storage (not shown) through to around £11-21/kW for 23-hour storage
- Calculated based on demand TNUoS values from NGESO's latest forecast, multiplied by charging load factors during constraints from the modelling

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4. Key messages

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By improving cost reflectivity of TNUoS demand charges for storage, CMP405 should lead to more efficient investment, reducing system costs

1.Current charges are not cost reflective

- Our modelling shows that storage in export constrained zones tends to charge during periods of constraints
- Current TNUoS charges “floored at zero” so do not reflect impact of sources of demand, on relieving constraints (and hence reduce network investment)
- Storage assets can face mistach between cost reflective generation locational signal and a distorted demand locational signal

2. Cost reflective charges should reduce system costs

- Improving cost reflectivity should lead to more efficient investment decisions, reducing system costs
- Our modelling shows additional storage in export constrained zones leads to sizeable operational system benefits
- In the long term we would expect a more efficient system to also lead to customer cost benefits

3. CMP405 addresses distortion for storage

- CMP405 addresses distortion for storage by paying demand credit linked to TNUoS Year Round element – implementation now consistent with government policy to enable LDES investment
- Appropriate design of CMP405 would not distort dispatch incentives and would reflect extent to which assets relieve constraints (e.g. “constrained ALF”).

- Sound economic principles (minimising distortions, fairness, and practical considerations) should form the basis of the final decision in relation to any changes to network charging arrangements
- We find that a CMP405 demand credit would better align the TNUoS charging framework with these principles and therefore it is appropriate for CMP405 to be taken forwards with a non-distortionary design

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