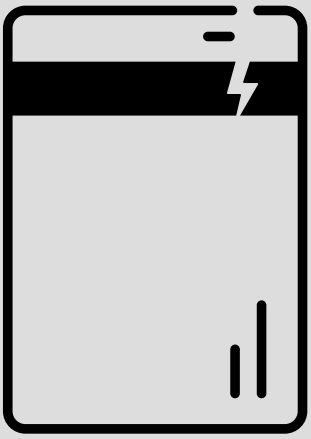
levelize

White Paper: Access All Areas

Domestic battery storage requires smarter approach to revenue generation

Harnessing domestic flexibility – battery storage, heat pumps and electric vehicles – will be critical in enabling a decarbonised power grid. But the benefits extend beyond decarbonising the grid as they can be used as real-time flexible assets to balance the grid and generate revenue for households as they can access all current and future flexibility markets.

Levelise acts as a virtual power plant operator tapping into all available value pools, which means higher incentives and better returns.



Here's a breakdown of the key market dynamics – and the nine pools of value residential batteries can access through Levelise.

The UK's energy system is undergoing rapid change – and will require much more to transition to net zero.

Huge volumes of renewable power have already been built out – with the power system regularly operating with minimal fossil-fuel input. For example, at 1.30pm on Friday 5 April 2024, gas contributed just 2.5 per cent to the mix, versus 44.4 per cent coming via wind, and 28.8 per cent via solar PV. (You can see the current mix here).

Over the last 12 months, fossil-fuelled power stations, mostly gas, contributed just a third of overall generation (33.8 per cent) whereas renewables, mostly wind, contributed 36.9 per cent. The remainder was largely nuclear and biomass. Coal contributed just 1.1 per cent.

New wind power records are set regularly – between 9:00am and 9:30am on 21 December 2023 British wind farms averaged a record 21.81GW of generation. As a result, the carbon intensity of our power system is falling, with emissions down from around 500g/kWh in 2012 to around 140g/kWh today.

All good news. **But replacing big thermal power stations with less 'dispatchable' renewable power – i.e. the wind and sun are variable and can't be turned on or off – means National Grid's key role in keeping the power system stable at 50Hz becomes a bigger challenge.**

The System Operator is losing what it calls 'inertia' that previously helped keep frequency deviations in check – that inertia came for free as a byproduct of big spinning turbines on coal and gas plant. But over the last decade, with those plants coming off the system and being used less frequently, the average annual system inertia has fallen by around 40 per cent. Lower levels of inertia also means system frequency is less resistant to change. So when something goes wrong – a power station unexpectedly shuts down, or an interconnector fails, or anything else that puts supply and demand seriously out of kilter – frequency changes occur much faster.

Which means National Grid ESO is having to work harder and intervene more regularly to keep the lights on – and as a result is building new flexibility products and buying greater volumes to meet those changing needs.

At the same time, GB power infrastructure is stretched – and particularly constrained in the highly concentrated South East, leading to lengthy connection queues for new developments. As of September 2023, that queue stood at 143GW across the distribution network. For context, 1GW equates to 20,000 rapid electric vehicle chargers, or 3 million solar PV panels, or the power needs for 500,000 homes, according to the Energy Networks Association. So the distribution networks also have increasing flexibility requirements.

Which is why batteries and flexible sources of demand – like domestic battery storage, heat pumps, electric vehicles and smart appliances – are becoming increasingly critical. Firstly to keep the system stable, and secondly to maximise available capacity.

Access is key

Access to all available flexibility markets – i.e. all of the places that flexible power can be sold into – is therefore imperative in order to create sufficient rewards for the flexibility required to keep the lights on.

But it is not straightforward for small-scale household assets, and very few aggregators have been successful in managing to package up flexibility, navigate a fragmented marketplace and reliably deliver at scale across multiple marketplaces. The admin burden is not for the fainthearted, with different form filling requirements and a lack of standardisation in data formats from one market to the next.

Which means few service providers are able to move seamlessly between markets and are therefore unable to access the full suite of revenue generating opportunities for flexible households – limiting financial returns as a result.

Levelise is an exceptional case. Its virtual power plant, made up of more than 5,000 residential batteries, can sell its flexibility into all available markets including the upcoming reserve ones. Its smart technology has been delivering real-time grid balancing since 2019, trading aggregated flexibility from household batteries and programmatically allocating that distributed resource based on availability and market requirements, ensuring value to the homeowner is maximised.

