energy
saving
trust

Electric vehicle smart charging: consumer research

Message development to promote consumers understanding and awareness of smart charging.

Completed by Energy Saving Trust for the Department for Energy Security and Net Zero prior to the recent general election in the United Kingdom in July 2024. As such, any references to government policies, commitments, or initiatives may reflect the stance of the previous administration and were accurate at the time of fieldwork and writing.

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Contents

Glossary

Term/Acronym	Definition/Explanation
EV	Electric Vehicle
Smart Charging	Optimizing the charging process of electric vehicles (EVs) by aligning it with periods of low electricity demand or high renewable energy supply, automatically adjust charging times and rates based on real-time grid conditions, electricity prices, and user preferences.
DESNZ	Department for Energy Security and Net Zero
REA	Rapid Evidence Assessment
ABC1	Social Grade Category (Higher and intermediate managerial, administrative, professional occupations)
C2DE	Social Grade Category (Manual occupations, lowest grade workers, pensioners, and others who depend on the welfare state for their income)
ICE	Internal Combustion Engine
PHEV	Plug-in Hybrid Electric Vehicle
Time Of Use tariffs (TOU)	Tariffs where the cost of electricity is cheaper at certain times of day
Dynamic Tariffs	Tariffs where the cost of electricity varies based on grid demand and supply conditions.
Type-of-Use Tariffs	Tariffs that offer cheaper rates for specific uses, such as charging an EV, regardless of the time.
ESG	Environmental, Social, and Governance
Demand Side Response (DSR)	Adjusting energy consumption based on supply conditions to help balance the grid.
Aggregators	Companies that group the electricity of multiple customers to act as a collective resource that can interact with the electricity grid.
Grid	The network that delivers electricity from producers to consumers.

Economy 7	A type of TOU tariff offering cheaper rates for electricity used during night-time hours.
Smart Meter	A device that records electricity consumption in intervals and communicates the information to the energy supplier for monitoring and billing.

Executive Summary

Introduction

The Department for Energy Security and Net Zero (DESNZ) formally commissioned Energy Saving Trust to undertake research on electric vehicle (EV) smart charging. The research began in February 2024 and was completed in May 2024.

Smart charging refers to charging EVs when electricity demand on the national grid is low, or when there is excess supply, in order to optimise energy consumption and reduce the energy system investment needed for EV uptake. As part of ensuring that the energy system can meet future electricity demand, the EV Smart Charging Action Plan[1] was developed by government. In order to support the aims of the action plan, DESNZ commissioned research to explore different consumer groups' understanding of smart charging concepts, to explore their attitudes towards smart charging and to develop and test messages to help build consumer awareness and encourage uptake of smart charging.

Method

The objective for the first phase of research was to gain a baseline understanding of UK consumer knowledge of smart charging at different stages of the consumer journey. To do this, we conducted a rapid evidence assessment (REA) of the current evidence base on consumer needs around smart charging, followed by 30 qualitative interviews with current and prospective EV drivers who charged at home or work and fleet managers who had either switched some of their vehicles to EVs or were planning to.

The objective of the second phase of the research was to develop a set of guiding principles for message development to promote and spread awareness of smart charging. To do this, we conducted 6 co-design focus groups with the same consumer groups as above, gathering feedback on messages and iterating them within and between the focus groups.

Key findings

Rapid Evidence Assessment

Awareness and understanding of smart charging were found to be fairly low amongst consumers, employees and fleet managers. Domestic consumers are likely to smart charge, however, they may not necessarily associate their experiences with the phrase "smart" charging specifically. Research suggests between 70% and 90% of domestic consumers smart charge to some extent (primarily overnight).

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[1]Electric vehicle smart charging action plan - GOV.UK (www.gov.uk)

Smart charging was not found to be widely done in the workplace, with only around 12% of EV users who charge at work are able to schedule their own charging. A barrier cited in previous research is that energy prices are typically higher during the day while office workers are charging at work.

Research has shown that fleet managers tend to be focusing on adopting EVs in the first instance, and not yet focusing on optimising charging. As such, smart charging is low. Furthermore, fleet managers struggled to see how smart charging might work for, and benefit, their business.

In terms of message provision, previous research has found that energy suppliers, online EV forums, and friends and family are preferred channels for general energy advice.

Phase 1: Consumer understanding, needs and behaviours

Understanding of and attitudes towards smart charging

Understanding of smart charging terminology was mixed. Current domestic EV owners had the best understanding of the phrase, though participants across all consumer groups had misconceptions around the phrase, thinking it might mean fast or wireless charging. However, when explained, participants understood and were familiar with the concept. There were some initial misconceptions, such as not realising it was done automatically via an app and thinking that the user might have to know when to plug in at the right time. Discussion of different types of tariffs helped to clarify the idea of charging while demand was low, or when supply was in excess.

Time of use tariffs were widely understood among participants. Benefits were seen as cheap prices, certainty of price and charging window, and the ability to use other electrical appliances during this window. A disadvantage mentioned by participants was that on some tariffs, the cheap window was not long enough to do a complete charge for some EVs.

Dynamic tariffs were less well known by research participants. Benefits were seen as balancing the grid, and getting access to cheap prices, though some had concerns about needing their car before the set time and not having enough charge. Participants tended not to mind the idea of the supplier having control of the charging, as long as they were confident that they would have enough charge when they needed it.

Type of use tariffs were easy to understand. Benefits were seen as cheap prices and ease of understanding as it was similar to having a set price for petrol/diesel. However, the more energy-savvy noted that it may not be as beneficial to the grid if people charged whenever they liked, as this might add to demand at peak times.

Overall, attitudes towards smart charging were positive; with participants identifying that cost savings and environmental benefits were worthwhile. A minority were more sceptical of smart technology, including smart meters, which extended to negative opinions of smart charging.

