WHEN TRUST MATTERS

Operational Metering Requirements

Report 3 VO: Operational scenarios Power Responsive Engagement

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Agenda

1. Introduction

Background to this report

This report covers the extension to WP3 Impact Modelling aimed at assessing the potential impacts of CER operational metering on NESO in greater detail

Power Responsive, a stakeholder-led programme to stimulate increased market participation of Consumer Energy Resources (CERs), commissioned DNV to conduct an independent review on Operational Metering (OM) Requirements for the Balancing Mechanism. The current requirements pose **barriers to aggregated portfolios of CERs,** which either face elevated implementation costs or are excluded altogether due to non-compliant embedded metering and communication systems. The project objectives are:

- developing **optimised, robust technical operational metering requirements** for Balancing Services; and
- consider how providers with a diverse range of assets could **meet the standards** and allow **National Energy System Operator to continue meeting the Security and Quality of Supply Standard (SQSS)**.

Reports previously issued as part of the project:

1. August 2024: WP1 & WP2: Current metering requirements and capabilities; Benchmarking, future requirements and capabilities
2. December 2024: WP3 Impact Assessment, assessed the impact of CERs at the single portfolio level and metering solutions which could mitigate that impact.

This report aims to address the following objectives as part of an extension to the original WP3 scope:

1. Understand how CERs on the system in 2035 might behave as a whole
2. Provide detailed analysis of the potential impact of portfolios of CERs, and their interactions, on NESO.
3. Understand the impacts on NESO from mitigating impacts of CER operational metering

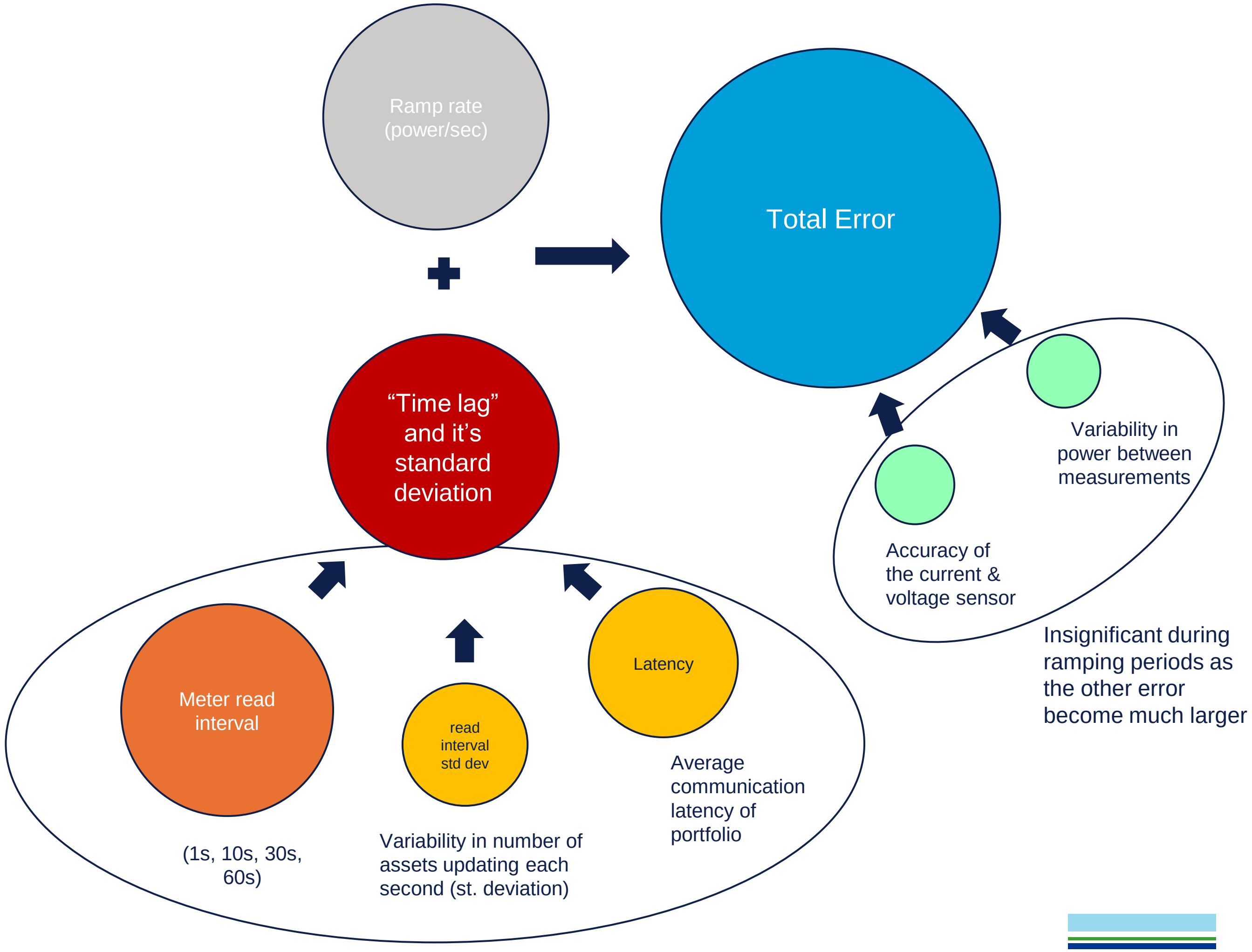
Overview of CER operational metering error components

In most situations the error from meter read interval is significantly larger than the other error components

Because the meter read interval of CERs is typically >1s, the portfolio's aggregated metering signal has an induced delay. This delay can be viewed as an **error between the actual power delivery and the meter signal value**.

The size of the error is determined by the four factors below. The analysis in this report focuses on the first two factors which are specific to CERs and may be influenced by metering requirements or other regulations.

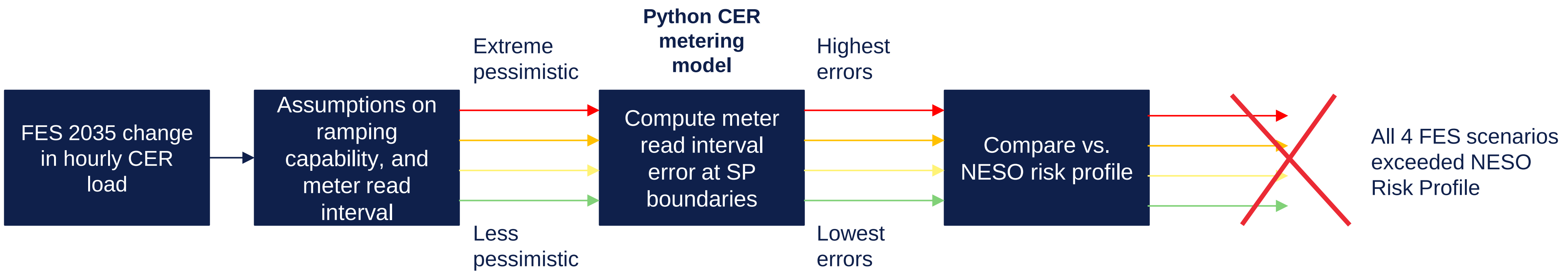
1. Chosen meter read interval, determining lag in aggregate signal
2. Portfolio ramp rate (time taken for the portfolio to ramp to full delivery)
3. Standard deviation in the meter read interval error, caused by variability in the number of assets updating each second
4. Variation in power between measurements (excluded from modelling – found to be insignificant for EV & V2G), but likely to be significant for other technologies – PV (rooftop)



2. Impact Assessment Scope & Methodology

We modelled CER operational metering signals based on FES24 data for 2035 to understand risks to NESO

There were three main components to our analysis: FES output for 2035, our model of CER metering, and the NESO risk profile



Assumptions:

- The analysis assumes all CER assets in FES2035 are active in the balancing mechanism.
- It models EV/V2G randomisation scenarios to assess impact of ramp rates.
- Hourly settlement windows in FES2035 likely reduce average load swings at boundaries.