Levelise does this directly – not through a third party aggregator or energy supplier – which means households using the Levelise Hub get a greater share of the rewards, while the Levelise App keeps them updated on trading results and financial wins.

Because it is a 'Virtual Lead Party' (and was the first residential service provider to take that approach to market access), Levelise can trade in National Grid ESO's Balancing Mechanism, its primary tool for balancing supply and demand. It can also trade in all of the other flexibility markets – currently seven markets and two behind-the-meter revenue streams detailed on the next page.

As a result, the company, now owned by BUUK, has shared more than £1.7m in revenue with its customers, by moving their flexibility into the most suitable markets 24/7 and 365 days a week.

Emerging opportunities

From next year, Levelise customers will be able to sell their flexibility on the wholesale power markets – a much deeper pool that represents 48 half-hour trading periods every day. So when prices spike in periods of high demand, Levelise can set the batteries to export power and take advantage of those price spikes.

The Levelise Hub works in a similar manner to minimise household energy bills. Its technology ensures that households charge their batteries from the grid when prices are lowest, and switch to powering their home using the battery when prices are high – as the algorithm in the software links with the time of use tariffs for all energy suppliers. That approach also helps the broader energy system by helping to flatten demand peaks.

From 2026, when all household electricity use is set to be settled on a half-hourly basis, it is envisaged that time of use tariffs – with higher price differentials to encourage people to help keep the system balanced – will become much more widespread. Which in turn should lead to a significant increase in demand for smart technologies like the Levelise Hub as bill payers are more exposed to the real-time costs of system stability.

But those real-time costs also present real-time opportunity for those with flexible assets – and the means to access and move between all value pools as the rewards on offer change.

Nine revenue streams

The main revenue streams are as follows, though it is important to note that these are not all 'stackable', i.e. not delivered simultaneously – it is the ability to provide one service at a time and then move to another that is key to optimising financial benefits to householders.

1. Demand Flexibility Service: Offered by most energy retailers, DFS is a simple service that rewards households and businesses for using less energy over peak periods. National Grid ESO introduced the scheme over winter 2022/23 and ran it again last winter. It suggested households could save up to £20 over the winter and stated around 350MW of flexibility was delivered in the scheme's first year.

Effectively a commercial trial, and only providing an incentive over winter, there are no guarantees that National Grid will run the DFS again. But it has served as means to highlight the need for system flexibility to the wider public: 1.6m homes and businesses took part in the first year of operation.

2. Balancing Mechanism: The 'BM' is National Grid's main tool for keeping the system stable close to real time. It makes up the largest chunk of spending on balancing costs. For example, In January 2024, the ESO spent £201.54m keeping the system balanced of which £140.4m, or 68 per cent, was via the Balancing Mechanism. Across the month, BM volume stood at more than 2 million megawatt hours.

Via an auction process, the BM pays providers (in this case batteries and other household assets aggregated via the Levelise virtual power plant acting as a single 'Balancing Mechanism Unit') to flex up or down. **So for batteries, that means getting paid to either draw power from the grid if there is too much generation on the system (i.e. it's very windy and sunny and there is insufficient demand to use all that power), or getting paid to push power onto the grid when there is insufficient generation – for example on a cold, windless winter's day.**

The BM operates in half hourly chunks – which means there are 48 periods every day that could present a revenue opportunity for those that can access that market.

Levelise has BM access – because it was one of the first providers of domestic flexibility to qualify as a Virtual Lead Party in June 2023.

3. Frequency Response Services: The first line of defence for grid stability, this is a fast-acting set of services that keep grid frequency close to 50Hz. National Grid ESO has a contractual obligation to keep frequency within plus or minus 1 per cent – and it varies all the time depending on supply and demand – but takes constant action to keep it much closer than that

Batteries are really useful in helping to manage frequency, because they can respond fast enough and in most cases can both give or take power as required to bring frequency up or down.

The ESO has lots of tools to manage frequency, but one of the main services Batteries connected to the Levelise hub can deliver is **Static Firm Frequency Response**, which basically requires batteries to either take power or push power onto the grid with 30 seconds notice and then keep doing that for up to 30 minutes, until the grid is back to a point where the System Operator is comfortable.