Consumer needs

For **domestic participants** (those who charged at home and those who charged at work) key needs were information provision (i.e. understanding how it works), price, reliability (knowing they would have enough charge for when they need it), and convenience (not adding extra "burden" to their charging routine). These needs were especially strong for prospective drivers, who were not used to charging an EV at all, and they needed more assurance that they would not be left without adequate range.

Participants who **charged at work** were less involved in their charging decisions, typically opting to charge at work because it was cheaper (often free). They were happy with whatever their workplace provided and hadn't spent too long looking into the chargepoints or different ways of charging. For them, cost was most important, as well as reliability – they wanted to know they would have enough charge to get home at the end of the day.

For **fleet managers**, key needs were efficiency (ensuring time was not wasted in the charging process) and reliability (knowing the vehicles would have enough charge to complete a shift). They stated that cost was important, though many were not utilising smart charging, despite potential cost savings. This was due to lack of understanding of how smart charging would work for their fleet, logistical difficulties, and concerns that cost savings would not be significant enough to warrant the perceived additional effort.

Current behaviour, levers and barriers

Smart charging was widely used by domestic participants who charged at home; with charging overnight on time-of-use tariffs the most common. Prospective owners were also planning to smart charge; as cost saving was a key motivation for buying an EV and they wanted to maximise this. Participants also noted that environmental benefits and convenience were levers to smart charging. The main barrier was habit; participants sometimes forgot to plug the vehicle in, leading to use of the override function or public charging facilities.

Smart charging in the workplace was not widely used, due to lack of chargepoint functionality (research suggests only around 12% of those who charge at work are able to schedule their own charging [2]), timing of shifts and logistics of number of cars to chargepoints.

A number of fleet managers perceived that smart charging would not work with their schedules; stating that vehicles were not "static" for long enough to charge slowly; or that they were only at depots during peak grid hours. Fleets where the vehicles went home with the drivers might have had the potential to smart charge, but fleet managers were reticent to interfere or dictate what tariffs the drivers should be on and noted that many drivers did not have off-street parking. Fleet managers were motivated by cost, so there is potential to leverage this benefit, along with the benefit of smart charging to the environment and thus meeting ESG (environmental, social, and governance) targets or net zero policy goals.

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[2] Electric Vehicle Smart Chargepoint Survey 2022 (publishing.service.gov.uk)

Phase 2: Message development

Six focus groups were conducted to test messages developed after Phase 1. Annex A provides a framework of 'dos' and 'dont's' for effective messaging for each consumer group. In summary, messages explaining 'how it works' were essential for understanding, which allowed participants to engage better with the subsequent messages. Messages explaining different tariff options helped aid understanding, and participants found this to be a key area where they would want more information on which tariff might suit them best. Messages around cost savings were motivational, and relative savings compared to non-smart charging were more effective than giving absolute figures. Participants were somewhat sceptical of absolute figures where they could not see the "working" behind them. Messages highlighting environmental benefits were motivating, especially if combined with cost-saving messages (i.e. a 'win-win'). Messages highlighting the ease and reliability of smart charging, including having enough charge for emergencies, were key for reassuring participants that their needs would be met. Messages that were too long, and messages with fluffy or "cheesy" language were not as well received. Participants found having a large block of text intimidating and found messages that were broken up by bullet points easier to digest.

Conclusions and recommendations

Smart charging as a concept was generally well supported by participants across all groups, although more difficult to action in workplace and fleet settings. The main misconceptions around smart charging stemmed from lack of understanding of the principles and technology, leading participants to worry about the effort involved and the reliability of smart charging. As such, messages highlighting the ease and convenience were well received. Previous research[3] has shown that the greater the understanding of smart charging, the greater the appeal, which was also demonstrated during our message testing focus groups. Showing participants the messages explaining 'how it works' and explaining the tariffs helped increase their understanding and made them more receptive to the idea and the wider benefits. As such, Energy Saving Trust recommends that messages explaining the concept of smart charging, including the tariff options available, should be presented first; before (or alongside) the benefits of smart charging.

Participants suggested that they would expect to see messages on smart charging provided by their energy supplier (as tariffs were seen as an integral part of the smart charging process). This is where many current owners had looked for information on tariffs when they had first got their EV. Other trusted messengers would include government, independent advice organisations and comparison websites, as well as trusted friends and family and trusted online forums.

There could be a large potential to maximise smart charging amongst fleets, where fleet managers might not have considered how smart charging could work for their fleet. As fleets operate so differently, we recommend providing a range of advice and options for different

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[3] https://delta.lcp.com/podcasts/smart-ev-charging/

types of fleets. Highlighting the cost benefits and reassuring fleet managers that smart charging is easy and reliable will be key across the board to encourage uptake. Case studies showing how smart charging could work for their specific fleet type would be useful to increase understanding of the different types of smart charging and could empower fleet managers to explore the options.

More information on tariffs, for both fleets and domestic groups, would also help increase understanding. An interactive tool or flow chart showing drivers which tariff might work best for their energy usage patterns would be welcomed.

Introduction and background

This report sets out the findings for consumer research on electric vehicle smart charging. This research was commissioned by the Department for Energy Security and Net Zero (DESNZ). It was conducted by Energy Saving Trust. The project began in February 2024 and was completed in May 2024.

The concept of smart charging has evolved significantly over the past decade. For a significant number of EV drivers, EV charging is still an individual demand led process of plugging in and charging at any time, regardless of electricity demand.

However, as the number of EVs increases, it's become clear that uncoordinated charging could strain the electricity grid, especially during times of peak demand. There are now a growing number of time-of-use tariffs, which incentivise EV owners to charge during off-peak hours to alleviate grid pressure and take advantage of lower electricity rates.