NESO risk tolerance

NESO provided a risk tolerance for operational metering error which would be acceptable to control room, the tolerance was based on the parameters below

NESO risk tolerance parameters:

Risk tolerance	Error (MW)	Duration (s)
Largest infeed risk	1800	1
Imbalance not allowed to cause operational limit excursion	300	5
Half acceptable zonal error	50	30

DNV assessed the behaviour of CER meter feeds under different scenarios against this risk tolerance. Discrete points on the risk tolerance curve were chosen. Analysis predominantly focused on the three points marked on Figure 1:

- 1800MW error sustained for 1 second
- 300MW error sustained for 5 seconds
- 50MW error sustained for 30 seconds
- In addition, larger errors must occur much less frequently than smaller errors (Figure 2)

Each time period was analysed separately, and results were aggregated to provide number of risk profile exceedances for all durations (1,5,30s) in each scenario, for every minute in 2035 FES data.

Other points on the line were also assessed to ensure that the methodology produced representative results.

Figure 1: Duration of error

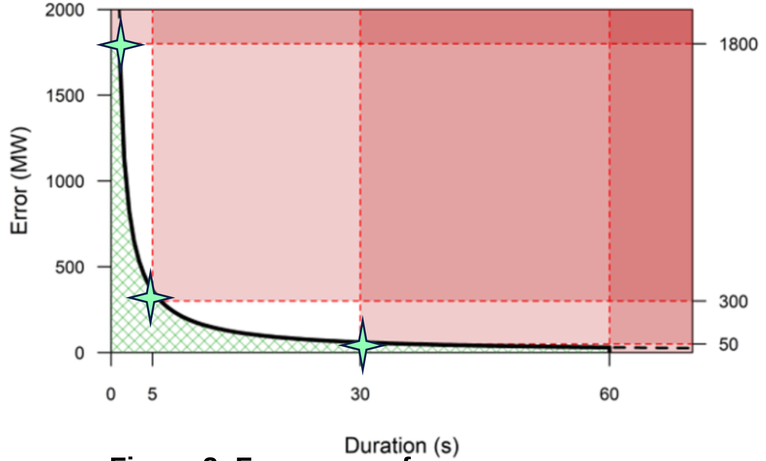
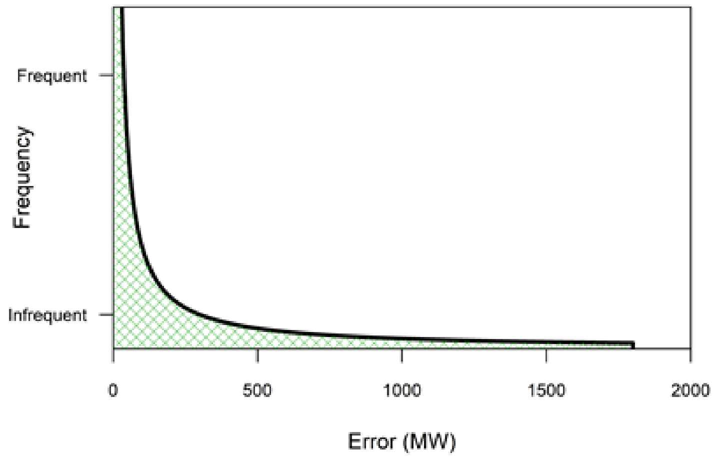


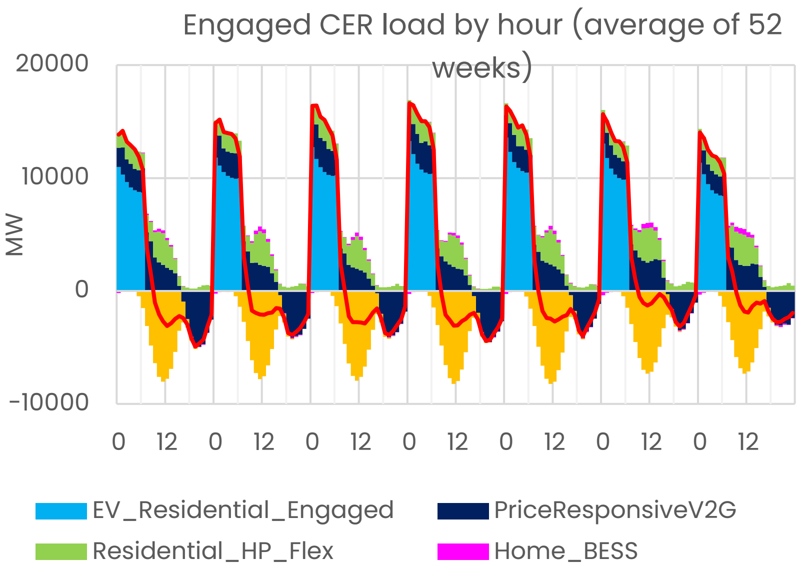
Figure 2: Frequency of error

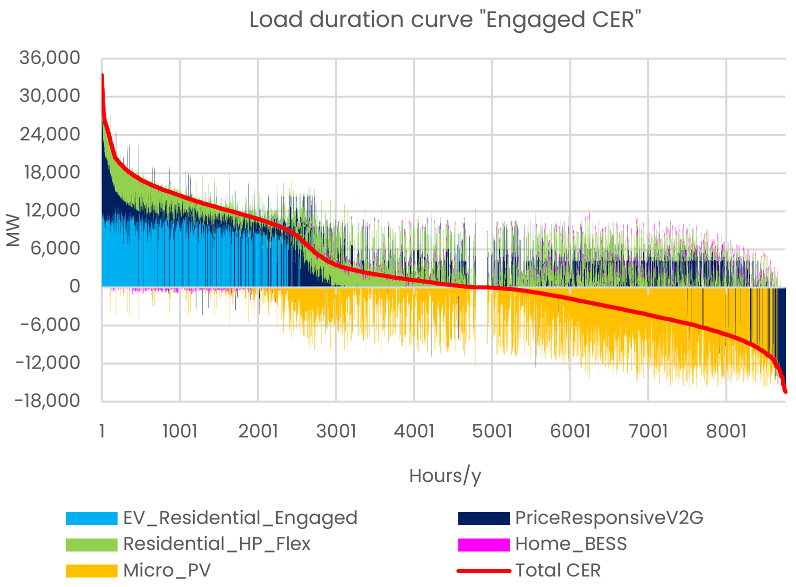


FES model outputs provide CER Load Profiles for each hour of 2035. The daily load profile is similar across the week.

The CER load and CER ramp (change in load from one hour to next) were plotted on Load and Ramp duration curves

- The weekly average CER load (left) shows that EV residential smart charging dominates load CER load
- Overall, CER load is concentrated between 0:00-07:00 and avoids the evening peak, at which time V2G and Micro BESS switch to generation
- Most changes occur at the hour mark, however we expect the changes aligning with the 30-minute settlement period.
- CERs respond to price signals, so ramping tends to cluster around price changes to optimise both settlement periods..
- Different portfolios show varied ramping behaviours, some can ramp sharply within seconds or minutes.





