CORNWALL INSIGHT

CREATING CLARITY

Turn on, Plug in, Check out: Unlocking value from smart meter-enabled EV flexibility

September 2024

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2 About Cornwall Insight

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This independent research paper prepared by Cornwall Insight was commissioned by Smart Energy GB.

3 Executive summary

This report was prepared by Cornwall Insight and commissioned by Smart Energy GB. It assesses the value of smart and V2G electric vehicle (EV) charging within a flexible energy system in three snapshot years of 2025, 2030, and 2040. It draws on the energy system modelling conducted in our previous collaborative study, "The Power of Flex: Rewarding smarter energy usage". We have projected how EVs and the different approaches to charging them could be taken up and the benefits that could be accessed from smart and V2G charging, as opposed to non-smart charging.

What are the benefits from smart and V2G charging?

Through our analysis, we have identified three primary types of benefit for consumers as a whole and EV users from smart and V2G charging:

1. **Flexible electricity use from EVs supports more renewable generation, lower electricity costs, and less carbon consumption for everyone**
2. **Smart charging unlocks lower network costs and 24% savings on wholesale electricity costs for drivers**
3. **Exporting electricity through V2G can save drivers up to 70% on electricity**

Flexible electricity use from EVs supports more renewable generation, lower electricity costs, and less carbon consumption for everyone

If all the EVs in our system modelling used smart charging to avoid peak times, around 7GW of peak-time electricity demand from EVs could be avoided in 2030. This is more than the capacity of Drax Power Station, the largest single power station in GB that powers more than 4 million homes

Our previous research in the Power of Flex report showed that household flexibility, including from EV charging, could facilitate ~£14.1bn of savings via wholesale power prices, avoided network investments, and avoided power plant costs

Smart charging unlocks lower wholesale electricity and network costs for drivers

EV drivers can engage with smart charging service providers (ranging from suppliers to charging companies or energy management services) to access rewards for domestic EV charging, from time of use tariffs to taking part in network management services

Informed by wholesale electricity cost signals via a time of use tariff, smart charging households access wholesale electricity prices that are 24% lower on average than those for non-smart charging

households in 2025. Savings on wholesale electricity costs are modelled to reach up to 77% on some days over the year for these drivers. If we compare this to the wholesale element in the Q2 2024 price cap, the saving would be worth £188 over the year

Exporting electricity through V2G can save drivers up to 70% on electricity costs

Considering just the value of selling power from the vehicle back into the wholesale power market, our modelling found that households in the V2G category made £320 in gross revenue in 2030 on average and £250 in 2040. This enables up to 70% savings on their overall charging costs in 2030.

When the costs of charging EVs in the V2G category (to cover both driving and exporting activities) is included, the net cost of charging is 2.5p/kWh for wholesale electricity in 2030 and 1.8p/kWh in 2040 – less than half the cost of non-smart charging.

4 About the report

This report was prepared by Cornwall Insight and commissioned by Smart Energy GB. It assesses the value of smart and V2G electric vehicle (EV) charging within a flexible energy system in three snapshot years of 2025, 2030, and 2040. It draws on the energy system modelling conducted in our previous collaborative study, "The Power of Flex: Rewarding smarter energy usage". We have used the scenario-based projections of power market dynamics from that study and focused analysis on the charging activities of EVs from different customer archetypes, alongside the associated costs and benefits at a system and average household level.

The modelling that we undertook for the 2023 "Power of Flex" report included numerous assumptions about the future energy system. At the highest level, we assumed the continuation of current UK Government policy aims, including:

- Achieving net zero emissions by 2050
- Decarbonising electricity by 2035

This new report focuses on the Flexibility Scenario from that research, where customers take up smart technologies (including EVs) at rates informed by analysis of National Grid Electricity System Operator's (NG ESO) Future Energy Scenarios and our in-house assumptions. The energy demand associated with these smart technologies can be used flexibly to support system needs and reduce customer costs. EV uptake influences the volume of electricity consumed by households through at home charging and provides greater opportunity to realise the benefits of domestic flexibility. These benefits come through smart charging and vehicle to grid (V2G) charging, which is used as a catch-all term here to cover bi-directional charging activities. EV refers only to battery electric vehicle (BEV) cars for the purposes of this study, with hybrid vehicles not included in this definition. Detailed information about the modelling approach, assumptions and scenarios can be found in the Technical Annex that accompanied the "Power of Flex" research report.

Through the rest of this report, we will:

- Summarise the EV modelling assumptions used in Section 6
- Discuss the charging activities projected and the financial and wider benefits associated with these smart meter-enabled actions in Section 7
- Consider commercial propositions and future market direction in Section 8, with a focus on recent innovation projects and the development of the V2G space

5 Introduction

In this section, we introduce smart charging and why its needed in the electricity system.

What is smart charging?