With advancements in technology and the proliferation of smart meters, the concept of dynamic smart charging has emerged. This type of charging allows for real-time adjustments to charging patterns based on grid conditions, renewable energy availability, and electricity prices. Aggregators and demand side response (DSR) programmes have also become part of the smart charging ecosystem, enabling third-party companies to manage charging schedules for multiple users, further optimising grid stability and efficiency. From an end user perspective, smart charging also offers EV drivers a more cost-effective way to charge their vehicles, by taking advantage of dynamic charging schedules and charging when energy demand is low and/or availability is high.

The government's EV Smart Charging Action Plan[4] aims to improve smart charging information provision, raise awareness of smart tariffs, enhance the provision of smart charging advice, and build understanding of consumer behaviour around smart charging.

In order to support the Action Plan, DESNZ commissioned research to explore different consumer groups' understanding of smart charging concepts, their attitudes towards smart charging, and how they currently charge, and to develop and test messages to help build consumer awareness and encourage uptake of smart charging.

The objectives for the first phase of the research were:

- Baselining understanding of smart charging concepts, phrases, and definitions. This includes the benefits of smart charging, default smart charging settings, the implications of overriding default settings, smart static and dynamic tariffs and demand side response.

- Understand how current EV drivers interact with their charge points, controls, and tariffs.

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[4] Electric vehicle smart charging action plan - GOV.UK (www.gov.uk)

- Consumer myths, where consumers are misinformed, or have been receiving conflicting or inconsistent information.

Specific research questions to inform the interviews included the following:

- To what extent do EV drivers and fleet managers (and prospective drivers and fleet managers), understand smart charging?

- How do EV drivers interact with their chargepoints, controls and tariffs?

- What are individual's perceptions and understanding of different types of tariffs?

- What are the barriers and levers for smart charging, in terms of Individual, Social and Material factors? Does this differ at different stages of the customer journey? Does this differ between consumer groups?

- What are the prevailing attitudes and perceptions towards smart charging amongst EV drivers, fleet managers, and prospective drivers and managers? Does this differ between groups?

- What misinformation or myths have consumers heard about smart charging? How do consumers decide which information to trust?

The objective of the second phase of the research was to develop messages based on the findings from the first phase, to promote and encourage smart charging. In particular, the message development considered the following objectives:

- How best to promote EV smart charging, including the cost savings which can be made through EV smart charging and encouraging customers not to override the smart settings.

- Encouraging uptake of smart EV static and dynamic tariffs

- Dispelling myths.

- Highlighting the role smart meters play in enabling time-of-use tariffs, including that smart meters enable accurate half hourly cost and consumption information, which improves consumer engagement with their energy use.

Methodology

To answer the objectives of the research, we conducted a rapid evidence assessment (REA) (found in Annex B), followed by 30 in-depth interviews, to explore the objectives around baselining consumers' understanding, and 6 focus groups to develop the messages.

We chose in-depth interviews as these allow thorough exploration of individuals' attitudes, perceptions and behaviours, and provide a nuanced and detailed view of a range of consumer experiences. For the first phase of research, we used 1 on 1 interviews to allow participants to speak openly about their experiences, including any areas of confusion or lack of knowledge.

In developing the messages we used a focus group with co-design principles, allowing participants to discuss the pros and cons of the proposed messages, and to allow creative discussions on improving the messages.

As with all qualitative research, the focus is on depth of understanding of participants' experiences, rather than generalisability of findings, and so conclusions cannot be drawn on how representative the findings are of the UK population. However, taking into account the findings from the rapid evidence assessment, we have been able to draw some conclusions as to whether the findings from our research are aligned with the wider evidence base.

Rapid Evidence Assessment

To inform the development of the topic guide for Phase 1, we conducted an REA to firstly build our understanding of the current smart charging landscape (including definitions of smart charging, existing messages, and variety of tariffs available). We then reviewed existing evidence on consumer needs and experiences around smart charging, starting by reviewing and summarising existing evidence from known sources, such as previous Energy Saving Trust research, and sources provided by DESNZ. From here, we explored research that had been referenced in, and by, these studies, as well as conducting searches on search engines and Google Scholar. We incorporated research papers as well as grey literature. The findings from the REA informed the development of the Phase 1 topic guide, showing where more evidence was needed and guiding the formation of prompts and probes on topic areas. The REA is summarised below (and found in full in Annex B)

Phase 1: Interviews

Sample and recruitment

We spoke to 30 individuals across 6 categories, as shown in Table 1. Full breakdowns are shown in Annex D. Participants were recruited by convenience sample, through a research panel, by a sub-contracted recruitment specialist.

Table 1

		Stage of consumer journey	
		Looking to purchase an EV in next 6 month	Owns or uses an EV
Type of consumer	Private domestic consumer with off-street parking	5	5
	Employees with potential to charge at the workplace	5	5
	Workplace fleet owners/managers	5	5

Topic Guide

The Topic Guides can be found in Annex E and covered understanding and perceptions of smart charging and associated concepts and terminology, understanding and perceptions of different types of tariffs, smart charging behaviours, perceived benefits and disadvantages of smart charging, and the barriers and levers to doing so. For fleet managers, we also explored understanding of energy aggregators.

Interviews

Interviews lasted between 30-60 minutes and were conducted over video conference between the 6th and 20th March 2024.

Analysis

Interviews were transcribed and coded using NVivo software, using Braun and Clarke's[5] thematic analysis approach to identify the key themes within pre-defined overarching categories (attitudes, motivations, etc.).

Message testing

We conducted an early workshop with key stakeholders from Energy Saving Trust research and transport teams, along with DESNZ research and policy teams to generate initial ideas for messages, based on the rapid evidence review and existing tacit knowledge. Following the first phase of research, we identified key areas which would underpin effective messages; including which motivations a message could leverage, and which concerns needed allaying; and further

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[5] Using thematic analysis in psychology-1.pdf (utk.edu)

developed the initial messages to address these areas. These messages were taken into focus groups with consumers; where the messages were discussed, and improvements suggested. The messages were iterated between focus groups based on consumer feedback, building a better understanding of what resonated with consumers.

