WHEN TRUST MATTERS

Operational Metering Requirements

The current and future metering requirements, impact and capabilities

Marellie Akoury, Joe Weston, Angeliki Gkogka
Energy Strategy Advisory
07 August 2024

Contents

Optimum operational metering is crucial for enabling smaller assets to provide flex and ensuring future-proof operation of the electricity system

As Great Britain moves to Net Zero, distributed and consumer energy resources are replacing traditional generation, providing flexibility and reducing costs.

ESO’s metering requirements are a barrier for smaller providers, leading Power Responsive to review participation in consumer energy resources.

This work identifies SQSS barriers and benchmarks global operators, with future reports recommending optimised metering requirements for diverse providers.

Scope of work

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

1. Findings and Observations

Major Findings

OM Requirements	1. OM is crucial for meeting the Security and Quality of Supply Standards (SQSS). 2. Accurate and frequent OM is necessary for balancing purposes, while more granular data might be needed less frequently for other analyses.
Market Participation	1. Market participants are interested in participating in services through the BM, strict requirements for frequency response services are confirmed. 2. Though Reactive Power signals are available from CERs, we don’t expect CERs to play a role in ESO reactive power markets, only in DSO flex. 3. Current OM requirements do not pose a barrier for assets that are 1 MW in size.
Challenges for CERs	1. OM requirements are a major barrier for CERs due to the cost of achieving the required 1% inaccuracy and 1-second frequency requirements. 2. The current minimum bid size of 1 MW for aggregated assets is a barrier, but this is expected to improve as more CERs are integrated into the BM.
Future Expectations	1. The range of CERs expected in 2035 is broad, with varying behaviours. 2. Metering each asset every second for home chargers might be redundant, while Demand Side Response (DSR) through smart meters might still require regular readings with appropriate baselining. 3. Smart domestic appliances are not expected to play a big role in 2035 due to the lack of a business case and regulatory framework.
Market Dynamics	1. Immersion heaters are expected to decrease in market share. 2. Complex regulations create varying requirements for participating in different GB markets, posing challenges for manufacturers and market participants.
Global Perspective	1. OM requirements for CERs are more relaxed for certain products globally. 2. Manufacturers are working on advanced metering capabilities driven by cost reductions, regulations, and enabling increased market access.

DNV recommends that NG ESO would specify OM requirements at the aggregate level and allow the aggregator to develop their solutions to meet those requirements

Observations

Improving access into the BM/ESO markets is facilitated by new optimised operational metering requirements

Regulation

1. Harmonising complex standards is essential to reduce operational burdens.
2. Stakeholders need to collaborate closely with the government to develop regulations and address concerns.

Reliability of Communication Infrastructure

1. Ensuring reliable infrastructure is crucial to avoid significant inconvenience and financial losses.
2. Clear guidance on handling missing data and a defined responsibility matrix in service level agreements (SLAs) between NG ESO and market participants are necessary.

IT Solutions

1. Automating performance monitoring of individual units at the ENCC is needed to replace manual processes.
2. Future systems should facilitate easier oversight of small BMUs or groups of BMUs dispatched by NG ESO's new platform, OBP.

Technology

1. Standardised communication protocols are vital for consistent and reliable data transmission.

Asset Metering and Baselining

1. Directly metering assets allows for accurate forecasting and measurement of responses to flexibility requests.
2. Using boundary meters can introduce interference, making accurate forecasting difficult. Metering at the point of use is recommended for precise measurements.

Forecasting Demand

1. Advanced and robust demand forecasting techniques are needed to accurately predict residual demand and avoid double-counting CER services in near real-time.

Settlement

1. All smart meters in Great Britain should be configured to be half-hourly (HH) settled to reduce barriers for independent aggregators and allow suppliers to forecast and optimise demand effectively.

Visibility

1. Access to DERs and CERs data beyond the Grid Supply Point (GSP) level enhance visibility and provide significant advantages to the ENCC.
2. Improved coordination between NG ESO and Distribution System Operators (DSOs) through new business processes can enhance data modelling, impact analysis, and output forecasting.

2. Operational Metering Impact on ENCC (ESO Engagement)

Interviews were carried out to determine the impact of Operational Metering on SQSS and critical ESO functions

NG ESO uses Operational Metering (OM) as a crucial tool for maintaining system security and quality of supply in line with SQSS

Stakeholder Engagement

OM data is utilised across multiple teams and functions within the ESO

- SCADA/EMS
- BM platform
- Demand Predictor
- EMS - Power Network Analysis
- Online Stability Assessor
- Data Historian
- Forecasting Platform

Interviews were carried out with 15 teams across NG ESO

- **Operational metering team**
- **Analysis & modelling**
- **Technical Operations & Policy**
- **Market change Delivery**
- **DER Visibility**
- **Process & Performance Reporting**
- **Energy Forecasting**
- **Demand Predictor**
- **ENCC-Transmission**
- **ENCC-Strategy**
- **ENCC-Energy**
- **Network Operability**
- **Future Design and Development**
- **Frequency Risk & Modelling**
- **Power Responsive**

Operational Metering is a key input to multiple real-time ESO systems and processes critical to SQSS