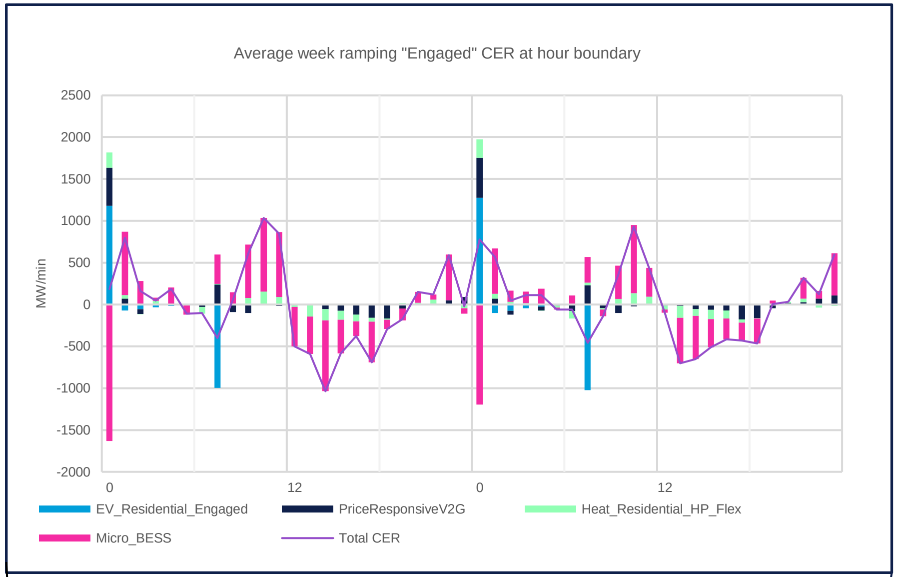
Ramping rate at hour boundary

Ramp rate is a key factor in quantifying the “error” caused by delay in metering catching up with the change in state of the portfolio.

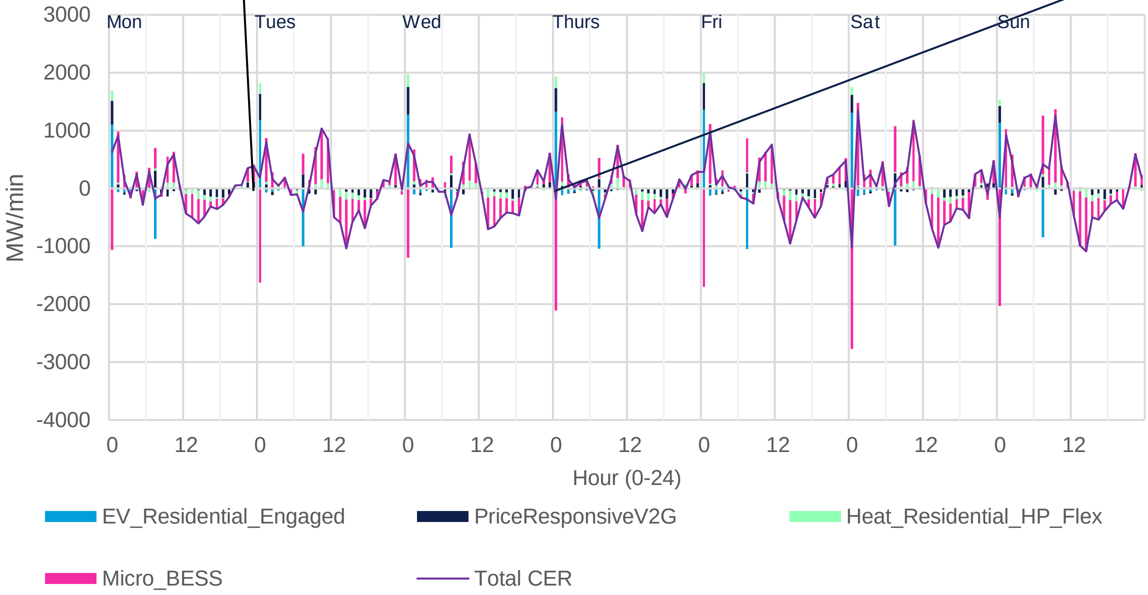
Ramp rate assumptions used in this study

Technology	Randomised	Ramp down time portfolio [min]	Ramp up time portfolio [min]	Ramp-down time asset [s]	Ramp-up time asset [s]
EV	Non-randomised	0.05	0.5	3	30
V2G	Non-randomised	0.05	0.5	3	30
EV	Randomised	10	10	3	30
V2G	Randomised	10	10	3	30
Res HP	n/a	5	5	300	300
Home BESS	n/a	0.17	0.17	10	10
Micro PV*	n/a	10	10	300	300

- The randomised EV scenario was used to assess its impact on NESO’s short-term demand forecasting.
- EVs and V2G assets, though scheduled via DA prices or TOU tariffs, can also respond to ID market signals and participate in the Balancing Mechanism.
- Actual ramp rates were included to better reflect operational behaviour, especially when assets are instructed via ID or BM.
- Micro BESS, though smaller in capacity, ramps very quickly (within 10 seconds) at hour boundaries.
- Fast ramping CER causes spikes however the error duration is quite short whereas slow ramping CERs cause smaller but longer-lasting errors.



Engaged CER ramp rate at the hour boundary (52 weekly average)



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Randomised Delay Applicability in EVs

Randomised delay applicability varies depending on how charging is scheduled or instructed

Randomised Delay Applicability

Asset Controller	Randomised Delay
Owner	
Charger default settings	Yes
Owner schedule based on TOUT	Yes
Owner override	No
Aggregator / Supplier	
Aggregator schedule based on TOUT	Yes
Aggregator schedule based on DA price	Yes
Aggregator instruction based on ID price	No
Aggregator instruction based on BM	No

The randomised behaviour policy was added to EV regulations to help protect the electricity grid from sudden, simultaneous demand spikes. It works by introducing a small, random delay (up to 10 minutes) when EVs begin charging, especially after a power or communication interruption.

Randomised behaviour aim to:

- Reduce the risk of grid instability caused by synchronized charging.
- Support a more flexible and resilient energy system.
- Offers a low-cost, effective alternative to more complex control mechanisms.

Randomised delay is mainly applied when charging is scheduled based on Time-of-Use Tariffs (TOUT) or Day-Ahead market prices. It is not applied when charging follows instructions from the intraday market or is controlled via Balancing Mechanism (BM) signals.

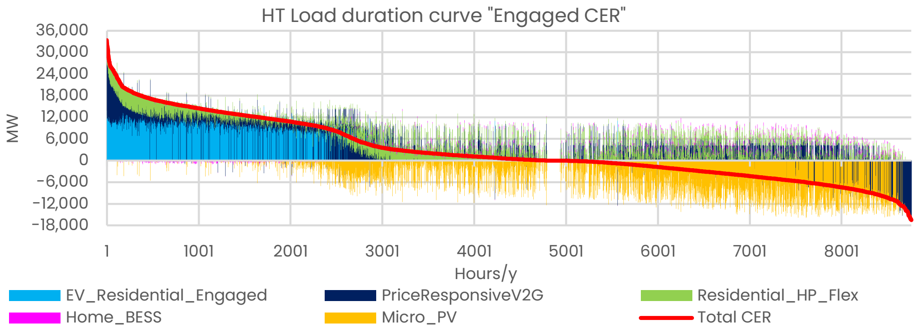
However, it's important to consider how ramp rates are updated under each of these conditions, as the timing and magnitude of changes can vary significantly depending on how chargers are scheduled or instructed.