Sample and recruitment

Six focus groups were conducted with 43 participants across the following groups. Further breakdowns are shown in Annex D. Participants were recruited by convenience sample, through a research panel, by a subsma-contracted recruitment specialist.

<table>
<tr><td rowspan="2"></td><td rowspan="2"></td><td colspan="2">Stage of consumer journey</td></tr>
<tr><td>Looking to purchase an EV in next 6 month</td><td>Owns or uses an EV</td></tr>
<tr><td rowspan="3">Type of consumer</td><td>Private domestic consumer with off-street parking</td><td>8</td><td>8</td></tr>
<tr><td>Employees with potential to charge at the workplace</td><td>7</td><td>6</td></tr>
<tr><td>Workplace fleet owners/managers</td><td>7</td><td>7</td></tr>
</table>

Focus Groups

Focus groups lasted 90 minutes, with between 6 and 8 participants each. They were conducted via video conference between the 26th of March and the 4[th of] April 2024.

After an initial warm-up where we discussed where participants' were in their EV (or fleet) journey and their understanding of smart charging, we presented the messages via screen-share and read them out; prompting participants to give initial reactions, discussion about how clear the message was, whether it would encourage them to explore smart charging, and any improvements that could be made to the messages. Findings from phase 1 indicated that many consumers were still at an early stage of understanding smart charging; and revealed multiple barriers and levers. As such, we had a wide range of messages to explore and the focus was on which types of messages resonated best and why, rather than honing fewer messages to perfection.

Analysis

Due to the iterative, co-design style of the focus groups; key feedback from each group was documented in real-time on a spreadsheet and built into the messages for subsequent groups

with the aim of producing a set of guiding principles for a messaging framework. The key feedback pertaining to each message category is detailed in the results section.

Results

Phase 1: Consumer understanding, needs and behaviours around smart charging

This section details the findings around current levels of understanding of smart charging, attitudes, behaviour, barriers and levers to smart charging. Drawing mainly on the 30 in-depth interviews conducted, we have also integrated findings from the REA (and highlighted where this is complementary or divergent to our findings) and evidence from the Focus Groups where these topics were discussed alongside the message testing.

Rapid Evidence Assessment

Awareness and understanding of smart charging were found to be fairly low amongst consumers, employees and fleet managers. Consumers familiar with smart charging valued the following: ease and accessibility of smart charging schemes, personalisation and control over settings, protections and guarantees on financial and technological aspects (including reassurances on battery health), confidence that smart charging is reliable, reassurance that the vehicle will be sufficiently charged, and understanding of the cost benefits.

For domestic consumers, smart charging experiences have been found to be generally positive once used; however, users may not necessarily associate their experiences with the phrase "smart" charging specifically. The EV Smart Chargepoint survey[6] found that around 70% of EV drivers use charging scheduling, while Department for Transport research[7] on EV drivers found that 90% charge overnight. Taken together, this suggests that this group may need less messaging to encourage awareness and use of smart charging. For those that don't schedule their charging, 50% cited energy tariff inflexibility (2021), suggesting a barrier for EV owners is not motivational but material. The energy landscape has changed since publication of this research, with a larger variety of smart energy tariffs on the market; and this was not found to be a barrier in our current research.

For workplace drivers, the benefits of smart charging are harder to conceptualise (as charging is often offered for free). Furthermore, it has been found[8] that only around 12% of EV users who charge at work are able to schedule their own charging; and 25% stated that their workplace controls the scheduling of the charge. A barrier cited in this research was that energy prices are typically higher during the day while office workers are charging at work; however, with the expansion of dynamic and type of use tariffs, we wanted to further explore whether workplace drivers would be open to this opportunity.

Previous research has shown that fleet managers struggle to see how smart charging would work for, and benefit, their organisation; and managers were concerned that smart charging

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[6] Electric Vehicle Smart Chargepoint Survey 2022 (publishing.service.gov.uk)
[7] Electric vehicle drivers: attitudes and behaviours - GOV.UK (www.gov.uk)
[8] Electric Vehicle Smart Chargepoint Survey 2022 (publishing.service.gov.uk)

approaches would take significant effort. Furthermore, fleet managers were found to be focusing on adopting EVs in the first instance, and not yet focusing on optimising charging. We wanted to validate these findings and understand more about the potential levers which might encourage fleet managers to explore smart charging. For instance, the opportunities for messaging around smart charging to highlight the ease and automation of smart charging, which we went on to explore in Phase 2.

In terms of message provision, previous research has found that energy suppliers, online EV forms, and friends and family are preferred channels for general energy advice. Ofgem research[9] into time-of-use tariffs specifically, found that EV owner-respondents were most likely to have first heard about ToU tariffs through online EV forums, and would primarily seek out more information from energy suppliers.

Understanding of smart charging terminology and concepts

Understanding of the phrase "smart charging" was mixed amongst participants across all groups, with some participants (especially current, domestic EV owners) immediately able to provide an accurate definition; however, many participants initially perceived it to mean fast charging, induction charging, a brand of charger[10], or a method of paying for charging. Some understood the term to mean that you could control the charging through an app, or set certain times for the vehicle to charge, but not necessarily that it would be aligned with demand on the grid. This mirrors what we found in the Rapid Evidence Assessment (Annex B), where it was found that understanding of smart charging is mixed[11].