Levelise and its customers get paid for being available to provide the service – even if they are not actually used – just for being ready if National Grid needs them. They get paid again if they are actually used.

Likewise the faster acting 'dynamic' frequency response services also pay for both batteries being available if needed, and again if actually used.

The main three services are:

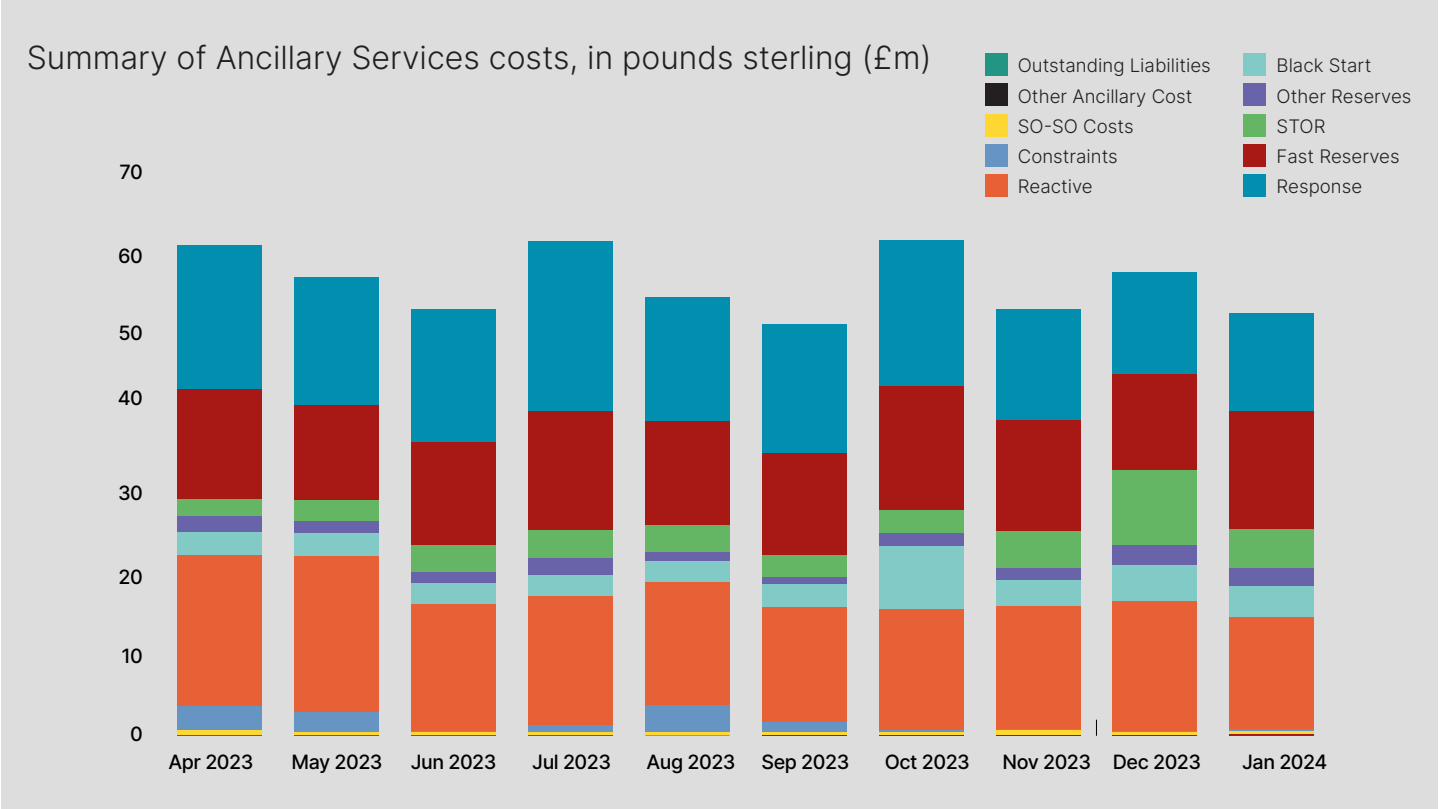
- **Dynamic Containment,** which requires batteries to respond to a signal within 0.5 seconds, start taking or giving power within a second, and keep delivering for up to 15 minutes. This service is needed quickly after a fault.