Smart Charging

Allows scheduled charging by a consumer or a third-party (like an energy supplier, with the customer's consent) that can automatically manage EV charging sessions remotely in response to different signals (e.g. the cost of electricity within a day). This may be at times when electricity prices are cheaper, or when there is a high volume of renewable electricity produced. One-directional smart charging typically allows consumers to set their charging preferences, including their minimum charge level at all time, their preferred charge level, and the time they want the charge level to be completed by.

Vehicle to Grid (V2G)

V2G is in the early stages of development but we expect it will allow consumers to flow electricity from their vehicle back onto the electricity network, typically in exchange for lower bills or financial reward. This requires specially designed charging technology in the vehicle to allow a two-way flow of energy. Under V2G, vehicles will typically be expected to charge their batteries when the price of electricity is lower and sell back the electricity when consumption (and prices) are highest. Consumers can set their charging preferences, including minimum charge levels to be maintained and the time they want the charge level to be completed by.

Why do we need smarter charging?

EVs are a critical part of the UK's transport decarbonisation strategy, supporting the transition towards a net zero economy and removing harmful emissions produced by internal combustion engine (ICE) vehicles. Meeting the charging needs to support this transition will require investment in electricity network infrastructure, power generation, and management tools to meet the peak power

demand associated with refuelling EVs. Without smarter charging, the home charging of EVs is likely to coalesce around the existing evening period of peak power demand, which would increase the infrastructure required to support EV uptake. By making the most of the flexibility in when charging is done and in the ability of V2G to help offset network constraints, the need for these network reinforcements can be deferred and reduced, saving all electricity customers money. Through this flexibility, the demand from EVs can also be matched to times when renewable generation may otherwise go to waste (e.g. overnight for offshore wind), helping to decarbonise our power supply quicker and more efficiently.

What is the role of smart meters?

Smart meters are an enabling tool which help consumers access the benefits of moving consumption away from times of peak demand, providing near real-time information about energy usage and access to time of use tariffs. The flow of relevant data between different parties engaged across the energy system is essential to delivering opportunities, ranging from the household to its energy supplier and any party managing its demand, to local and national networks operators, and central parties like Elexon, which is responsible for the settlement process. Smart metering infrastructure is a core component in ensuring this information is available to all of the parties that need it, when they need it, in a secure and accessible manner. Without a smart meter, benefits including those from many flexibility services cannot be accessed, because traditional meters do not tell your supplier when you use energy.

6 Modelling approach and assumptions

In this section, we present the scenario building and modelling assumptions used to underpin our analysis, before focusing on the EV charging dynamics and related impacts from our "Power of Flex" future scenarios.

Scenario development

This report draws on the scenario-based modelling of the GB power market conducted as part of our 2023 The Power of Flex: Rewarding smarter energy usage" research. That modelling analysed the difference between a scenario where households participate in flexibility, and one where they do not. Our projections covered three snapshot years (2025, 2030 and 2040) to understand how the benefits change over time.

Our analysis in this paper specifically considers the Flexibility Scenario to take a closer look at the value achieved from the smart and V2G charging of EVs and to compare this against a non-smart charging counterfactual. In developing the Flexibility Scenario, we utilised a range of consumer segments that reflect plausible developments in different areas, including households' uptake of low carbon technologies (including EVs), deployment of smart meters, and engagement with propositions like time of use tariffs. The segments, whose relative size grows and shrinks across the three snapshot years, cover:

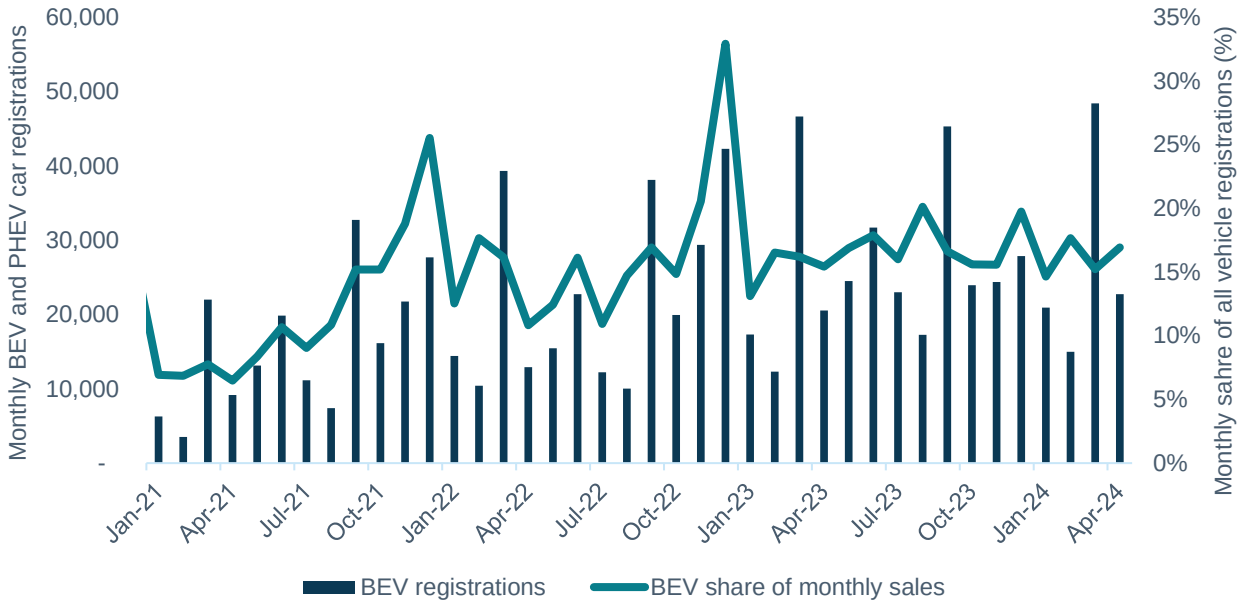
- **Segment 1 – "Active & asset equipped":** Households in this segment have the ability to undertake demand side response (DSR) through their smart meter-enabled time of use (ToU) tariffs and have a high take up of EVs with smart controls which operate them. Flexible capacity from these vehicles is used as part of the overall demand side response potential for these households
- **Segment 2 – "Smart customer response":** Households in this segment have smart meters and ToU tariffs, but no significant uptake of EVs ahead of the baseline level of adoption in line with policy requirements
- **Segment 3 – "Static state":** Households may have smart meters installed but consumers choose not to move their consumption in response to price signals through ToU tariffs, for a variety of reasons