Function	System	Relevant Teams	Role of Operational Metering	Impact of inaccurate metering / lagging metering
🔵	**SCADA**	Control Room Analysis and Modelling	• Provides real-time visibility of system state and feeds data to other systems	• Reduced situational awareness • Potential for incorrect operational decisions
🔵 🟢	**Network Analysis tool** (includes State Estimator, Fault Level Analysis, Contingency Analysis)	Analysis and Modelling Control Room	• Provides inputs for network analysis (including state estimation, fault level, and contingency analysis)	• Limited impact in terms of frequency given refresh rate of systems is 1 to 4 minutes however inaccurate results • Potential for incorrect operational decisions
🔵 🟢	**Network Model**	Analysis and Modelling Control Room	• OM data generates topology and real-time representation of network in SCADA/EMS	• Inaccurate network representation • Potential for incorrect operational decisions
🔵	**Balancing Platform**	Control Room	• Monitoring BMU output and response • Input data for balancing mechanism systems, supports dispatch decisions	• Incorrect assessment of available balancing capacity • Suboptimal dispatch decisions • Potential system imbalances • Increased system operation costs
🔵 ⚪	**Demand Predictor**	Control Room Forecasting	• Provides real-time demand assessment and supports short-term demand forecasting (0-4hrs ahead)	• Incorrect demand predictions and dispatch advice • Potential for unnecessary balancing actions • Increased system operation costs

* The state estimator determines the best estimate of the current state of the system, based on the available measurements from various measuring systems. e.g. SCADA

Real Time Balancing/ Analysis	**Forecasting**	**Post Fault Analysis**
🔵	⚪	🟢

Historic data from Operational Metering is used in offline systems and processes to support SQSS

Function	System	Relevant Teams	Role of Operational Metering	Impact of inaccurate metering / lagging metering
○ 🟢	**Data Historian**	Technical Operations Policy Team Operational Metering team Frequency Risk and Modelling Energy Forecasting Team	• Data Historian input to Frequency Risk and Control Analysis, Forecasting, Planning Tool, post-event analysis, metering quality assurance, and other systems	• Less accurate forecasts, post-fault analysis, and reduced ability to understand asset behaviour
○	**Planning Tool**	Control Room Network Planning	• Input data for Constraint Forecasting model	• Suboptimal network planning decisions
○	**Forecasting Platform**	Energy Forecasting Team	• Used for forecast model training (provides inputs for demand, wind, and solar) • Used to create wind farm profiles	• Impact on demand predictor • Inaccurate forecasts and system operating plans
○	**Frequency Risk and Control (FRCR) analysis**	Frequency Risk and Modelling Team	• Combined with BMU PN's and error against closure to calculate reserve requirements	• No impact of lag when ramping, only from accuracy of final value as currently smaller size, might have bigger impact in the future • Response Analysis currently applies to generators >700MW
🟡	**Externally Published Data** **(e.g. BM Reports)**	Wider Electricity Market	• Calculating total Demand and Generation	• Inaccurate information provided to external stakeholders

Real Time Balancing/ Analysis	**Forecasting**	**Post Fault Analysis**	**Energy System**
🔵	○	🟢	🟡

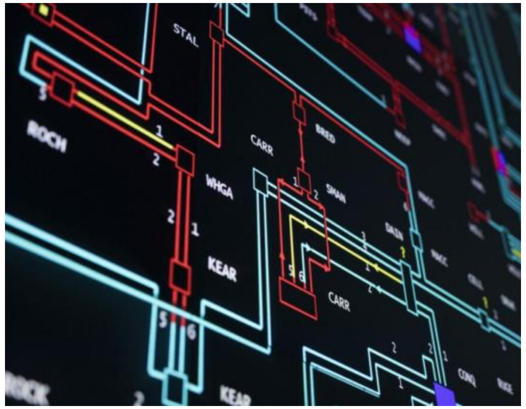
Systems upgrades will enable increase visibility of DER & CER and make them easier to dispatch

Upgrades and replacements of core systems may increase the importance of accurate OM data from small BMUs as they become more integrated into frequency control processes

NCMS (SCADA/EMS replacement)

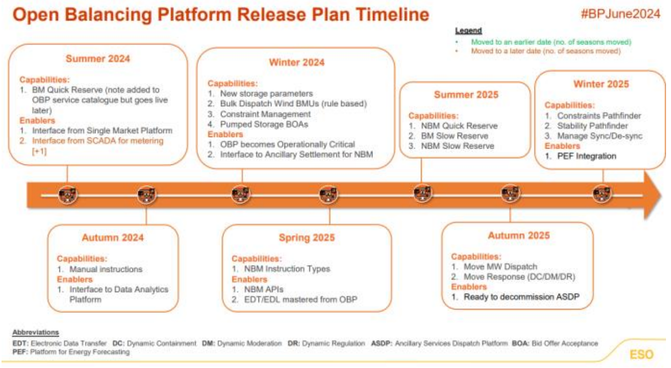
- NCMS will replace the current SCADA/EMS system.
- It will provide modernised infrastructure and develop new online and offline modelling capabilities, including whole electricity system simulation and modelling aided by machine learning and probabilistic analysis.
- It will make the impact of distribution network capability more visible, so that ESO can make better decisions.
- The NCMS will continue to send data (e.g. OM) to Open Balancing Platform (replacement for BM), CCDR (replacement for Historian, Energy Forecasting System, OLTA. All integrations will go via the Data Integration Layer (Grid Data Fabric)

.