- **Dynamic Moderation** is exactly the same in terms of response speed, but batteries have to keep delivering for up to 30 minutes. It's used before any frequency faults occur, but when the system is looking volatile, to try and head off potential problems.

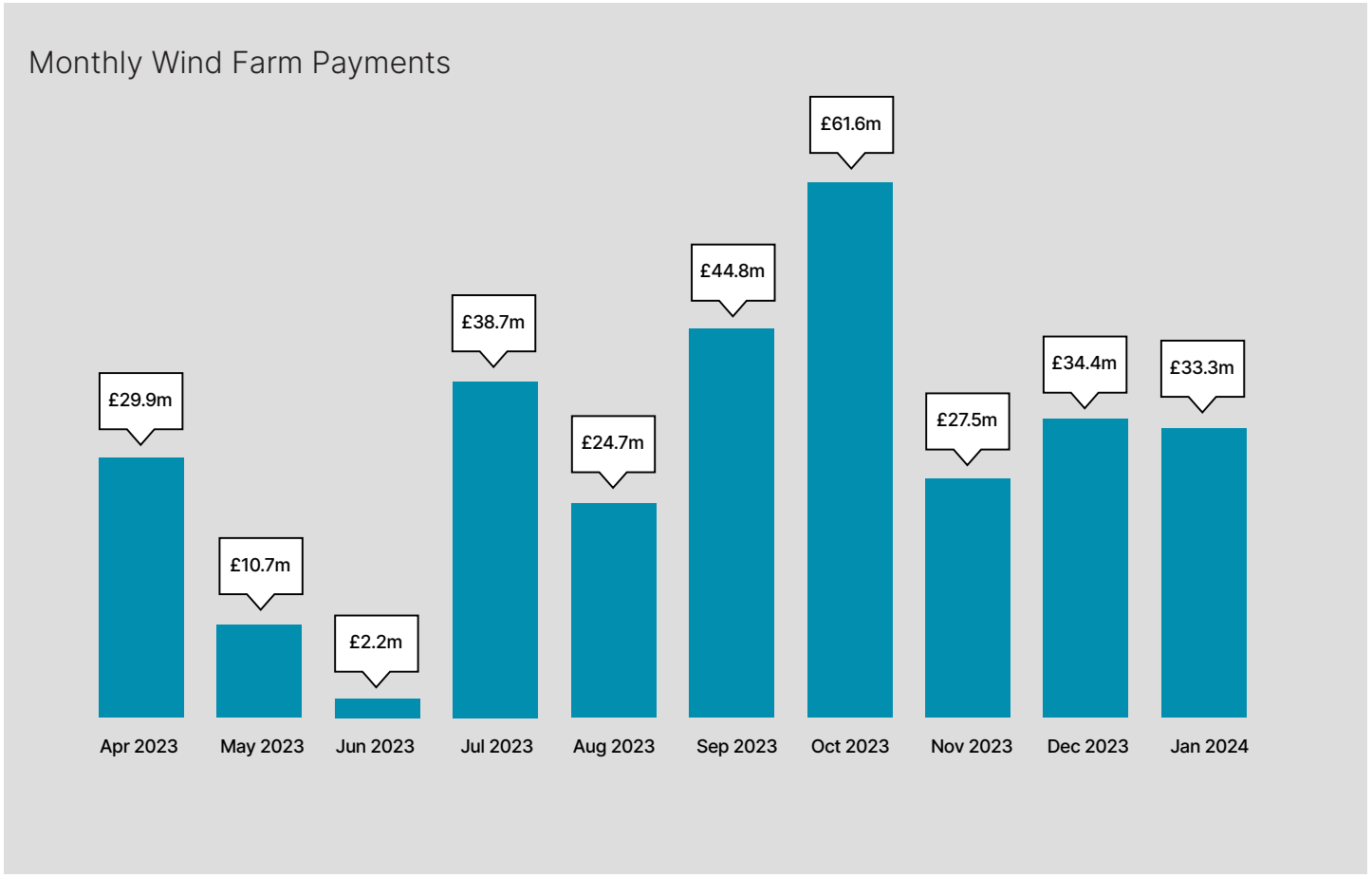
- **Dynamic Regulation** is also used before faults actually happen, but kicks in before Dynamic Moderation. Providers have to start responding within 2 seconds, get up to full response within 10 seconds and keep delivering for up to an hour.