EV uptake today and under our scenarios

The move from ICE vehicles to EVs is an essential component of the UK government's efforts to meet the legally binding target of net zero emissions by 2050, as surface transport (including road vehicles and rail) remains the UK's highest-emitting sector, contributing 23% of total GB emissions in 2022. Decarbonising the sector will require a major overhaul, with the Climate Change Committee (CCC) projecting that to reach net zero by 2050, EV uptake will need to accelerate to 23.2 million passenger vehicles and vans by 2032.

There is an increasing appetite for EVs in GB, with over 1 million fully electric cars on GB's roads. As shown in Figure 1, battery electric vehicle (BEV) car registrations made up 17% of all new car registrations in April 2024 as more than 100,000 new BEVs were registered over 2024 so far. This is up by 11% compared to the same period in 2023 and represents a circa. 14-fold increase against 2019.

Figure 1: Historic monthly BEV registrations and share



Source: SMMT data

Our projection of EV uptake in our modelling was informed by NG ESO's Future Energy Scenarios (FES) 2022 (see Figure 2). We have assumed that uptake of EVs occurs across all consumer segments, in line with background market adoption rates and policy requirements to phase out ICE vehicles.

Figure 2: Percentage and number of households assumed to have an EV under the Power of Flex system modelling, by snapshot year

	Percentage of all households	Number of EVs
2025	7%	2,050,000
2030	39%	11,650,000
2040	96%	30,400,000

Source: Cornwall Insight

Approach to EV charging and flexibility

Being able to charge EVs at home is a significant part of the driver experience in the market today, with a 2023 Zap-Map survey revealing that 80% of EV owners surveyed had charger access installed on a private driveway. Smart charging plays an important role in the ease and affordability of home charging for drivers. Typically, the signal informing smart charging comes from a time of use tariff from a household's electricity supplier, which uses smart metering infrastructure to provide lower-cost electricity at times of day when the cost to generation and transport the power are also lower.

For drivers charging at home, engaging with smart charging through these types of structures can allow them to take greater control of their EV-related energy bills, allowing them to access more affordable charging rates. Looking across the EV-focused tariffs available to households, the off-peak rates can be up to six-times lower than the respective peak-time costs. This provides a strong signal to homes with a smart meter to capture savings on their EV charging by having this align with lower-cost times (or even be paid to charge, depending on the type of tariff and market situation).

Alongside these benefits for the EV owner, smart charging also assists in managing demand on the grid as users shift their charging activities and reduce the level of peak-time electricity requirement. There are several different network management tools that are using smart and V2G EV charging to help manage system conditions.

Our projections of flexibility from EVs include different approaches to home-charging of EVs, covering:

- Non-smart charging
- Smart charging
- V2G charging

For this report, we consider each of these, with particular interest in the V2G group. We assume that only Active and Asset Equipped households participate in V2G charging and that Smart Customer Response and Static State households see rising levels of smart charging over time (with charging signals focused on wholesale electricity costs).

The increasing prevalence of smart charging reflects the overall increase in uptake of EVs at a national level, the expected need for network management as electricity demand for charging needs increases, and the impacts of mandatory smart charging capability regulations on projected charging behaviours. Ultimately, access to charging equipment and charging times will need to be convenient for consumers to support savings delivered by flexibility. Over time, charging patterns may also alter in response to changes in access and use of public transport, working patterns and technological capabilities.

What network management services are EVs participating in?

Balancing Mechanism

The Balancing Mechanism (BM) is NG ESO's primary tool for balancing the grid and is used to manage unforeseen imbalances in electricity supply and demand. Participants provide information to the system operator on the costs of delivering an increase or decrease in their expected generation or consumption, which is used to organise and deliver system management actions.