Open Balancing Platform

- The Open Balancing Platform (OBP) is designed to modernise and optimise the balancing of the national electricity network by providing the following capabilities:
- Bulk Dispatch Capability: send hundreds of instructions simultaneously to smaller Balancing Mechanism Units (BMUs) and battery storage sites, reducing the time and manual effort required to issue dispatch instructions,
- Enhanced Precision and Optimisation: list of pre-selected and optimised lists of units to meet network requirements, reducing the number of manual instructions and enabling new technologies
- The OBP is set to incorporate a wider range of technologies .
- By 2027, the OBP aims to replace both the existing Balancing Mechanism and the Ancillary Services Dispatch Platform, streamlining the entire balancing process.



Open Balancing Platform Release Plan Timeline

#BPJune2024

Legend
- Moved to an earlier date (no. of seasons moved)
- Moved to a later date (no. of seasons moved)

Summer 2024
Capabilities:
1. BM Quick Reserve (note added to OBP service catalogue but goes live later)
Enablers
1. Interface from Single Market Platform
2. Interface from SCADA for metering [+1]

Autumn 2024
Capabilities:
1. Manual instructions
Enablers
1. Interface to Data Analytics Platform

Winter 2024
Capabilities:
1. New storage parameters
2. Bulk Dispatch Wind BMUs (rule based)
3. Constraint Management
4. Pumped Storage BOAs
Enablers
1. OBP becomes Operationally Critical
2. Interface to Ancillary Settlement for NBM

Spring 2025
Capabilities:
1. NBM Instruction Types
Enablers
1. NBM APIs
2. EDT/EDL mastered from OBP

Summer 2025
Capabilities:
1. NBM Quick Reserve
2. BM Slow Reserve
3. NBM Slow Reserve

Autumn 2025
Capabilities:
1. Move MW Dispatch
2. Move Response (DC/DM/DR)
Enablers
1. Ready to decommission ASDP

Winter 2025
Capabilities:
1. Constraints Pathfinder
2. Stability Pathfinder
3. Manage Sync/De-sync
Enablers
1. PEF Integration

Abbreviations
EDT: Electronic Data Transfer DC: Dynamic Containment DM: Dynamic Moderation DR: Dynamic Regulation ASDP: Ancillary Services Dispatch Platform BOA: Bid Offer Acceptance
PEF: Platform for Energy Forecasting

ESO

Source: https://www.nationalgrideso.com/document/320711/download

3. Asset Mapping (Future Generation Mix)

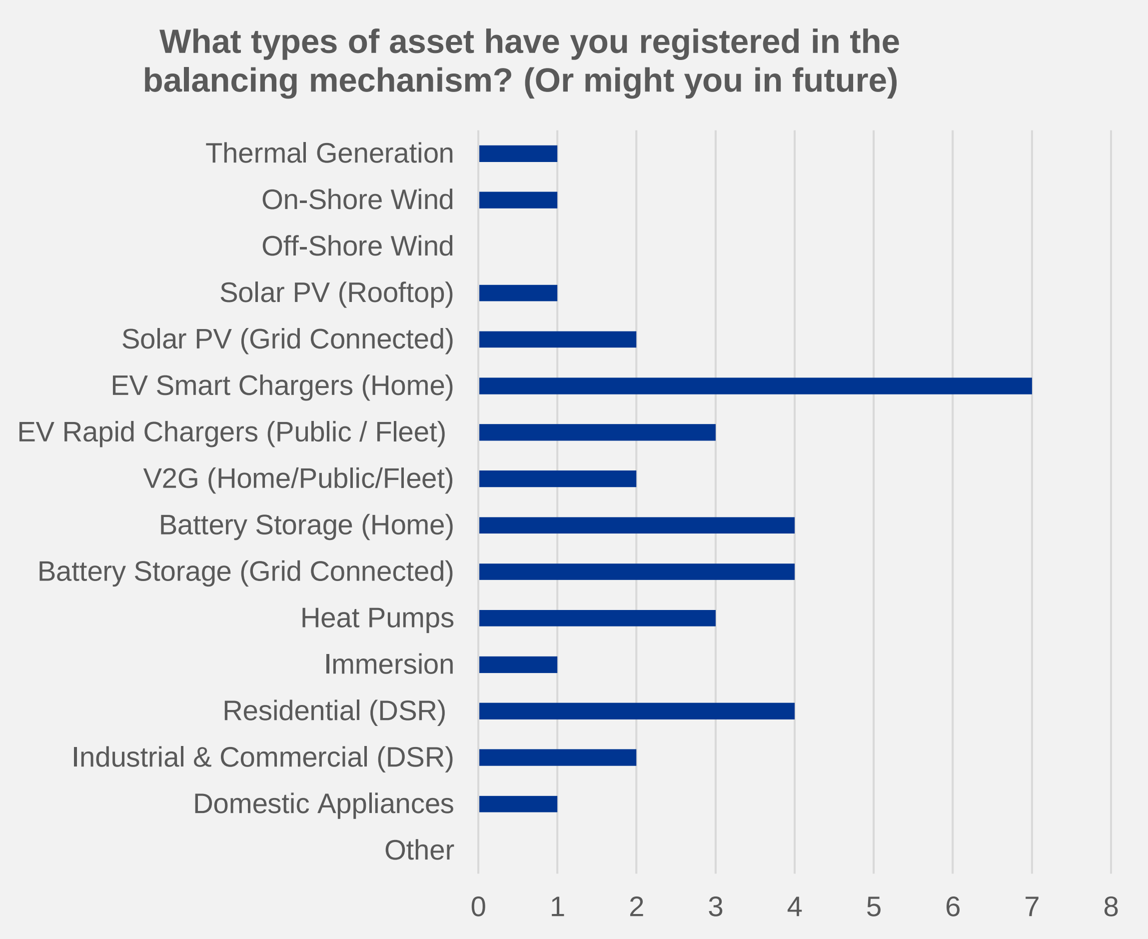
Consumer Energy Resources could provide around 53GW of flexible capacity by 2035 and 85GW by 2050