"I don't know if it means smart charging is like it can do a fast quick charge. I don't know if that's what it is, but I have heard of it vaguely" (Current workplace driver)

However, once a full description of smart charging[12] was provided to participants, most realised that they were familiar with it, and many of the current drivers (both domestic and workplace) did already smart charge. In general, current drivers had higher levels of understanding than prospective, although level of understanding was also influenced by how technologically savvy participants were and how interested they were in energy-related topics. A similar pattern was present for the other phrases we explored, such as "demand side response"; where participants were unfamiliar with the specific phrase but understood the concept, and some participants had taken part in "saver" demand flexibility sessions.

"Ah, well, yes actually, I kind of do that already, I've got the tariff where between 4:00 and 7:00, if you shift your usage out at that time, they give you credit back." (Prospective workplace)

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[9] PWC. (2020). Energy consumers' experiences and perceptions of smart 'Time of Use' tariffs. https://www.ofgem.gov.uk/publications-and-updates/energy-consumers-experiences-and-perceptions-smart-time-use-tariffs

[10] Sainsbury UK stores had recently released their own brand of rapid chargepoints, called Smart Charge: Sainsbury's launches Smart Charge: new ultra-rapid service to build confidence in public EV charging | Sainsbury's (sainsburys.co.uk)

[11] Phase 1 EV publication v2.pdf (ofgem.gov.uk)

[12] Smart charging is a way of charging your EV at times when demand for electricity is lower, for example at night, or when there is lots of renewable energy on the grid.

With the current and prospective fleet managers, we explored the concept of energy aggregators, whereby a third-party company provides financial incentives for managing the electricity usage of the fleet. None of the fleet managers had heard of this concept, though all were positive about the idea and would explore it. However, a misconception was that it works by having the vehicles discharging energy back into the grid, which is a separate, emerging technology called Vehicle-to-Grid (V2G)[13].

"Yeah, I think I think that's great. I was listening to a podcast of a company that does that… they don't produce any energy, but energy companies pay them to reduce demand at certain times of day. And it seems like they've sort of stopped a few brown outs and things like that." (Current fleet manager)

Participants widely understood terminology such as "grid", "demand" and "pressure on the grid" and used analogies such as relating it to everyone putting the kettle on at the same time during advert breaks. No participant needed these concepts to be explained further.

There was some discussion around green tariffs and how smart charging is an additional benefit, as some participants believed that by being on a green tariff they would be getting renewable energy either way.

Attitudes and perceptions

Once participants understood what "smart charging" meant, attitudes were generally positive. Cost saving was mentioned as a benefit by all respondents, with many also mentioning environmental benefits from balancing the grid. Convenience was another benefit mentioned, particularly in relation to having to top-up ICE vehicles at petrol stations. It was important to participants that they could plug-in when it was convenient to them and still benefit from off-peak tariffs, rather than having to stay up late to plug-in at the right time. This supports what we found in the REA, that the greater the understanding of smart charging, the more appealing consumers find it to be[14]. Once participants were assured that the smart functionality allowed timers to be set, the idea did seem more appealing.

A small number of respondents did have negative views of smart charging, which focused on security concerns and also a perception that "balancing the grid" should not be the consumers' responsibility. This was also found in previous research[15], particularly amongst those with low trust in the government. However, in both the REA and in our research, this was found to be a minority opinion, and indeed one respondent was still using an EV tariff. However, it is still worth noting as messaging focusing on this may have the potential to backfire for a small proportion of people.

"It is a very, very good concept. I would wholly agree to it. And one thing is it reduces the load on the National Grid, and it is cost effective for the consumer". (Prospective domestic)

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[14] https://delta.lcp.com/podcasts/smart-ev-charging/
[15] EV Smart Charge Point Regulations 2021 Process Evaluation, to be published.

"I do not think for a supposedly first world advanced civilized large economy that we should be running our infrastructure based on charging electric vehicles when we've got a bit of spare electricity" (Current EV owner, EV tariff)

Consumers had not heard specific myths around smart charging, though many mentioned the more general myth of EV's being more likely to catch fire, although this was widely acknowledged as being untrue or exaggerated. A small handful did mention they would be more concerned about safety if leaving their car unattended for long periods of time to smart charge; (though this was not specific to fire risk and also encapsulated battery theft or having the car unplugged by pranksters). One had heard that insurance would not cover any incidents that occurred if the vehicle was unattended. Misconceptions around smart charging more generally were related to lack of understanding; for example, thinking that you might have to wake up in the middle of the night to plug it in. A few respondents initially queried how they would know when the grid was greenest. As such, it will be important for messaging around smart charging to highlight that this is done automatically by the supplier or through the app rather than by the end user.

Information sources

Participants got information on EVs and charging from a variety of sources. Most used the internet as a general starting point; either using search engines or going on specific motoring websites. Friends and family were also a widely used source; and often part of the trigger for moving to an EV in the first place, although friends and family were also cited as a source of misinformation. Social media plays a role, with influencers on sites such as TikTok sharing real-life experiences with EVs (which were overarchingly positive amongst the participants we interviewed), and special interest forums on Facebook and Reddit also being a widely used source of information for real life opinions and experiences. This is supported by findings from the Smart Charging Process Evaluation[16] where it was found that many consumers defer to word of mouth to confirm pre-existing thinking on the subject, utilising a network of friends, family and colleagues who have gone through the journey. Participants tended to have heard of EV tariffs while they were looking into getting an EV and explored these with their energy supplier; sometimes using comparison websites to see what the best tariffs would be. However, participants had generally not spent a lot of time researching smart charging, compared to researching EVs in general.

Participants tended to be quite trusting of most information sources, though they suspected that car manufacturers and dealerships would give biased information as they have a product to sell. Social media was treated with some caution, although forums with like-minded people were well trusted compared to random people on sites like X (formerly Twitter). Friends and family were also generally trusted, and participants seemed well able to identify instances of misinformation. It is worth noting that this sample consisted of participants who were early adopters of EVs or were exploring buying one within the next six months (which would still be classified as relatively early adopters), and so were likely to be more well-informed than the

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[16] EV Smart Charge Point Regulations 2021 Process Evaluation.

general public and perhaps better able to identify misinformation. Indeed, Energex[17] found that becoming an EV owner generates growth in energy literacy.