Large electricity generators are required to take part, but there is ongoing work to reduce the barriers to smaller, aggregated assets like EVs taking part in the BM and facilitate them being rewarded for the services that they can provide. Several flexibility service providers have taken EV charging capacity into the BM recently, such as PodPoint and British Gas, ev.energy and Flexitricity, and Octopus Energy.

Distribution System Operator services

The Open Networks project saw the development and roll out of a standardised set of Distribution System Operator (DSO) services across all regions – although discrepancies do still occur between the DSO services. These fulfil a range of functions for local lower-voltage network operators, from managing an ongoing requirement to reduce peak demand to supporting the network during fault conditions.

We are seeing EV smart charging service providers engaging with the value opportunities that these services offer, with increasing opportunities being targeted at smaller, flexible users. However, these services are highly locational and minimum flexible capacity requirements vary between DSO. Providers are typically distributed assets which can provide generation turn up, DSR portfolios, which can provide demand turn down or storage assets which can provide both.

Demand Flexibility Service

Developed by NG ESO in 2023, the Demand Flexibility Service (DFS) incentivises households with a smart meter to vary the time of their electricity use during winter to help manage system constraints. By choosing to delay demand, including EV charging, in response to requirements from the DFS, households can access rewards via their supplier or other third party. The DFS is an evolving service and these rewards (as well as how they're earned) may look different in the future.

7 Opportunities for EVs under the "Power of Flex" scenarios

Through our analysis, we have identified three primary types of benefit for consumers as a whole and EV users from smart and V2G charging:

1. Flexible electricity use from EVs supports more renewable generation, lower electricity costs, and less carbon consumption for everyone
2. Smart charging unlocks lower network costs and 24% savings on wholesale electricity costs for drivers
3. Exporting electricity through V2G can save drivers up to 70% on electricity

Flexible electricity use from EVs supports more renewable generation, lower electricity costs, and less carbon consumption for everyone

As we move through the snapshot years, we project that the cost of electricity on the wholesale market will fall, as will the carbon intensity of this power (see Figures 3 and 4 below). This is primarily driven by the increasing deployment of renewable sources of electricity across these years, especially large-scale offshore wind farms. At a system level, deploying these renewable assets is also supported by patterns of electricity use, from EVs to heat pumps and smart appliances to static batteries, which can help capture more of the electricity generated by these intermittent sources.

Under our Flexibility Scenario:

- The overall cost of wholesale electricity falls in real terms from £110/MWh on average in 2025 to £40/MWh in 2040
    - This is driven by both rising levels of renewable generation and the flexible use of electricity across the market
- The distribution of those costs during the day also changes, as lower reliance on higher marginal cost fossil-fuelled plants reduces the influence of evening peak periods on costs in 2040 compared to 2025
- Similarly, the carbon intensity of power is impacted by the generating technologies, with the changing shape of carbon intensity between an average summer and winter day in Figure 4 below being influenced by the amount of electricity being generated by solar and wind farms respectively

Figure 3: Average wholesale electricity price in 2025, 2030 and 2040

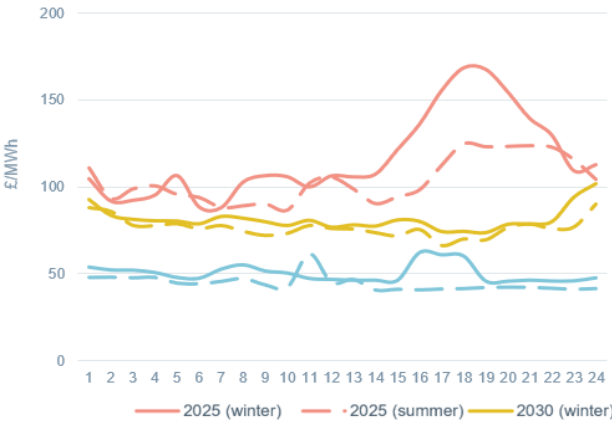
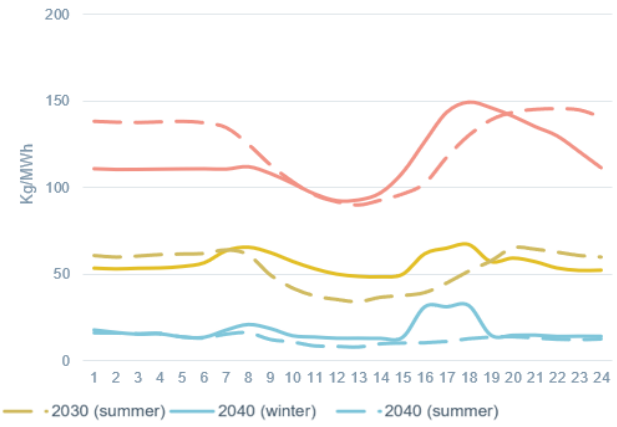


Figure 4: Carbon intensity by season in 2025, 2030 and 2040



Source: Cornwall Insight

For EVs, these trends influence the overall electricity price paid to charge all EVs, the scheduling decisions for those using smart charging services, and the export activities for customers engaged in V2G charging. Looking across our Flexibility Scenario:

If all of the EVs in our system modelling used smart charging to avoid peak times, around 7GW of peak-time electricity demand from EVs could be avoided in 2030.