Aggregated Consumer Energy Resources (FES 2024 Holistic Transition and FES 2023 Leading the Way)

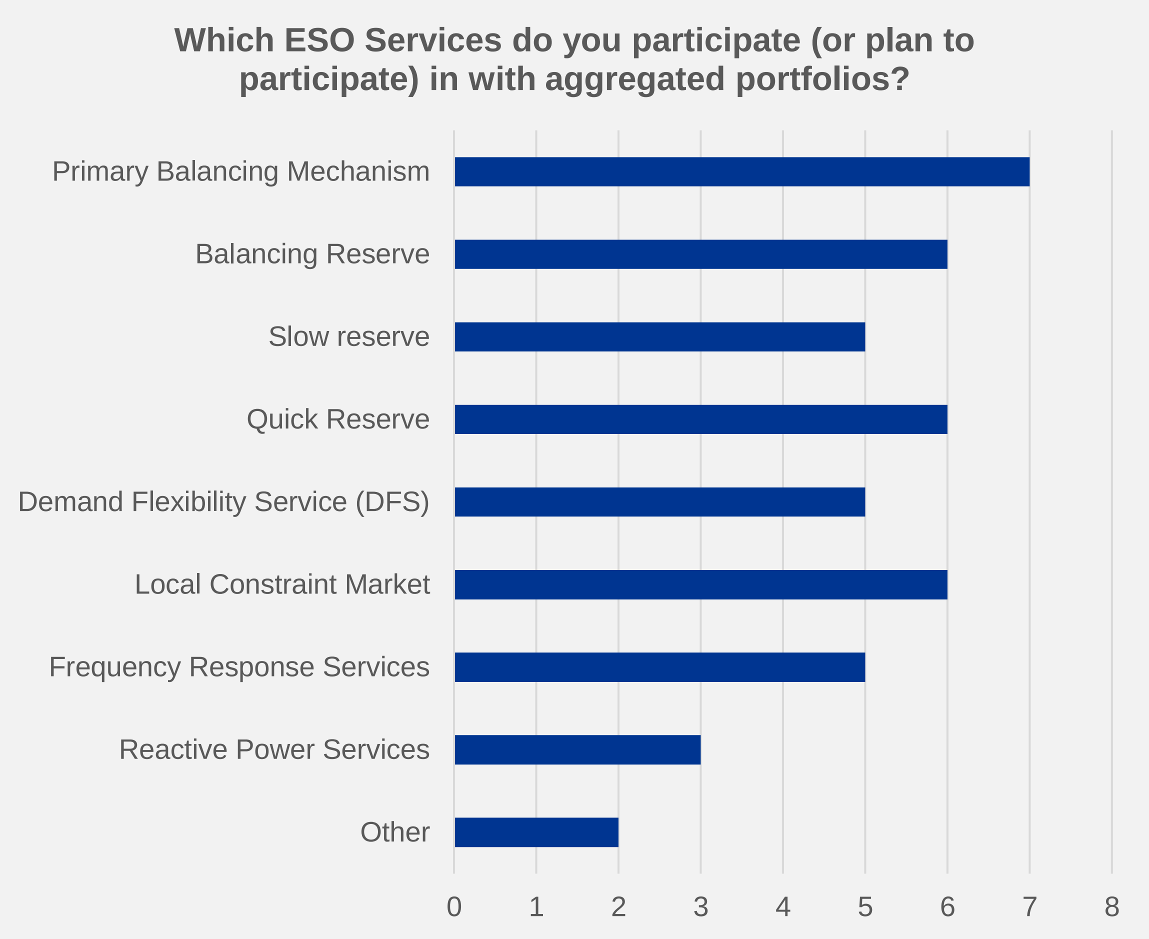
Technology Type		Rooftop Solar PV[#]	Charger (smart charging)[#]	EV Charger (V2G available at peak)[#]	Micro Battery Storage*	Immersion heater*	Electrified Heat*	Residential Demand Side Response at peak[#]
Unit power (range)		1-12kW residential (avg. 3.5kW) 10-100kW commercial	7kW	7-1000kW	10-30kW	3-6kW	4-16kW	2kW
Typical Connection Point		415V and below	415V and below	415V and below	415V and below	230V	415V and below	230V
Currently installed decentralised capacity (2022)		4.7GW	0.5GW	0GW	0.04GW	6.1GW	9.9GW	0.4GW
Future Capacity (Decentralised)	**2035**	Dx PV total 52GW	9.7GW	8.9GW	2GW	2.9GW	22.3GW	2.7GW
	2050	Dx PV total 83GW	16.2GW	32.4GW	8.3GW	2.5GW	33.2GW	6.4GW