Consumer needs and preferences

Previous Energy Saving Trust research (summarised in Annex B) found that consumers value protections and guarantees on financial and technological aspects, ease and accessibility of smart charging schemes, personalisation, sufficient information provision and control over settings and preferences. Convenience and reliability have also been found to be key needs for drivers[18], in terms of wanting to charge their car when it works for them and knowing that they will have enough charge for when they need it.

Similar themes emerged in our primary research, though protections and guarantees being a concern for only a minority of participants; with most assuming that safety and security regulations were a "given".

Information provision (i.e. understanding how it works), convenience, reliability and control all emerged more strongly. Control was strongly linked to reliability and certainty, with participants wanting to know that they would be able to determine when the vehicle was charged by, and by how much. Control of the charging schedule by the supplier (i.e. through dynamic charging) was not met with resistance by most as long as it provided the required level of charge.

I think there would need to be like parameters for that. If I know that vehicle needs to be 100% by 10:00 AM but it's plugged in from 6:00 PM previous day and I don't really care when that happens (Current fleet manager)

For fleet managers, their key needs were dictated by the charging model for their fleet. Some fleets had vehicles that returned to the depot or office between shifts, while others had vehicles that returned home with the drivers. Although they stated that their top priority was generally cost, EV tariffs were not being generally used by those who charged their vehicles in the workplace, and managers had not actively engaged in looking for suitable tariffs. Those whose drivers charged at home tended to feel that it was not their place to try and encourage smart charging, though it could lead to savings on expenses; so, the stated importance of cost was not reflected in their current behaviour. Efficiency was a key priority, with fleet managers not wanting to add any additional time to their fleets' rounds or shifts by having to charge for longer than necessary. Reliability and certainty of having sufficient charge for the next shift was also paramount.

Awareness and understanding of tariffs

We discussed three different types of tariffs with participants: time of use, type of use, and dynamic[19]. Previous research[20] found low awareness of EV tariffs, and perceived inflexibility of such tariffs, is a barrier to smart charging. However, we found that smart tariffs (particularly

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[17] Electric Vehicle Customer Experience Journey Mapping (energex.com.au)
[18] Phase 1 EV publication v2.pdf (ofgem.gov.uk)
[19] Definitions used are show in the Topic Guide in Annex E
[20] Electric Vehicle Smart Chargepoint Survey 2022 (publishing.service.gov.uk)

time-of-use ones) were widely known and utilised by domestic participants. This could be due to the rapid growth of EV tariffs in recent years, which were not as readily available at the time of previous research.

Time of use tariffs were widely understood, with many participants relating these to "economy 7" tariffs and they were generally supportive of these. Some participants did query whether the night-time would remain "off-peak" once more people had EVs and everyone wanted to charge during that window. Many of the current drivers were on these tariffs and found the benefits to be cheap prices, certainty about when you would get a charge, and the ability to use other electrical appliances (e.g. dishwasher) during this window too. A disadvantage was that on some tariffs, the cheap window was relatively short and for some models of vehicle not long enough to do a complete charge from empty to full; so, participants reported that they had to plan ahead to charge on consecutive nights if they were planning a long drive; otherwise, they would just top-up during the window.

Dynamic tariffs were less well known, particularly amongst prospective drivers. Current drivers were more supportive of these types of tariffs, and some were already on them. Those who were savvier about energy and technology noted that this would be the best way to balance the grid in the future when more people had EVs. Prospective drivers, who weren't yet in the habit of charging, tended to be concerned about whether this type of charging would leave them "short" when they needed it. These participants were in the mindset of topping up their car with petrol or diesel when it was nearly empty; rather than the participants who owned EVs who tended to charge when the vehicle got to 30%, and so were less worried about being left without any range. Even with assurances about setting minimum charge levels and times, prospectives worried that in an emergency situation they may need their vehicle before the pre-set time and that the vehicle may not have charged at all.

Participants tended not to mind the idea of the supplier having control of the chargepoint, as long as they had control (and certainty) over when it would be charged. Some participants were also unsure about leaving the vehicle plugged in constantly – citing safety concerns as well as the cable looking "messy" or being a trip-hazard. Those in two-car households stated that it might be harder to manage charging both vehicles if you didn't know when the cheap windows might be; unlike time-of-use tariffs where the cars could take turns each night.

Type-of-use tariffs, where customers get cheaper rates for charging their EV regardless of the time were less well known than time-of-use tariffs[21]. For prospective owners, this was a popular option as it felt more familiar to their current model of having a set price for petrol or diesel, as it enabled them to think of having one price for fuelling their car and one price for everything else. Although most thought they would charge overnight for convenience anyway, this was found to be a good option for those who might work shifts. The more energy-savvy noted that this might be less "smart" in terms of alleviating pressure from the grid as it did not incentivise drivers to charge at the best times (however, it is worth noting that most type of use

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[21] We found only one on the market that was not also time bound.

tariffs also have a dynamic or time-bound element to them, and smart functionality on modern chargepoints would also enable this).

"I think that's quite useful to think of it a bit sort of like how you think of it now, like petrol or diesel, it's set price and it's different to your electricity tariff." (Prospective domestic)

Charging behaviour

As discussed above in relation to tariffs, most current domestic EV drivers interviewed did tend to have smart tariffs (time-of-use, dynamic or type-of-use), and were smart charging, mostly overnight. This is in line with previous research[22] which found that 90% of respondents charged overnight. Most current drivers had chargepoints installed, and all prospective drivers were planning to install chargepoints. A handful of participants used 3-pin chargers because they felt that the expense of a chargepoint was not worth it as they were still able to use cheaper overnight tariffs alongside the timer on the car; and were able to spare the extra time taken to charge. However, most participants had opted for chargepoints as this was seen to be the done thing, safety was more guaranteed, and it was quicker.