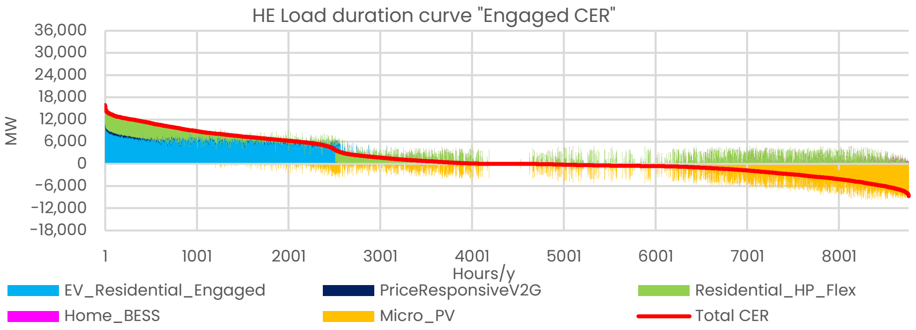
3. Findings

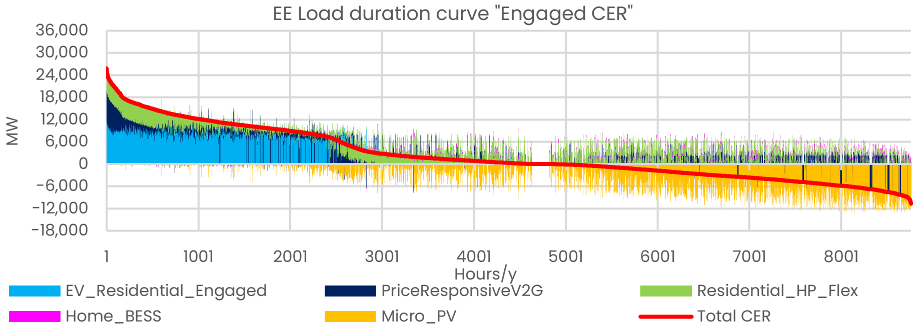
We started first with the Holistic Transition scenario, which has the highest CER uptake

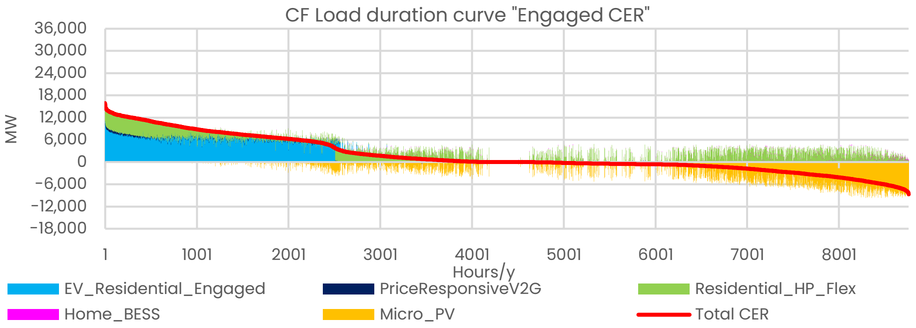
CER load is much lower in Counterfactual (CF), Hydrogen Evolution (HE) and Electric Engagement (EE) than Holistic Transition (HT)

- Peak CER load (somewhere between midnight and 7:00h) is reduced from 33.4 GW in HT, to 25.8 in EE, and 15.9 GW in HE and CE respectively.
- Without the 200 most extreme hours the load stays below 17.6 in EE and 12.4 GW HE and CF respectively (from 20 GW).
- Especially V2G, Home BESS and Micro PV uptake is significantly lower.
- Combined EV and V2G extreme load drops from 28 GW to 21.6 GW in EE and 11.5 GW in HE and CF







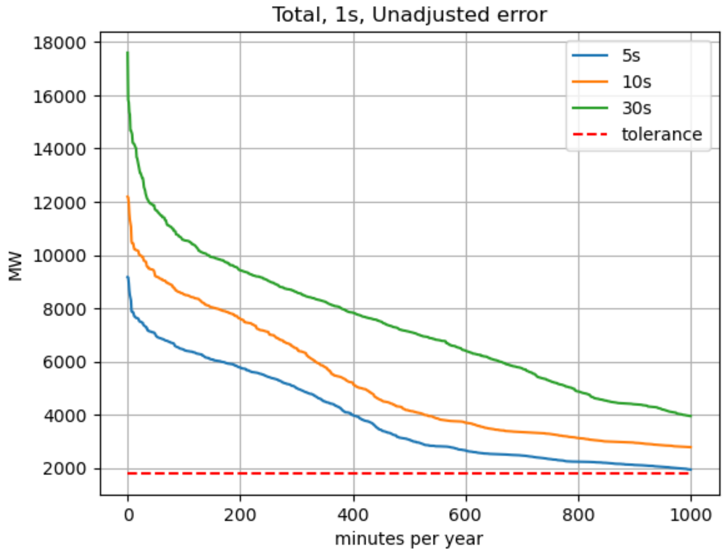


In Holistic Transition, even with 5s meter read interval the risk tolerance is exceeded for all NESO risk tolerance durations

Comparing 5s, 10s and 30s meter read intervals, none are able to stay within the NESO risk tolerance during large CER swings.

Minutes / year with >1800MW error for 1s duration

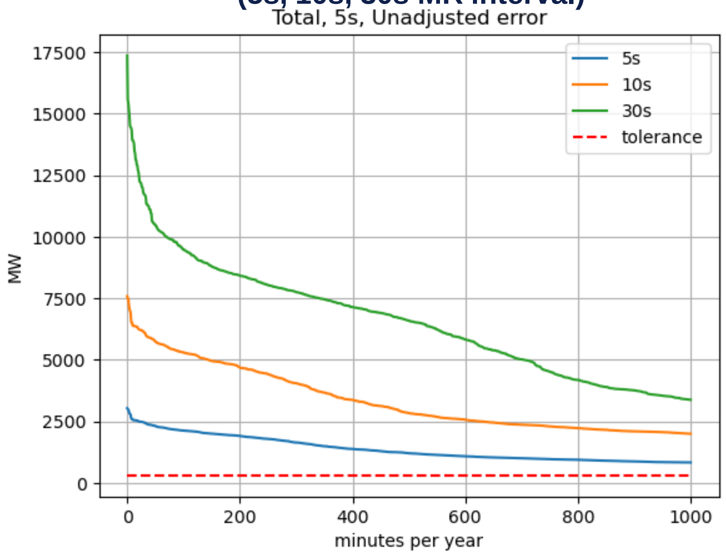
(5s, 10s, 30s MR interval)



MR 5s: 1080 minutes per year exceed risk tolerance
MR 10s: 1660 minutes per year exceed risk tolerance
MR 30s: 2220 minutes per year exceed risk tolerance

Minutes / year with >300MW error for 5s duration

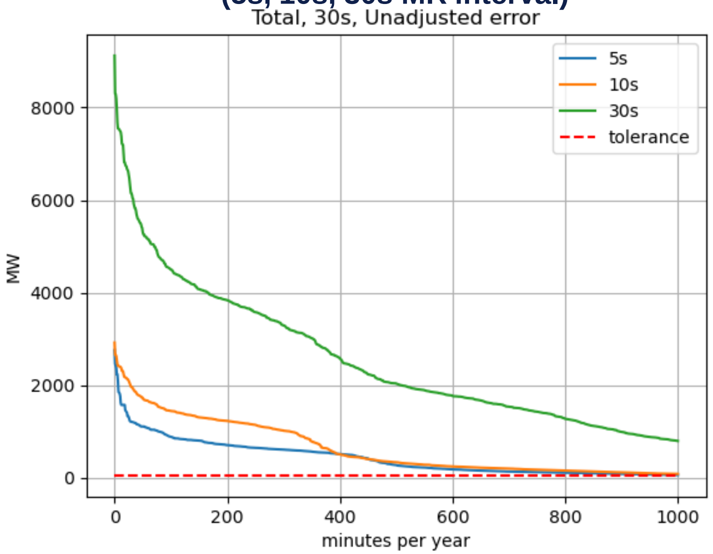
(5s, 10s, 30s MR interval)



MR 5s: 2260 minutes per year exceed risk tolerance
MR 10s: 3980 minutes per year exceed risk tolerance
MR 30s: 6030 minutes per year exceed risk tolerance

Minutes / year with >50MW error for 30s duration

(5s, 10s, 30s MR interval)



MR 5s: 1080 minutes per year exceed risk tolerance
MR 10s: 1550 minutes per year exceed risk tolerance
MR 30s: 2220 minutes per year exceed risk tolerance

We also computed errors for 3, 10 and 20 sec duration however errors the overall risk error was increased by 100 min, indicating that using 5, 10, and 30-second durations provides a reasonably accurate and balanced representation of the model.