Sources:
[#] ESO FES24
* ESO FES23
https://www.sunsave.energy/blog/demand-flexibility-service
https://www.glowgreenltd.com/solar-advice/commercial-solar-panels
https://www.greenmatch.co.uk/solar-energy/solar-panels
https://energysavingtrust.org.uk/advice/solar-panels/

EV chargers and home batteries are of greatest interest to aggregators



Thermal Generation	1
On-Shore Wind	1
Off-Shore Wind	0
Solar PV (Rooftop)	1
Solar PV (Grid Connected)	2
EV Smart Chargers (Home)	7
EV Rapid Chargers (Public / Fleet)	3
V2G (Home/Public/Fleet)	2
Battery Storage (Home)	4
Battery Storage (Grid Connected)	4
Heat Pumps	3
Immersion	1
Residential (DSR)	4
Industrial & Commercial (DSR)	2
Domestic Appliances	1
Other	0



Primary Balancing Mechanism	7
Balancing Reserve	6
Slow reserve	5
Quick Reserve	6
Demand Flexibility Service (DFS)	5
Local Constraint Market	6
Frequency Response Services	5
Reactive Power Services	3
Other	2

4. Barriers (Market Participants Engagement)

We interviewed and distributed a questionnaire to manufacturers, suppliers and flexibility providers

Stakeholder engagement was carried with the following groups, through both interviews and a questionnaire.

- Current market participants e.g. BMUs
- Aggregators only
- Aggregators & Suppliers
- Aggregators & Manufacturers
- Aggregators, Suppliers & Manufacturers
- Manufacturers
- Trade associations and lobby groups

9

Nine providers were interviewed to support this study, of which five also returned a questionnaire. The questionnaire was distributed to 23 additional flexibility providers and there were four responses. 3 current BMU providers were approached, none of the current market participants respondent to our questionnaire or showed concern over the current OM requirements.

Information on the types of asset the respondents operate / plan to operate, which ESO services they participate in now or plan to in the future, type and capability of meters installed, barriers to participation in ESO services with aggregated portfolios.

CERs face three key barriers to participation in ESO services

Assets above 1MW can generally meet OM requirements. Below 1MW, and especially below 100kW, assets face significant barriers

Many assets do not currently meet the +/-1% meter accuracy requirement

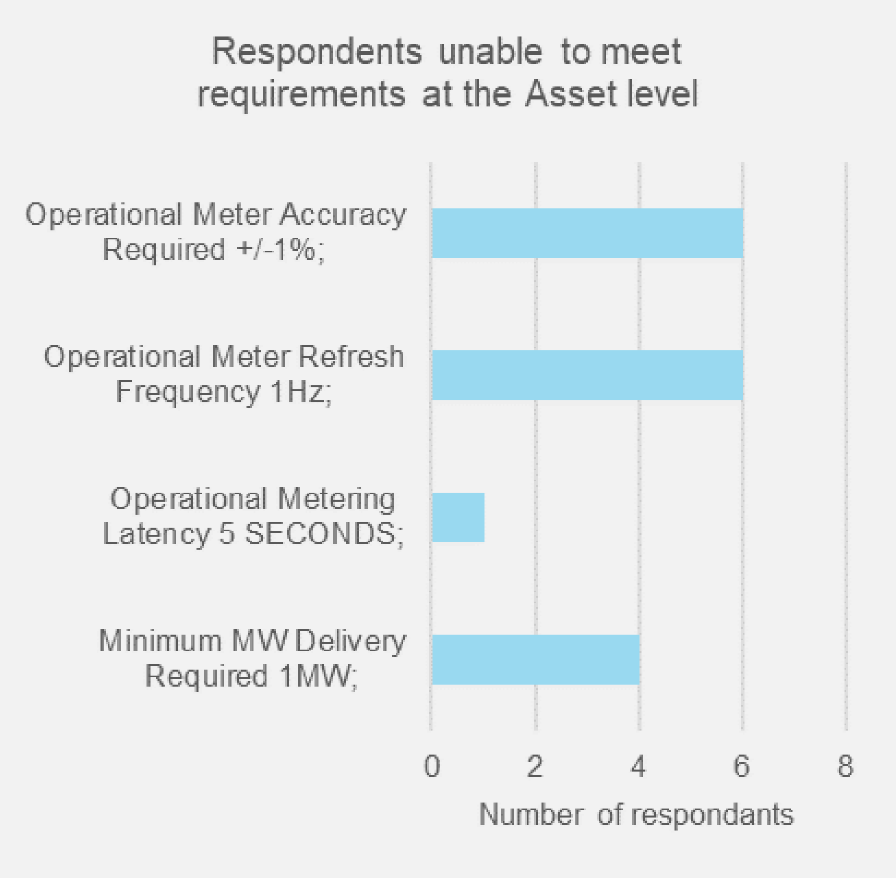
- CER assets typically have embedded meters with accuracies from +/-1% to +/-2.5%
- Retrofitting legacy assets to achieve higher accuracy is cost-prohibitive
- There are multiple GB and EU regulatory and settlement standards which add complexity for manufacturers