Smart charging in the workplace was not used by any participants. Participants who primarily charged at their workplaces tended to do so because it was offered for free. Participants had not spent much time investigating the chargepoints at work and were unsure whether they were smart enabled. This is in line with the findings from the EV smart chargepoint survey[23] which found only around 12% of chargepoints installed at work locations can schedule charging. Participants also noted that there were more EVs than chargepoints available, and that they often had to move their cars to allow a colleague to charge – thus making smart charging in a dynamic way more difficult as cars needed to charge quickly in their allocated slot. Participants reported that they would be willing to smart charge at work, noting that it might not be free forever, and so cheaper rates would be preferable as long as the savings were passed down to them.

Smart charging was low amongst fleet managers too (though some did have personal EVs which they smart charged). We spoke to managers of a wide variety of fleets, from delivery companies to pharmacists, who operated their vehicle fleets in very different ways. Some had company cars which were allocated to staff members who would either take them home between shifts and charge there or would charge at the office during the day. Other businesses had vehicles which stayed on site and were driven by multiple different drivers. While some of these businesses operated only during the day (including a veg box delivery service), and left the vehicles on-site overnight where they charged, others (including a port operator and police force) operated 24/7 with vehicles in constant use and so charged whenever they could. As such, conversations around the potential to smart charge were very different with different participants, which is discussed further within the barriers and levers section below.

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[22] The Department for Transport's survey of electric and/or plug-in hybrid vehicle drivers (2022)
[23] Electric Vehicle Smart Chargepoint Survey 2022 (publishing.service.gov.uk)

Barriers and levers

In order to aid the development of messages to encourage smart charging, we explored the barriers and levers to smart charging in-depth with participants; guided by the ISM behavioural framework[24] which helps categorise themes into Individual, Social and Material (ISM) factors.

Individual

Financial

Cost savings were the top lever for almost all domestic and workplace participants, with many citing this as a reason for switching to an EV in the first place. However, not all participants were doing the most cost-effective type of charging, which could suggest that the savings from converting from combustion fuel to electricity is perceived as more of a significant saving than switching from dumb to smart charging. This is something that messaging could leverage.

Participants who charged at work were often given free charging by their employer, which underpinned their decision to charge at work instead of at home. As such, there was less of a personal motivation to smart charge, as employees would not get cost savings from this. However, it was acknowledged that charging might not remain free forever, and some employees recognised that saving their employer money might benefit them indirectly (i.e. through increased profit margins and thus bonuses), and so smart charging was still viewed beneficially.

Fleet managers who provided company cars to employees also cited financial motivation for switching to EV, with benefits-in-kind being a common reason for switching. However, some had not switched their vehicles to EV for cost-saving reasons, instead doing so to meet net-zero policies, boost or improve the company's reputation, or out of necessity because of low emission zones. Nonetheless, finances did still play a large part in their work role and so recouping some of the cost of the vehicle through smart charging could be a lever.

Environment/grid

Many respondents did note that smart charging would be better for the grid and appreciated that using more renewable energy to charge their vehicle was better for the environment. For most, this was an added bonus on top of financial savings rather than the primary motivation; though a minority were highly motivated by it, and some were not motivated by it at all. For fleet managers, this was more around brand reputation and meeting ESG (Environmental, Social and Governance) goals, although personal motivation did factor in for some fleet managers who were more environmentally aware.

"Obviously, the grid thing is nice, a nice little cherry on top but the main thing for me is and I think for most people is probably the cost. I feel like you've done your bit by getting a hybrid or EV anyway" (Current workplace)

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[24] HOW TO USE THE ISM TOOL" A STEP-BY-STEP APPROACH - Influencing behaviours - moving beyond the individual: ISM user guide - gov.scot (www.gov.scot)

Certainty

It was important across groups, though particularly for prospective drivers who had more "range anxiety" than current drivers, to be assured that their car would have enough charge whenever they needed it. For fleet managers, this was about ensuring that their drivers could start a shift promptly and complete their work. For domestic and workplace drivers, this centred more about concern about needing the vehicle in an emergency or having enough charge to get home. Current drivers tended to acknowledge that they tried not to let their car get too low in the first place, so this was less of a concern for them about smart charging specifically, although some had been caught out by app malfunctions before and needed to rapid charge at a public chargepoint.

"You'll spend the entire workday worrying about whether you got electricity to get out, and then you'll just be on your app, going, OK, great. It's 2:15 and we've got only 35%". (Current domestic/workplace)

Control

Most participants were not concerned about the supplier having control of the chargepoint to charge the vehicle. Some participants stated that they preferred to have control themselves, but this was largely due to them wanting the certainty of knowing the vehicle would have enough charge whenever they needed it, rather than widespread concerns around data or security (although this was a concern for a minority). A small number of participants did not feel they could trust their energy supplier to do the right thing by them, given recent turmoil where some companies had collapsed, and customers didn't have a choice in their new supplier; and controversy over energy price rises happening despite energy company profit increases.

"To me it makes no difference. I mean, some people might be thinking it's too much AI or something. For me as long as it's charging, and if it's saving me a bit of money it makes no difference". (Current workplace)

Habit

For current drivers, remembering to plug in the vehicle was the main barrier to charging their EV, leading to having to get out of bed to do it, use the override function, or use public rapid charging. Forgetting to plug in meant that participants were not reaping the financial benefits of smart charging, and potentially using energy at times of higher grid demand. Some participants had routines whereby they plugged in as soon as they got home; though for some participants, such as those with families, this was not convenient as they often had their hands full when arriving home. Some participants did not need to charge every night, which might also make it harder to establish a habit.