The number of risk profile exceedances differs significantly between scenarios and on EV & V2G randomisation

Even with an optimistic 10s meter read interval, no scenario is 100% within the NESO risk tolerance
Lower risk profile exceedances is correlated with FES scenarios that feature less electrification

- Due to the decreased load and step-changes within EE, HE and CF, the risk profile exceedances per year are lower when compared to HT.
- Responsive V2G has a significant impact on non-randomised error. The HE scenario experiences far fewer non-randomised EV & V2G errors compared to HT and EE. This is due to the reduced presence of responsive V2G in the HE scenario.
- Randomised numbers are higher because they exceed the 30s duration tolerance more often than the non-randomised scenario. The 1s and 5s duration are exceeded less often and with high significantly lower magnitude.

	CER hourly swing [GW]			EV & V2G randomised		EV & V2G non-randomised	
FES Scenario	Highest	3rd highest (99.97 percentile)	Meter Read Interval	Exceedances of all NESO risk tolerance durations per year (all CERs)	% of minutes per year*	Exceedances of all NESO risk tolerance durations per year (all CERs)	% of minutes per year*
Holistic Transition	**37.3**	**33.8**	10	**7960**	1.6%	**4680**	0.9%
Electric Engagement	**29**	**25.6**	10	**7050**	1.4%	**3930**	0.8%
Hydrogen Evolution	**15.9**	**14.7**	10	**6030**	1.2%	**1370**	0.3%
Counterfactual	**6.6**	**6.3**	10	**200**	0.04%	**730**	0.1%

* Results are reported as % of minutes per year rather than % of minutes modelled, because interviews with industry found that aggregators are likely to dispatch assets at the settlement boundary to maximise revenue, therefore portfolios will in most cases only ramp during the settlement boundary period which we modelled. If all the minutes in the year were modelled with the same underlying assumptions the results would be expected to match the above.

Potential risk of large errors per CER type in a HT scenario

EV and V2G likely present the largest risk due to their very large installed capacity and fast ramp speeds

CER type	Max load on grid in 2035*	Potential risk for large error	Risk situation
EV “engaged” and V2G	28 GW (17.3 GW EV; 16 GW V2G)	High	○ High risk comes from fast ramping of large BM capacity. ○ Short metering intervals help but don’t eliminate risk of large errors. ○ Peak EV/V2G capacity is available at night and early morning. ○ Daytime charging is lower but still benefits from solar PV.
Home BESS	1.75 GW	Moderate	○ Home BESS can ramp quickly to full load, similar to EV/V2G. ○ However, its total market capacity is much smaller than EV/V2G. ○ V2G and Home BESS may ramp simultaneously when discharging.
Residential HP	5.5 GW	Moderate	○ Heat pumps ramp slowly and are less likely to participate heavily in the BM compared to EVs ○ Their control complexity and user preferences reduce flexibility. ○ Current heat pump systems may not support fast metering (e.g. 10-second intervals) or be suitable for Report on Change metering.
Micro PV	15.9 GW	Moderate	○ Solar PV ramps follows sunlight patterns. ○ Fast ramping only occurs when micro-PV is curtailed, which is rare. ○ Behind-the-meter demand reduces curtailment incentives. ○ Negative wholesale prices may encourage aligning generation with local demand, causing sharper ramps. ○ Pairing PV with home BESS further reduces curtailment and shifts behaviour toward price responsiveness.

*FES holistic transition

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4. Summary of Options

We assess three high level options for CER OM requirements

<table>
<tr><th>#</th><th>Option</th><th>Description</th><th>Variant</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Keep (close) to Current Requirements</td><td rowspan="2">• Maintain current latency requirements
• Measure Meter Accuracy on portfolio level,
• Provide an option for assets capable of report-on-change to do so thus minimising data costs for aggregators.</td><td>a- Meter Accuracy= 1%, MR=1 sec (portfolio-NESO), Latency =5 sec (Counterfactual)</td></tr>
<tr><td>b- Aggregated Meter Accuracy= 1%, Report On Change on asset level, Latency =5 sec</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Use delayed CER OMD as real-time data</td><td rowspan="3">• Allow CER portfolios to submit meter data with an induced delay from meter read interval of assets being >1s.
• Assess risks of MeterError on demand forecasts, potentially leading control engineers to act on inaccurate information.
• Mitigate by setting limits on meter read interval*/ RampRate and increasing reserve and response levels.</td><td>a- Allow error by mitigating its impact, set a 30s maximum meter read interval</td></tr>
<tr><td>b- Allow error by mitigating its impact, set a 5s or 10s maximum meter read interval</td></tr>
<tr><td>c- Ramp rate control (suitable to all range of MR).
Aggregators must comply with an accuracy requirement by limiting the ramp rate of their portfolio according to its meter read interval, thus preventing high magnitude errors</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Consider CER OMD, invest in systems to mitigate risk</td><td rowspan="2">• Allow CER portfolios to submit meter data with an induced delay from meter read interval of assets being >1s.
• Mitigate the impacts by upgrading NESO/Aggregator systems to quantify the delay and limit its impact on operational decision making.
• This option introduces an error into NESO systems relying on OM data only when CERs do not follow their PN / BOA, or the forecasted behaviour is inaccurate.
• The error persists until the timestamped OM feed is received (likely 15-30 seconds). This error can be further reduced through different advanced forecasting methods (e.g. historical behaviour)</td><td>a- Aggregators timestamp OM data, NESO create real-time estimation and update with delayed OM feed</td></tr>
<tr><td>b- Aggregators send synthetic data that best reflect the current real-time situation</td></tr>
</table>

*The 60-second MeterRead interval was not modelled, as the 30-second results already significantly exceeded NESO's risk tolerance thresholds. Moreover, all aggregators indicated they were comfortable meeting the 30-second requirement, as confirmed by the WP1 survey.

Guiding principles and evaluation criteria

The following guiding principles have been used to evaluate the options across 4 areas

Guiding Principles

1. System Reliability: ensure that all solutions contribute to the stability and resilience of the energy system.
2. Operational Feasibility: prioritise approaches that are technically and practically implementable within existing infrastructure and regulatory frameworks.
3. Scalability and Flexibility: design mechanisms that can scale with future growth and adapt to evolving technologies and market conditions.
4. Transparency and Accountability: maintain clear, auditable processes and data flows to support trust and regulatory compliance.
5. Cost-effective Consumer Cost: minimise the financial burden on consumers by promoting cost-effective solutions and ensuring that any additional costs are justified by tangible system or societal benefits.

Evaluation Areas:

1. Control Room Impacts: assess effects on visibility, situational awareness, demand forecasting accuracy, and access to controllable resources.
2. Aggregator Impacts: evaluate clarity and duration of requirements, capital and operational expenditure (CAPEX/OPEX), and market accessibility.
3. Implementation Complexity and Timeline: consider technology and systems readiness, as well as the need for legislative or protocol changes.
4. Cost to Consumer: Analyse the direct and indirect financial implications for end users, including tariff structures and potential incentives.

Option Scores

- **Red** – High impact on aggregator access to BM , high risk of implementation delays and costly solution.
- **Amber** – Moderate risk requiring attention; may affect aggregator access to BM and lead to additional costs.
- **Green** – Low risk with smooth implementation expected and minimal cost impact.