1-second update frequency requirement poses significant challenges

- Cost of data transmission, particularly when using cellular networks
- Computing resources and data storage needed to processing and store 1-second data
- Legacy assets are often not capable of 1-second communication frequency

1MW portfolio requirement is restricting growth

- Achieving 1MW consistently in each GSP group is challenging
- For EV chargers a large number of assets is required to consistently meet the 1MW threshold
- Lack of HH settlement capability limits the eligible portfolio size and requires costly retrofit of meters for supplier aggregators



5. Existing GB and Global Operational Metering Requirements

Services dispatched via the BM have common OM requirements, non-BM services have different requirements

Current interpretation of these ESO requirements is that that each sub-unit within an aggregated Balancing Mechanism Unit (BMU) or secondary BMU should provide data of the same granularity.

Service Requirements	Requirement Description	Dynamic Containment	Dynamic Moderation	Dynamic Regulation	Quick Reserve	Slow Reserve	Balancing Reserve	LCM	DFS
Operational Metering Required	A live feed to ESO control room to measure providers live service delivery	YES	YES	YES	YES	YES	YES	NO	NO
Asset metering permitted (vs boundary point metering system)	What type of metering is permitted? Some services only allow boundary meter data whilst others allow metering behind the boundary i.e. asset metering	Asset metering permitted	Asset metering permitted	Asset metering permitted	Asset metering permitted	Asset metering permitted	-	Boundary metering only	Asset level metering permitted (but with ad hoc boundary meter checks)
Operational Meter Accuracy Required	The accuracy rating required of physical meters providing operational metering	**+/-1%**	**+/-1%**	**+/-1%**	**+/-1%**	**+/-1%**	**+/-1%**	**N/A**	**+2.5% / -3.5% (COP11 DERIVED)**
Operational Meter Refresh Frequency	The frequency that the physical meter captures real-time data snapshots	**1Hz**	**1Hz**	**1 Hz**	**1Hz**	**1Hz**	**1 Hz**	**N/A**	**N/A**
Operational Metering Latency	Operational metering data must reach the ESO Control Room within this time	**5s**	**5s**	**5s**	**5s**	**5s**	**5s**	**N/A**	**N/A**
Operational Metering Signal Type	The type of electrical data collected for operational metering	Active power and SoE	Active power and SoE	Active power and SoE	Active Power	Active Power	Active Power	N/A	N/A
Performance Meter Refresh Frequency	The frequency that the physical meter captures real-time data snapshots (e.g. 20Hz= 20 snapshots per second)	20Hz	20Hz	2Hz or 20Hz	N/A - Phase 1 1Hz (TBC) - Phase 2	1Hz (TBC)	1Hz	Half Hourly	Half Hourly
Aggregation /Virtual Lead Party (VLP) Route Available	The option of having more than a single asset within a unit	YES	YES	YES	YES	YES	YES	YES	YES

Metering Requirements in GB markets

Operational metering requirements are stricter compared to those for other services.

Our recent survey highlighted the complexity and divergence of these requirements which make it challenging for market participants to navigate the different metering requirements needed for various services.

Service Requirements	Requirement Description	Balancing Mechanism (and Services dispatched via BM)	Settlement	Capacity Market	DSO Flexibility Services
Live Metering Required	A live feed to ESO control room to measure providers live service delivery	YES	NO	NO	NO
Asset metering permitted (vs boundary point metering system)	What type of metering is permitted? Some services only allow boundary meter data whilst others allow metering behind the boundary i.e. asset metering	Asset metering permitted	Asset metering permitted	Asset metering permitted	Asset metering permitted
Meter Accuracy Required	The accuracy rating required of physical meters	**+/-1%**	**+/-2%**	**+/-0.5% - +/-2.5%**	**None**
Meter Refresh Frequency	The frequency that the physical meter captures real-time data snapshots	**1Hz**	**30m**	Half-hourly or converted to 30-minute Settlement Period format.	**1m - 30m**
Meter data Latency	Metering data must reach the ESO Control Room within this time	**5s**	**N/A**	Dependant of type of solution	**N/A**
Meter Signal Type	The type of electrical data collected	Active power and SoE	Active power	Active power	Active power
Aggregation /Virtual Lead Party (VLP) Route Available	The option of having more than a single asset within a unit	YES	YES	YES	YES
Regulation	Applicable regulation/required compliancy	See CM	CoP11 (based on IEC/EN standards)	Equivalent to CoP 1,2,3 5 but not CoP11	N/A

Balancing market differences in and outside GB

While the GB aligns with other regions in several operational metering requirements for fast ancillary services, notable differences exist, primarily in metering accuracy, refresh frequency, and latency requirements when it comes to slower services. Developing operational metering requirements to support GB-specific capabilities can be quite costly.