This is more than the capacity of Drax Power Station, the largest single power station in GB that powers more than 4 million homes.

By avoiding this power demand at peak times and instead meeting it when renewable generation is higher and spare capacity on the electricity network is greater, the total cost of the system is reduced, reducing costs for all electricity consumers.

Smart charging unlocks lower wholesale electricity and network costs for drivers

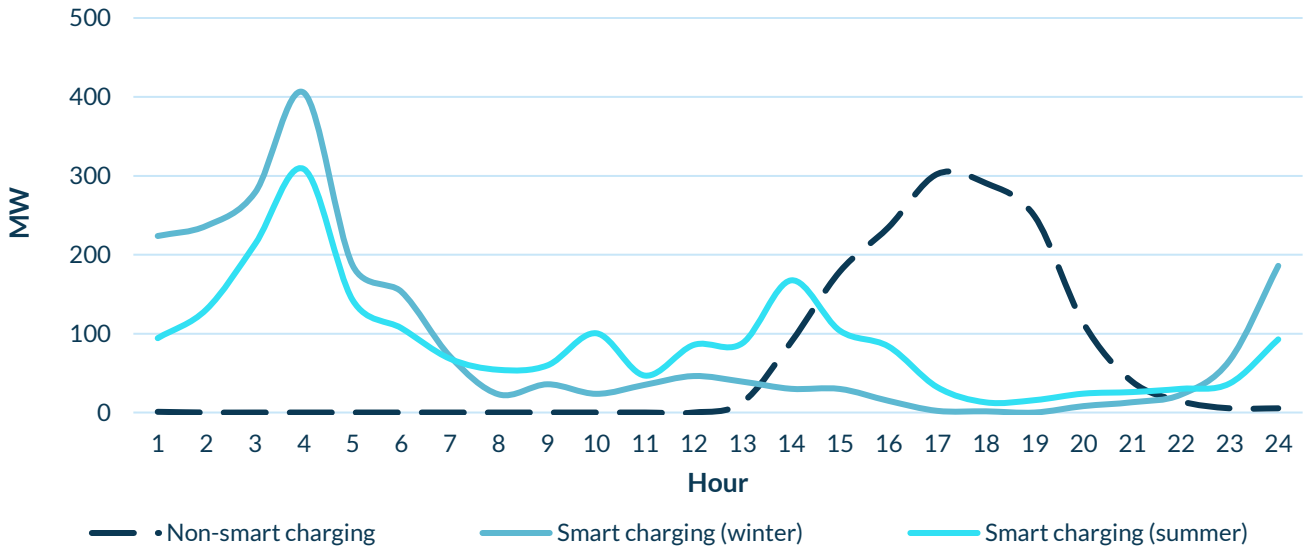
Informed by wholesale electricity cost signals via a time of use tariff, we see:

- Smart charging households access wholesale electricity prices that are 24% lower on average than those for non-smart charging households in 2025
- In our model, savings on wholesale electricity costs reached up to 77% on some days over the year for these drivers

This is achieved through access to an hourly wholesale price that can change within each day

Households engaged in smart charging see their peak demand occurring in the early hours of the morning (shown in Figure 5 below). This typically aligns to lower wholesale power prices and, especially in the winter, higher periods of electricity generation from wind farms.

Figure 5: Averaged Smart and non-smart charging patterns, 2025



Source: Cornwall Insight

Figure 5 also shows seasonal variations in average charging demand, with greater consumption through the middle of the day in summer when solar output is higher and prices relatively lower. In comparison, our averaged non-smart charging profile is shown for reference, with charging loads at these households associated with projected overall vehicle plug in times.

Wholesale electricity prices are not the only time-based signal that smart EV charging services can use to deliver value for drivers. Within a household's electricity tariff, network charges and policy cost recovery approaches (particularly the Capacity Market) could also contribute to the time of use rates that make up the tariff:

- Network charges can provide signals to reduce consumption during peak periods, which are particularly powerful for loads which can easily be moved to other times of day such as smart EV charging.
    - The time-based costs for domestic customers using the distribution network can be around 50-70-times higher in peak time periods (normally 16:00-19:00 on weekdays, although

these vary by region) than in off-peak times.

- These peak time costs exceeding 20p/kWh in some areas.

Although our modelling focused on wholesale electricity price signals, network charges also influence the costs paid by customers and these signals can influence charging times for customers with smart meters that choose to use time of use tariffs to save on their EV charging costs.

The opportunities for smart charging service providers to share the rewards for the flexibility unlocked from domestic EV charging extend beyond time of use tariffs. Taking part in network services can also offer signals to one-directional smart charging, either to 'turn-up' charging actions when there is excess generation on the system or, more typically today, to reduce electricity demand until a later time during periods of peak electricity consumption.