	Option	Solution	Control room impact	Aggregator impact	Implementation complexity and timeline	Cost to consumer
1	Keep (close) to Current Requirements	a- Meter Accuracy= 1%, MR=1 sec (portfolio-NESO), Latency =5 sec	No impact	Processing the data in the cloud is cost-prohibitive, and not all assets can transmit 1-sec MR	Requires changes to communication protocols. Not all CER technologies are able to meet the 1 sec MR, requires cheaper data storage& processing	Higher data quality results in lowest impact on CR however the restricted access not allow CERs to participate which impact market liquidity/earning potential
		b- As above + Report On Change on asset level	Lowest impact on CR because data OM quality is maximised. Not all assets will be available to report on change which will have impact on visibility and access to resources	Investment in systems needed and increased data costs mean that business case must be proven. Suitable for EV/V2G, and potentially Home BESS portfolios, but not for other CER types.	Requires changes to communication protocols. Not all CER technologies suitable for RoC. Requires upgrades to asset firmware and aggregator IT systems	Higher data quality results in lowest impact on CR and response and reserve costs however the restricted access not allow CERs to participate which impact market liquidity/earning potential
2	Use delayed CER OMD as real-time data	a- Allow error by mitigating its impact (MR=30sec)	Although it will allow visibility in the BM and access to resources, CR might take wrong decisions due to delays in CER OM data which will be mitigated by increased reserve and response	No impact	No impact	The impact would be lower at the start but as more CERs enter the BM, it would require increased response and reserve to mitigate error impacting situational awareness that might lead to wrong decision
		b- Allow error by mitigating its impact (MR= 5, 10sec)	Although it will allow limited visibility in the BM and access to resources, CR might take wrong decisions due to delays in CER OM data which will be mitigated by increased reserve and response	Relatively higher cost to the aggregator compared to 2a	Requires changes to communication protocols. Not all CER technologies are able to meet the 5-10 sec MR,	Still require reserve and response to mitigate risks, the restricted access to some CERs to participate will impact market liquidity/earning potential
		c- Ramp rate control (suitable to all range of MR)	Requires an accuracy requirement limit which can be implemented by controlling assets ramp, the might error persist for longer duration. CR ability to balance system impacted by CER ramp limit. Imbalance risk grows if BM lacks fast-ramping assets to offset wholesale volatility	Accuracy limit reduces ability to (quickly) act on all markets, but allows own cost benefit analysis for investment in metering capability	Aggregators can easily limit their ramp rate slower staggering assets.	It would require relatively less amount of additional response and reserve to mitigate error impacting situational awareness that might lead to wrong decision
3	Consider delay in CER OMD, invest in systems to mitigate risk	a- Aggregators timestamp OM data, NESO create real-time estimation and update with delayed OM feed	CR have real-time estimate of CER behaviour, with any errors rectified within ~15 seconds. Wrong decision made only if estimate is inaccurate, or CER does not follow BOA. Requires additional work to ensure performance of PN/BOA	Small investment in systems needed to add timestamp to outgoing data	Requires investment in NESO OM (SCADA) and demand predictor (BM) systems (ongoing upgrade), as well as industry coordination to implement timestamps. Implementation timeline likely 2-5 years. Visibility of wholesale market assets is essential for effective deployment	Likely very low additional need for response (as not all aggregators will fail to comply with their obligations at the same time). Reserve not needed because metering corrects <30s.
		b- Aggregators send synthetic data that best reflect the current real-time situation	Process less transparent and might impact NESO's situational awareness	Investment in systems needed	No impact	Likely very low additional need for reserve and response (as not all aggregators will fail to comply with their

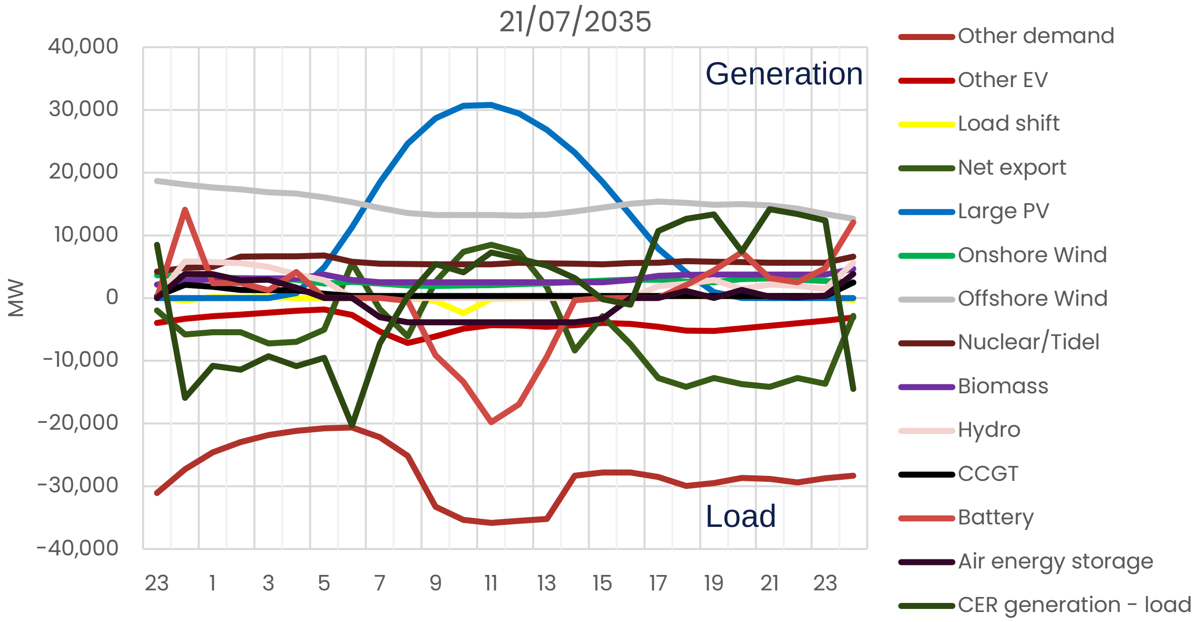
5. Counterfactual

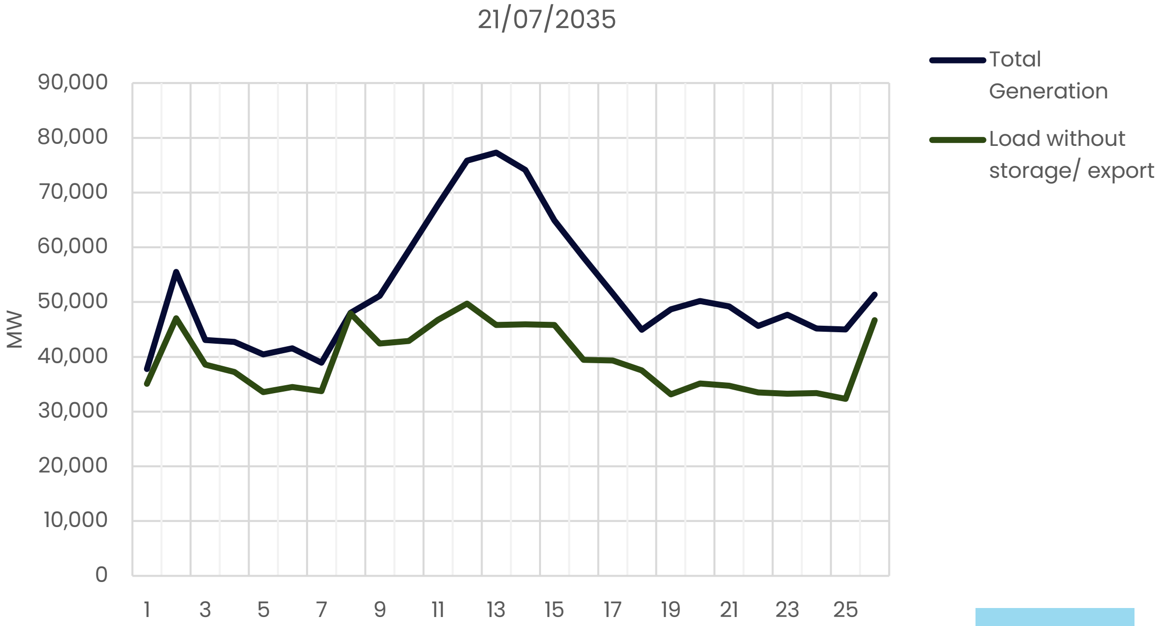
A counterfactual scenario with no CERs in the BM was assessed for resulting impact on balancing prices

Scenario chosen: 21-July 2035, almost highest CER generation at 11am, and highest evening demand at 8pm

Method used:

- Assess generation mix, upward and downward reserve
- Using previous studies, online resources and analysis conducted on BOAs, develop a merit order based on different generation type
- Balance generation and demand using the HT data considering 2 scenarios (1- assuming CERs are part of BM, 2 assuming no CERs available in BM)
- Comment on quantitative impact (price/savings) + qualitative impact (visibility/market liquidity)





Integrating CERs in the BM delivers broad system benefits across operational and market dimensions.