			EU			Outside EU		
Service Requirements	Requirement Description	GB	Belgium	France	Netherlands	US	Australia	New Zealand
Operational Metering Required	A live feed to ESO control room to measure providers live service delivery	YES	NO, with exception of mFRR	NO	YES	YES	YES	YES
Asset metering permitted (vs boundary point metering system)	What type of metering is permitted? Some services only allow boundary meter data whilst others allow metering behind the boundary i.e. asset metering	Asset metering permitted	Asset metering permitted	No	Asset metering permitted	Asset metering permitted	No	Asset metering permitted
Meter Accuracy Required	The accuracy rating required of physical meters providing metering	**+/-1%**	**+/-2%**	**+/- 0.5% / 2%**	**+/-1% for FCR** **N/A for aFRR, mFRR and RR**	**+/-2%**	**+/-2%**	**+/- 0.5%/2%**
Meter Refresh Frequency	The frequency that the physical meter captures data snapshots	**1Hz**	**2s – 15m**	**10s – 5m**	**1s – 5m**	**4s – 10s**	100 ms - 4 s	**6s – 1m**
Meter Data Latency	Mtering data must reach the ESO Control Room within this time	**5s**	**2s – 15m**	**10s**	**-**	**-**	1 s - 5 min	**-**
Meter Signal Type	The type of electrical data collected for metering	Active power and Energy	Active power and Energy	Active power and Energy	Active power and Energy	Active power and Energy	Active power and Energy	Active power and Energy
Aggregation /Virtual Lead Party (VLP) Route Available	The option of having more than a single asset within a unit	YES	YES	YES	YES	YES	YES	YES

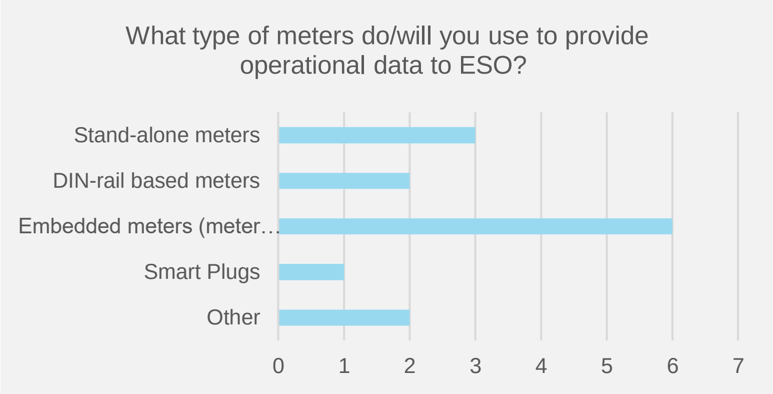
6. Current and Future Asset Metering and Communication Capabilities (Manufacturers Engagement)

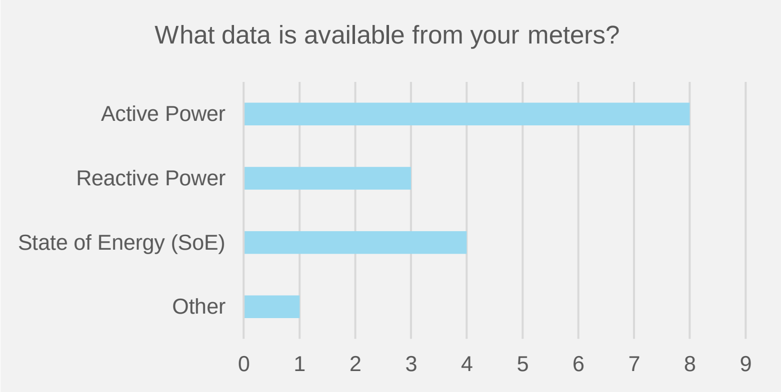
There is a high degree of variability in CER metering technology and communication capabilities

The most frequently cited factors influencing choice of metering technology were cost and regulations

Overall Findings:

- The analysis mainly covers residential-scale assets like EV chargers and home batteries, as well as larger commercial & industrial assets up to around 1 MW in size. Metering used by large generators is included for comparison.
- Many flexibility providers have no control over the type of metering technology installed in all or part of the portfolios they manage, given that all or part of their portfolio is manufactured by third parties.
- There are multiple conflicting metering requirements in national and European legislation, as well as requirements set by settlement bodies and TSOs, therefore manufacturers may not have a strong incentive to align metering capabilities to the service requirements of a particular TSO.
- Some manufacturers already provide flexibility services directly to DSOs and TSOs, whilst others indicated that they may do so in future. Yet during our interviews market access was mentioned less often as a driver of metering technology than cost and regulations.





Manufacturer roadmaps for metering technology will provide higher capability at lower cost

Main drivers for improved metering are cost reductions, regulations, and enabling increased market access

Manufacturers incorporating more capable metering

- Manufacturers are developing higher capability metering with lower hardware costs,
- New capabilities expected to come to market over the next 5 years.
- Improvements are expected in accuracy and read frequency.