For an idea of the value National Grid places on frequency response services, in January 2024 it spent £12.09m on them – but that's the low end of the scale, as they tend to be required more when it's both sunny and windy.

In July 2023, for example, the ESO spent £21.08m on frequency response and it also spiked in October (£18.18m) – both months when National Grid spent more than usual paying wind farms not to export to the power system to keep supply and demand in check.



Source: National Grid ESO



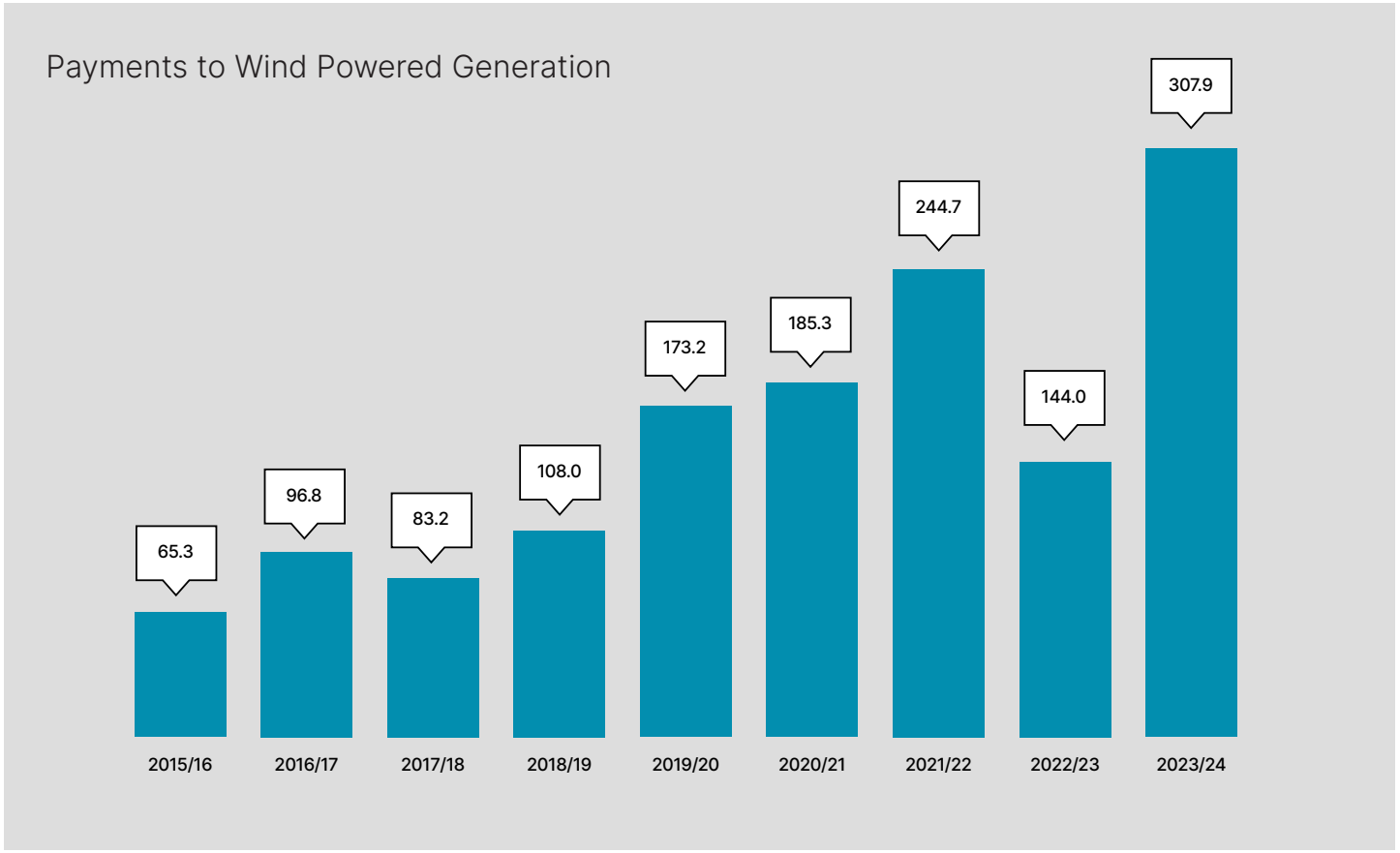
Source: National Grid ESO

4. Reserve services: After the fast-acting frequency response services have done their job, Reserve Services keep things steady over longer timeframes – they are still fast-acting, but not sub-second. Providers for **Positive Quick Reserve** have to be able to give power within one minute, i.e. Batteries connected to the Levelise hub must push power onto the grid within 60-seconds. Providers of **Negative Quick Reserve** have to be able to take power from the grid within 60-seconds (see the nitty-gritty here.)