CERs in the BM will increase reserve capacity, reduce costs, improve visibility for control operations, boost market liquidity, and provide a flexible resources against large system swings

Quantitative Assessment

Reserve Capacity

The integration CERs into the BM substantially increases the system's available reserve, strengthening grid flexibility and resilience.

Financial Impact

Integrating CERs into the market has the potential to deliver system-wide savings, particularly given that CER pricing is expected to be lower than that of large-scale batteries and other conventional generators e.g. CCGT enabling more cost-effective of balancing services

Qualitative Assessment

Visibility

Visibility of CERs in the BM improves situational awareness for the ENCC, enabling more informed and timely decision-making. This reduces the risk of misattributing frequency deviations and supports more accurate forecasting and dispatch.

Market liquidity

Integrating CERs in the BM will allow greater market liquidity. Market liquidity enhances the efficiency and responsiveness of the energy system by enabling more dynamic price formation, increasing competition among participants, and improving the visibility and valuation of flexible assets such as CERs.

Availability of resources

The availability of CERs within the BM provides a critical resources against large system swings (e.g. Interconnector, weather driven) by increasing the volume and diversity of responsive assets. With sufficient visibility and integration, CERs can act as a distributed, fast-acting reserve that complements traditional assets, reducing reliance on centralised interventions and improving overall system resilience

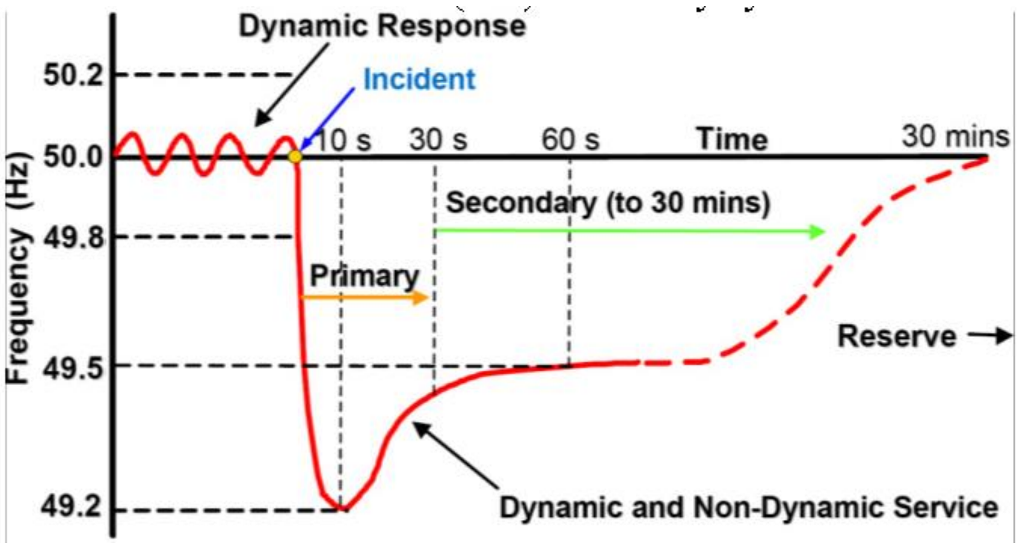
6. Impact on NESO

Operational metering errors impacts the demand forecast, requiring reserve and response hence operational costs

The ENCC constantly manages numerous data inaccuracies. Introducing additional metering error adds uncertainty, leading to wrong decisions and increasing operational costs.

- NESO’s demand predictor uses operational metering data for 0–4 hour forecasts.
- Aggregated portfolios are not yet included but will be in the future.
- Incorrect metering data can lead to errors that affect demand forecasts and can cause system imbalar and frequency deviations and can lead to the following risks:

1. **Forecast Inaccuracy**: Lagging data distorts short-term demand predictions until the next fixed fore point.
2. **Dispatch Errors**: Inaccurate starting values lead to incorrect dispatches, with errors up to the size of metering discrepancy.
3. **System Imbalance:** These inaccuracies affect zonal targets and dispatch programs, leading to real- frequency drift.



Metering Error Effects:

1. **Negative error** (actual > metered): under-dispatch → low frequency.
2. **Positive error** (actual < metered): over-dispatch → high frequency.

To mitigate the risks, the ENCC uses Reserve and Response:

1. **Response:** used to correct frequency imbalances.
2. **Reserve:** used to mitigate metering errors.

Future risks envelope would need to be scaled up by a factor of 10 to 40 which could have a serious impact on system reliability

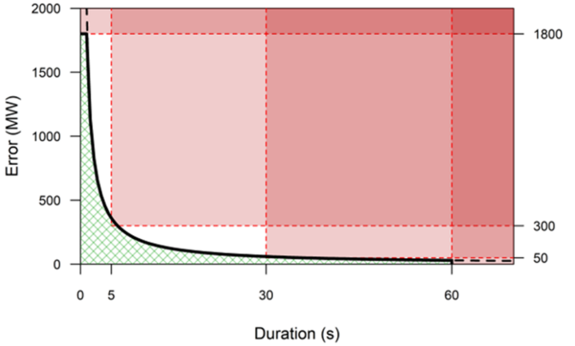
A higher penetration of CERs would breach NESO's current risk envelope. Expanding this envelope to accommodate such behaviour introduces considerable risk and is unlikely to be a sustainable long-term solution.

With a 10-second meter read interval; the following exceedances of current risk tolerance were observed across various durations:

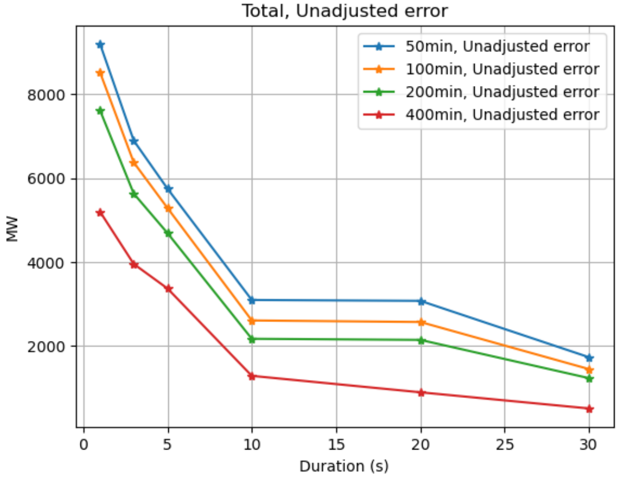
HT: 4,680 minutes/year,
EE: 3,930 minutes/year,
HE: 1,370 minutes/year
CF: 730 minutes/year