Hardware cost reduction

- Increased integration of meter hardware in embedded assets resulting in economies of scale
- Commoditization of more capable current and voltage sensors results in lower costs to install more capable metering

Data transmission costs are falling

- Data transmission costs will remain a significant barrier particularly for high read frequency data from embedded meters
- Cost of data transmission has been falling over time, if this trend continues communication costs may become less of a barrier in future

There are multiple drivers for more capable metering

- Compliance with regulations and standards e.g. Smart Charging
- Market access: access to existing markets
- New markets and system needs: development of technology to serve unmet system needs (e.g., LV network monitoring) with potential dual-use of this technology for operational metering
- Future-proofing: Anticipating stricter requirements in the future to avoid stranded assets

Source: https://techneconomyblog.com/2023/08/03/on-cellular-data-pricing-and-consumptive-growth-dynamics-the-elephants-in-the-data-pipe/

CER Asset Meter and Communications Capabilities

	Residential Solar	EV Charger	Heat Pump / AC	Immersion heater	Micro Battery Storage	Buildings (DSR)	Domestic Appliances
Meter Types (Embedded, None, Both)	- Embedded meter - Standalone meters (in separate fuse box)	- Embedded meter - Also standalone meters may be used here	Sensor electronics	Sensor electronics	- Embedded meters - Standalone meters (in separate fuse box)	- Embedded meters - Standalone meters (in separate fuse box) - Typically, multiple meters aggregated via a gateway	Sensor electronics
Signals available	Real-time active power output Total active energy produced Daily active energy produced	Active Energy Imp/Exp Reactive Energy Imp/Exp Active Power	Active Energy Active Power	Real-time active power consumption Total active energy usage	Active Energy Imp/Exp: Energy drawn form or sent to the grid Active energy stored in the battery Acive energy used from battery Real-time power In/Out	Active energy consumption and generation Power demand Real-time power	Active Energy Active Power
Accuracy	± 2% (IEC 62053-21) or better	± 2% (IEC 62053-21) or better	Not well know ± 10%	Not well know ± 10%	± 2% (IEC 62053-21) or better	± 2% (IEC 62053-21) or better	Not well know ± 10%
Latency: communication meter/appliance to central system	The latency depends much on the used communication technology Communications over **4G/5G** and Internet is typically **lower that 1 s** The latency in **NB-IoT** networks is typically between **1.6 to 10 sec** The latency in **LTE-M** is typically in the range of **100 – 200 msec**						
Latency: comm between backend → aggregator → ESO	Also, the latency of the comm between backend system and aggregator, and processing at the aggregator must be included**.** This may also take several seconds (e.g. **1-10 sec depending on processing time**)						
Frequency	From meter perspective, 1 sec is possible. But is this feasible? → Communication cost, data processing in back-end systems	Normally, transaction based. Aligned with residential metering (15 min). In theory 1 sec is possible.	5 min; 10 or 15 min is OK 30 sec to 1 min: OK More frequent communication is feasible but limited by communication cost and data processing in back-end systems				

Asset Mapping: Out of scope for impact assessment

	Centralised Generation			**Distributed Generation >1MW**					
	Gas	Nuclear	Pumped Hydro	Solar	Onshore Wind	Offshore Wind	Grid Battery Storage	CHP	Reciprocating Engine
Unit capacity range	100-1000 MW	1000-1600 MW	300-1700 MW	1-75 MW	1-300 MW	100-1500 MW	7MW-100MW+	1-50 MW	1-5MW
Metering point Point	Metering at the connection point to the grid. Separate metering per generating unit								
Metering cost	suitable for Meters used are industrial and expensive and requires CT and VT to reduce the voltage and current flowing through the meter. A metering installation which includes the meter + CTs and VTs can range from £ 500 to £1500** depending on features, installation requirements, and the supplier								
Meter Types	Typically, indirect metering using CTs and VTs instrument transformers								
Meter Examples (We only provide some examples. More meters exist.)	Schneider Electric Powerlogic ION series Siemens Sentron PAC series GE Multilin EPM Series Landis+Gyr E650, E660 Iskraemeco MT880								
Accuracy (*)	CT: 0.2s VT: 0.2 Wh: 0.2s Varh: 0.5								CT: 0.2 VT: 0.2 Wh: 0.5 Varh: 2
Frequency	Per 1s measurements are possible.								
Latency	Depending on communication infrastructure								
Communication	Meters are locally read out via modbus by an RTU. On RTU conversion to IEC60875-5-104 to send to SCADA. Conversion to IEC61850 is also possible.								

(*) According to IEC standards: IEC 62053-21, IEC 62053-22, IEC 62053-23, IEC 62053-24. The example accuracies are for Belgium. Other EU countries are similar.
(**) These meters are not applicable CERs as they are not fit for the power level and are too expensive.

7. Next Steps

WP3 scope and next Steps

Accuracy Impact

1% inaccuracy requirements on asset level

- Examine the impact of accuracy when aggregating assets and setting requirements at the portfolio level while examining minimum portfolio sizes for aggregated accuracy.
- Explore the minimum required meter accuracy rates at the portfolio level, considering different reporting frequency rates

Frequency Impact

1-second read frequency

- Assess the impact of lower frequency reads (e.g., 10s, 30s, 60s during dispatch) on meter lag error and exploring methods such as reporting on change when the charge rate exceeds a certain threshold, combined with regular reporting at larger intervals.
- Assess adjusted aggregate metering for less frequent metering (10s, 30s, 60s) combined with later validation.
- Explore other methodologies such as staggered dispatch

Latency Impact

5-second latency

- Explore the effect of delays observed between many stakeholders on the quality of operational metering and effect on the SQSS.

Financial Impact and Counterfactual

Establish a base case based on 2035 scenario ‘leading the way’

- Assess cost of actions taken by ENCC to mitigate risks of delayed metering errors
- Estimate cost of keeping current requirements on market participants
- Develop 2 scenarios: 1- with no CER assets (alternatively use ‘falling short scenario), 2- use leading the way scenario to compare prices