These quick reserve services are contracted via a daily auction – so there's an opportunity 365 days a year for **Levelise battery owners, and those that take part get paid for being available – and again if they are actually called on to deliver if needed.**

5. The Local Constraint Market is another new service that Levelise and its battery customers can access. Launched last year, it's also related to wind power – in short, because there are lots of wind farms in Scotland, and more coming, while most of the UK's massive offshore wind farms are being built out in the North Sea.

The problem is, demand is highly concentrated in the South East and at times there is literally not enough capacity to carry it – the cables simply aren't big enough – putting pressure on the grid.



Source: National Grid ESO

The Local Constraint Market is designed to help solve that by paying people to increase demand (draw power from the grid) in the north while at the same time paying those in the south to reduce demand (i.e. switch to batteries). **That's something Levelise can do well, instructing its fleet of batteries in the north to charge, and those in the south to discharge.**

Everyone gets paid, the grid congestion eases and the idea is to make it cheaper for all bill payers by having to pay wind farms to dump their power less often. In 2023/24 National Grid ESO paid a record £307.9m in wind farm payments, more than double the previous year and up from £65.9m in 2015/16 – all of which ends up on energy bills.

6. Distribution System Operator Flexibility Tenders (or DSO Flex) are similar in nature, but work at a distribution level across the seven regional power networks run by UK Power Networks, Northern Power Grid, Western Power Distribution and the like. Because those grids are also becoming congested – and will have to work harder as more electric vehicles hit the roads and more homes switch to heat pumps – the local grid operators are likewise paying those who can adjust demand.

Batteries connected to the Levelise hub can help, and are bidding into these auctions – but they are highly location specific. Providing DSO Flex also helps bill payers, because otherwise the networks have to spend more upgrading the networks – essentially, more copper and more substations – which does not come cheap.

7. Wholesale market trading: From the end of this year, Levelise will also be able to trade the power from household batteries in the wholesale power market. This is a major opportunity for customers to make gains every half hour, every day of the year. That's because part of the wholesale power market trades in half-hourly chunks and prices vary every half hour – sometimes by a little, sometimes by a lot – and the difference between the highest and lowest prices can vary quite dramatically over the course of a day.

Sometimes prices are actually negative. **So Levelise customers can make money or savings by effectively charging or discharging batteries depending on what wholesale market prices are doing at any given time.**

There is also an opportunity to trade in the day-ahead markets (those that take place every day, but with power traded for the next day).

8. Time of use tariff arbitrage: Sounds very Wall St, but actually just means using the battery to make best use of time of use tariffs that suppliers are increasingly bringing to market.

Time of use or 'multi-rate' tariffs will become much more widespread from next year, when all households will be metered and settled on a half-hourly basis – which provides more opportunity for Levelise customers to save money. **The software in Hub will automatically switch from grid supply to the battery to avoiding peak prices and then back to mains to charge the battery at the cheapest times – which means lower energy bills.**

9. Efficiency optimisation: Not actually a flexibility market, but definitely worthy of inclusion, because efficiency equals money and plays a key role in making battery economics stack up.

The Levelise Hub always optimises battery operation to minimise energy losses between charging and discharging. Its self-learning algorithms work out and when the home usually consumes power, when it doesn't – and then uses predictive analytics to make the most efficient use of the battery – which means more savings, stronger ROI and less wasted energy.

Flex next

Over time, there will be more markets and products that reward flexibility as the UK energy system decarbonises, and electricity plays a much greater role in both heating and transport.

Levelise aims to access all of them to make domestic battery storage, electric vehicles, heat pumps and smart appliances work harder for the grid, enabling the decarbonised economy – while making it easier for people to contribute to a fairer, more efficient transition.

Unlock greater flexibility: levelise.com

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