Although many of these services have traditionally focused on participation from larger-scale assets like fuelled power plants, new network services like the DFS are being introduced, and the requirements for existing services like the BM altered where appropriate, to enable participation from smaller-scale, aggregated assets like EVs. These services can provide valuable opportunities to reward smart meter-enabled household flexibility, especially for integrated smart charging service providers that use automated controls to deliver value to their customers.

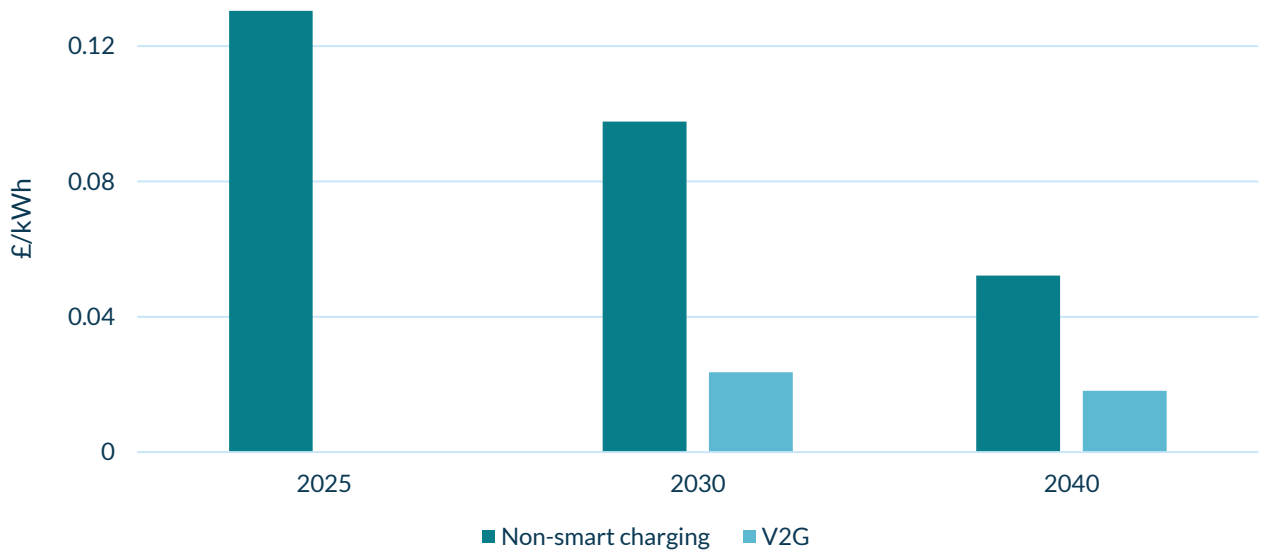
Exporting electricity through V2G can save drivers up to 70% on electricity costs

As hardware markets mature and cost and availability barriers lower, V2G charging is expected to become an increasingly common part of the domestic charging landscape. Charging within this category allows multiple charging and discharging cycles through the day in response to wholesale price signals, with households exporting electricity from the EV where financially beneficial and viable within the overall charging requirements for the vehicle. In the "Power of Flex" scenarios, we projected more than 4 million EVs taking part in V2G actions when we reach 2040. However, as the technology is still at a relatively early stage, we do not include any V2G charging within our customer segments in 2025, with very limited numbers of V2G-capable charger or vehicle available today.

Considering just the value of selling power from the vehicle back into the wholesale power market, households in the V2G category made £320 in gross revenue in 2030 on average and £250 in 2040 (noting that the overall power prices are lower in 2040). This represents up to 70% savings on their overall charging costs in 2030 compared to non-smart charging households, as illustrated in Figure 6.

Participation in specific network services was not considered in the system-level modelling that we conducted in this study. However, just as these can offer value to one-directional smart charging, network support schemes like the Balancing Mechanism and DSO services will offer value to customers V2G charging as the technology matures.

Figure 6: Average annual net EV wholesale electricity cost for non-smart and V2G categories, per household[1]