NESO current risks tolerance

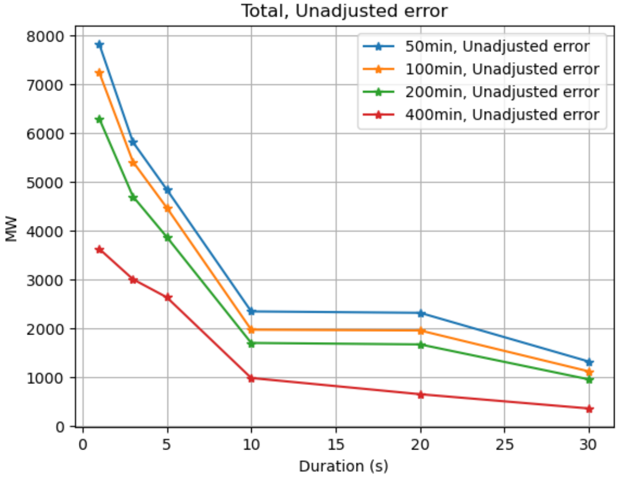
Risk tolerance	Error (MW)	Duration (s)
Largest infeed risk	1800	1
Imbalance not allowed to cause operational limit excursion	300	5
Half acceptable zonal error	50	30



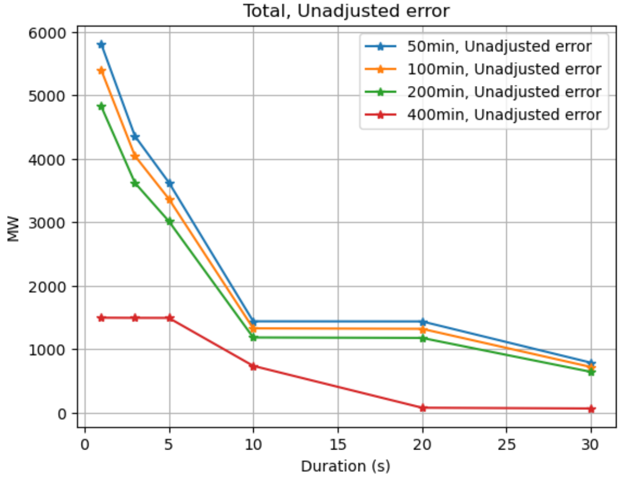
HT



EE



HE



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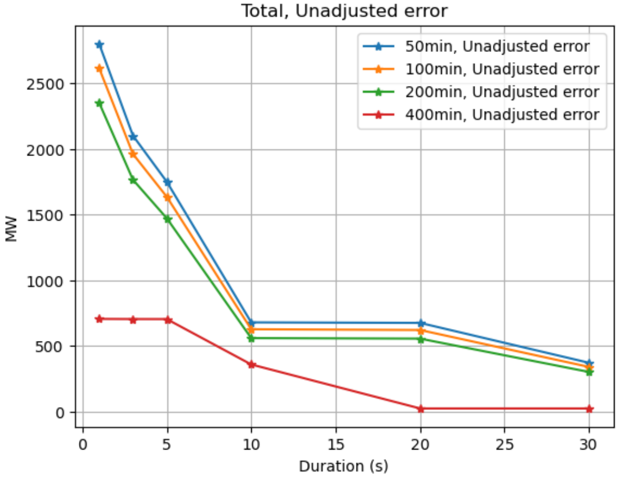

Carrying additional reserve and response lead to higher operational costs- example: increased Response holding

Higher penetration of CERs would significantly increase the need for reserve and response, driving up overall operational costs, an approach that is unlikely to be sustainable in the long term.

- Taking the errors modelled from the FES 2035 dataset (HT pathway), it is possible to estimate how this would impact NESO service procurement.
- Assuming minutely average errors will be fed through the control loop, therefore having the potential for inefficient dispatch and creating forecasting errors leading to frequency deviations.
- Taking the example of covering this through pre-fault frequency response holdings*. Currently NESO procure around 700-800MW (both directions) of pre-fault frequency response between DM & DR products.
- As has been shown, the time of day influences the size and direction of errors expected. The response requirement would vary to mirror this. In Option 2, the pre-fault requirement could increase to up to 10 times the current requirement to accommodate 30 second measurements.
- Option 3a/b (ramp adjusted), can help reduce the additional response requirement, however this is heavily reliant on accuracy of methodologies and ability of units to follow intended delivery.

	Option 2	**Option 3a/b**
30 seconds	*Up to 10x increase*	*Up to 2x increase*
10 seconds	*Up to 3.5x increase*	*Minimal increase*
5 seconds	*Up to 1.5x increase*	*Minimal increase*

*The reality would be that NESO would be continually reviewing how these errors propagate into impacts on system balancing, allowing them to formulate more accurate requirements across response and reserve products to mitigate the impacts.

7. Next Steps

DNV recommends that the relevant accuracy requirement for meter read interval to be implemented in a phased approach

WP4 focuses on implementing the recommended option, DNV will be conducing a consultation to determine the most appropriate option to enable CERs in the BM while optimising system reliability and costs

Option 1 – Keep Close to Current Requirements

- **1a: Keep current requirements –** doesn't work in short-medium term because barrier to entry. Incentivises aggregator investment in metering.
- **1b: RoC metering –** best for control room, but only works for specific asset types, requires changes to comms protocols, and is against principles of technology agnostic regulations. Incentivises aggregator investment in metering.

Option 2 – Use delayed CER OMD as real-time data

- **2a & 2b: Set a maximum MR interval –** reasonable as a short-term solution, but very expensive in medium-long term as impact of systematic error in control room and reserve & response costs increase. Incentive to invest in metering depends on chosen MR interval.
- **2c: Limit ramp rate based on MR interval –** restricts opportunities for aggregators and restricts control room ability to access fast responding balancing resources. Incentivises aggregator investment in metering.

Option 3 – Consider delay in CER OMD, invest in NESO systems(3a) or Aggregator systems (3b) to mitigate

- **3a – NESO constructs synthetic meter feed:** requires updates to NESO systems and to a lesser extent aggregator systems. Requires estimation methodology to be developed. Requires PNs to be accurate. Does not lead to larger reserve and response costs as CER population increases. Does not incentivise aggregator investment in metering..
- **3b – aggregator constructs synthetic meter feed:** Similar to 3a however more resource-incentive to implement since all market participants must implement their own solution and introduces challenges for NESO to verify quality of metering submitted by aggregators in real-time. Aggregator responsibility for synthetic profile may provide reduced situational awareness and/or confidence in metering compared to 3a. Incentivises aggregator investment in metering.

Guiding Principles

Ensure solutions are reliable, feasible within current systems, scalable for future growth, transparent and accountable, and cost-effective for consumers.

Important Considerations:

1. **Incentivises higher PN or forecasting accuracy:** by assessing the performance of PNs. Improved accuracy reduce the need for corrective actions and contribute to greater overall system efficiency and reliability.
2. **Incentivise higher meter quality**: by linking performance to metering standards, the framework should motivate stakeholders to invest in higher-quality meters.

Next Steps

Working closely with NESO and PR stakeholders to harness the value of CERs

Scope of work

1. Confirm current metering requirements and asset capabilities
2. Benchmarking future requirements and capabilities
3. Impact assessment
4. Monitoring and implementation
5. Recommendations and final reporting

WP 3- Impact Assessment

Assess operational errors (Accuracy, MeterRead, Latency) and evaluate **methods** to improve meter errors

Evaluate the impact of CERs on the Security and Quality of Supply Standard (SQSS) by 2035.

Simulate **operational scenarios**, including **counterfactuals**, to understand system dynamics.

Develop a **shortlist of viable options** based on modelling outcomes.

WP4 – Implementation

(June 25)

Aggregator Implementation: Consult on the impact of proposed options (survey to be released in one week, expected to be retuned in 2 weeks).

NESO Implementation: Assess how the options affect NESO's implementation.

Feedback Review: Evaluate responses

WP5 – Final Report & Recommendations

(Jun -Jul 2025)

Compile **key findings** from the project analysis and stakeholder input.

Submit the **final report** including clear, actionable recommendations.

Propose suitable **implementation pathways .**