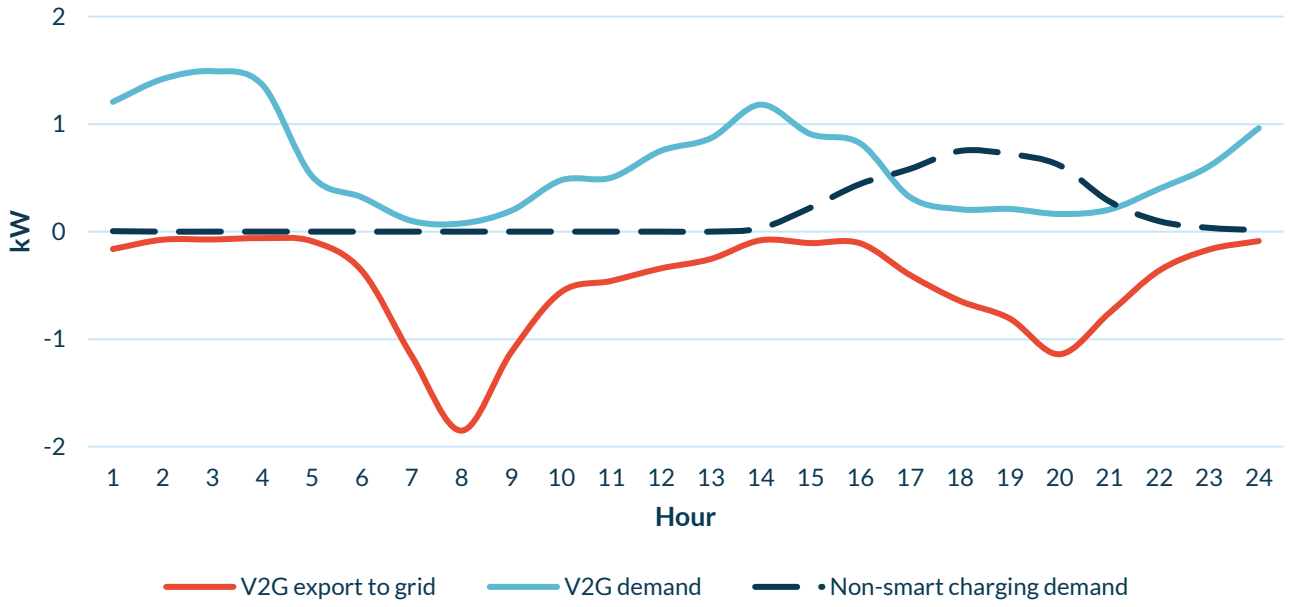
Source: Cornwall Insight

This low net cost of charging is achieved by exporting excess power stored in the vehicle's battery during periods of relatively high power costs, typically focused around evening and morning peaks. This is shown in Figure 7, where the negative values show average levels of export from V2G charging, with the positive values representing the vehicle charging up. Although in our modelling power sold from the vehicle is exported onto the wider grid, it could also be used to meet electricity demand at drivers' homes instead, for example by powering the house during the evening peak and saving on grid imports. The total daily electricity demand for the average V2G household is more than double the smart and non-smart charging households (to facilitate export actions to earn revenues) but the overall cost is lower due to the benefits derived from choosing when to take demand and when to export.

Looking forward to 2040 where V2G represents a much more established technology in the modelling, we project continued savings on net charging rates for V2G households. The net wholesale electricity charging cost fell slightly to 1.8p/kWh, influenced by lower wholesale prices and with network services as additional upside.

[1] Due to the relatively early stage nature of V2G, we do not include any households within the V2G category in our modelling for the 2025 snapshot year

Figure 7: 2030 Average daily EV charging activity for V2G and non-smart charging, on a per household basis



Source: Cornwall Insight

8 Future market developments and innovations

In this section we look at the current offers and upcoming opportunities for smart and V2G charging that can offer value for the energy system and drivers charging at home and beyond.

Market innovations are engaging with market barriers

From hardware costs to vehicle availability, there are various barriers to the widespread deployment of smart and V2G capabilities. However, the market is evolving and there are a range of innovative projects and propositions that are engaging with these challenges, exploring the value from smart and V2G EV charging, and establishing the services and routes to market that could deliver for customers, including:

Improving smart charging options for households without off-street parking (e.g. flats, rental properties)

- As EV ownership becomes more commonplace, whether for personal use or as part of commercial fleets, the proportion of households without the ability to charge their vehicle using an off-street charger will grow. Increasing options for these drivers will be important to maintain EV uptake momentum and support access and confidence for households
- The Agile Streets project used smart metering to enable time of use charging at on-street, kerbside chargepoints. Participating drivers could choose between two smart charging options - low-peak or immediate power delivery. The study illustrated the potential for public smart charging to save drivers ~£600 per year in charging costs compared to 'non-smart' public charging

Improving the financial incentive for smart charging to ensure EV drivers benefit

- As we have described in this report, smart and V2G charging could deliver significant benefits to households, the system, and the environment, and ensuring the rewards for these services are passed back to EV users, across multiple different use cases, is key
- Optimise Prime was the largest fleet-focused EV trial to date and sought to understand the electrification of commercial vehicles, how to minimise the impact on electricity networks, and the potential flexibility opportunities for EV fleets, including for those charging at home through Centrica's fleet of commercial EVs. The project found that, overall, customers could save c.£196 million in network costs, as well as 3.8 million tCO_2e in carbon emissions by 2040, equivalent to that absorbed by ~80 million trees
- The project's home charging trial focused on the charging behaviour and flexibility potential of commercial EV fleets where the driver charges their vehicles at home. These smart charging trials estimated revenues of up to £215/year in cases where the vehicle is in an "area where flexibility is regularly needed and charges at the required time"
- Away from commercial charging, Octopus Energy launched Octopus PowerPack in February 2024 which it states represents the UK's first household V2G tariff (and follows on from National Grid's Powerloop trial). Customers with V2G-compatible EVs can allow the supplier to schedule the import and export from their EV in exchange for free charging

Managing the cyber security and grid stability risks of digital, connected, smart energy assets like EV chargepoints

- The Department for Energy Security and Net Zero (DESNZ) is currently engaged in its latest consultation on implementing its Smart Secure Electricity Systems (SSES) programme, which covers the interoperability, cybersecurity, and grid stability of energy smart appliances, including EV chargepoints, as well as wider regulatory requirements and time of use data considerations
- Customers with smart meters have a greater visibility, and therefore control, of their energy consumption. With these requirements in place alongside an installed smart meter, a domestic EV user is able to take advantage of time-of-use tariffs which require the half-hourly settlement which underpins smart charging. Furthermore, customers will have the necessary tools and protections in place to participate in V2G activities

Developing V2G charging technologies, which are currently at a nascent stage

- Numerous innovation projects are focussed on supporting the commercialisation of V2G charging capabilities, including the recent £4.8 million funding to support four new V2G-focused programmes. These include increasing the number of vehicles that can use technology, exploring fleet focused V2G applications, and examining public charging depot deployment via linking with solar and storage
- These build on many previous projects, such as Powerloop, above, or the Electric Nation – PoweredUp study, which highlighted the cost and availability barriers to V2G but noted the potential for continuing improvements in both to see these challenges addressed

Based on the modelling and analysis we have conducted, there is a significant prize available from widespread engagement with smart and V2G charging throughout the uptake of EVs and transition to a net zero electricity system. All of these schemes, trials and targets will need to continue and be further built upon to ensure that consumers benefit from the opportunities presented from the EV rollout

9 Glossary

Term	Meaning
Aggregator	Intermediary party that combines energy customers together as a group to secure better prices, service, or other benefits in the wholesale or balancing services markets
Balancing Mechanism (BM)	A mechanism that enables the Electricity System Operator (ESO) to instruct generators and suppliers to vary electricity production or consumption close to, or in real-time, in order to maintain safe operation of the system
Balancing services	Procured by National Grid ESO, and providing electricity to and from the network in response to changing system-level frequency, reserve, restoration and margin requirements
Battery Electric Vehicle (BEV)	Battery Electric Vehicles rely only on electricity for propulsion
Capacity Market (CM)	Government scheme to ensure security of supply through competitively let agreement where capacity providers receive a regular revenue in exchange for being available at times of system stress.
Charge point operator (CPO)	Commercial party providing charge point access and management
Constraint	A point on an electricity network where there is insufficient capacity to allow energy to flow as desired at all times
Demand Side Response (DSR)	Allows businesses and consumers to turn up, turn down, or shift demand etc. in response to signals from the wider system.
DESNZ	Department for Energy Security and Net Zero. Formed in February 2023, with responsibility for delivering security of energy supply, ensuring properly functioning energy markets, encouraging greater energy efficiency and seizing the opportunities of net zero to lead the world in new green industries
Distribution Network Operator (DNO)	Companies licensed to distribute electricity in GB by Ofgem. There are fourteen licensed areas, based on the former area electricity board boundaries, where the DNO distributes electricity from the transmission grid to homes and businesses.
Distribution System Operation (DSO)	Concept of active management of electricity distribution networks, which currently only respond to activity on transmission network. New

	DSO services are a potential revenue stream.
Electric vehicle (EV)	Any plug-in vehicle, including battery only and plug-in hybrids (PHEV)
Energy Management	The monitoring and analysis of energy consumption. This can involve comparing usage, reducing wastage or optimising energy efficiency
Half-hourly settlement (HHS)	A method by which electricity usage is read every half hour. Meters read electricity usage every half hour, this information is sent to suppliers to settle a more reliable price of energy used by a business or homeowner.
Net Zero	Typically used as shorthand for the UK's legally binding target for net zero carbon emissions across the economy by 2050.
Non-smart charging	EV charging behaviour that is not exposed to or informed by wholesale power price or network operator command signals
Peak Demand	A point in time (usually annually) where demand for energy is at its highest. It is often used to derive network charges and understand the need for system wide electricity generation capacity and network requirements.
Smart charging	Coordinated EV charging by a consumer or third-party (like an energy supplier, with the customer's consent) allowing them to manage EV charging sessions remotely in response to different signals (e.g. the cost of electricity within a day). This may be at times when electricity prices are cheaper, or when there is a more renewable electricity produced
Smart Meter	Gas and electricity meters that can be read remotely and allow consumer more accurate and timely consumption information.
Time of Use (ToU) tariffs	A variable tariff based on the use of electricity at different times of the day, which can be charged by an energy company.
Vehicle to Grid (V2G)	Allows consumers to flow electricity from their vehicle back onto the electricity network, typically in exchange for lower bills or financial reward. This requires specially designed charging technology in the vehicle to allow a two-way flow of energy
Vehicle to Home (V2H)	The process whereby electricity that has been stored within the battery of an EV can be used towards meeting the demand of the owner's domestic properties
Vehicle to X (V2X)	Bi-directional charging whereby end-users can realise benefits from discharging the EV battery at certain times to provide power to the home or deliver system services

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