For fleet managers, remembering to plug-in was also a concern, particularly when just having switched to EVs and getting used to the new process. One manager had put notices up in the office to remind drivers to plug in. Bigger fleets tended to have vehicle handover forms which they had added plugging in to, so remembering to plug in was less of a concern.

"Once they get used to driving the EV vans, the only thing I would worry about is not remembering to charge it, that would be the one I'd have to bang them on the head about, to not forget to charge it when you take it back to the depot" (Prospective fleet manager)

Skills/knowledge

Most participants were not concerned about having the requisite skills or knowledge to use smart charging. Current drivers tended to find the apps relatively easy to use, and prospective drivers were not concerned. Some were familiar with other smart tech, or at least used smart phones, which contributed to feeling confident with the technology. Participants felt happy with the chargepoints themselves, usually having been shown how to work them when they were installed or found it simple to figure out by themselves. Drivers who charge at work also did not report any concerns with the chargepoints, having been shown how to use them by colleagues or having worked it out themselves.

Fleet managers had provided training to drivers on how to use the chargepoints in addition to the training on the new vehicles; and none reported any significant concerns about using them. However, the fleet managers we spoke to had not yet explored smart charging using apps. Previous research[25] has found that fleet managers were concerned that smart charging might require significant effort to set-up and operate on a day-to-day basis; and many we spoke to were not aware of EV tariffs for businesses; showing a lack of knowledge in this area.

Privacy concerns

A minority of participants had concerns about data sharing, privacy and security. For one, this centred around the risk of data leaks. Another was more generally suspicious about how their smart meter data was used; and was concerned that data showing their daily movements could make it easier for thieves to work out when they were out of the house. Most participants reported that this was not something they'd even thought of and had assumed that chargepoints were well regulated and secure[26].

"They'll have a lot of data from me and a little bit not too sure about the confidentiality of the data because there are so many leaks and hacks all the time that we hear about." (Prospective domestic)

Social

Norms

Social norms were a big influencer for getting an EV in the first place; with people either hearing positive stories from friends and family, or noticing more EVs on the streets, and feeling that it's the way things are going. Hearing stories of cheap charging were part of this motivation, in particular how cheap it is compared to petrol; and to a lesser extent the benefit of an EV tariff compared to a fixed rate. This was interestingly observed in the focus groups, where current EV owners who smart charged shared their experiences and were met with interest and enthusiasm by those who were not currently using EV tariffs.

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[25] EV adoption and smart charging for electric vans and commercial fleets report (TRL, 2023), not currently published; EV Smart Charge Point Regulations 2021 Process Evaluation, to be published.
[26] Smart chargepoints are indeed regulated to meet certain safety and security standards, as per Regulations: electric vehicle smart charge points - GOV.UK (www.gov.uk)

"If someone is telling you over a pint, saying that I'm only paying this much and it's charging whatever then you're like why am I not doing this?" (Current workplace)

Fleet manager/driver relationship

Some fleet managers whose drivers took the cars home to charge were reticent about trying to influence or persuade their drivers to smart charge at home. They felt that it wasn't their place and were worried that encouraging drivers to switch to a two-rate tariff might raise their electricity bills during the day which would cause friction. However, some managers (generally of smaller fleets) who had allocated vehicles to employees said they had worked with employees, or were planning to, to identify what the best tariffs would be. One manager reported the employees were saving money. So, the workplace culture and relationship between fleet manager and drivers, as well as fleet or company size, may be a factor in how comfortable fleet managers feel in encouraging drivers to smart charge. Highlighting potential cost benefits beyond charging the car (i.e. on other electricity usage) might help assure fleet managers that smart charging is not necessarily an 'imposition' on drivers.

Material

Time and schedules

Fitting charging in around schedules was a big factor that could either help or hinder smart charging. For the domestic groups, charging overnight was usually highly convenient, and so time of use tariffs, or dynamic tariffs set to an overnight window tended to work well, and participants found that this was preferable to having to fill up an Internal Combustion Engine (ICE) vehicle at a petrol station.

For drivers who charged at work, it was convenient to let the car charge while they were getting on with work. However, due to the window of time they were at work (often 9-5) use of overnight tariffs would not be suitable. Dynamic tariffs could be explored, though participants were often not plugged in for the whole duration of the day, and were worried about not maximising charge in the window while they were plugged in.

"I think the reason why I don't know how it could work for us as a business is because it seemed to focus on midnight to 5:00 AM and they're not hours that anybody is in the office." (Current fleet manager)

For fleet managers, time and schedules of when vehicles were "off duty" varied greatly; with some operating 24/7, some during the day and some only used infrequently. For some fleets, charging overnight would work well (and was already being done), though EV tariffs were not being made use of, mainly due to lack of awareness of suitable tariffs for businesses.

Ratio of cars per chargepoint

Having more cars than chargepoints was felt to be a barrier to smart charging, mainly for workplace chargepoints, but also for households with multiple EVs. In a workplace setting, drivers found they often had to coordinate with other EV drivers to ensure that they all got the charge that they needed; meaning that plugging in all day to allow the system to dynamically

charge wouldn't work. It also raised questions of fairness, if one driver happened to plug-in at the cheap time and therefore paid less.

"You can sometimes have all the chargers sitting there empty, or sometimes you can have them all full of people waiting." (Current fleet manager)

Likewise, with multiple car households, participants wondered how smart charging might work with just one chargepoint. While not all participants charged every day or night (and could thus take turns), others had higher usage and wondered how both vehicles would be able to make use of the cheaper charging windows.

Technology

A few participants reported that they had experienced issues with the smart charging app or chargepoint, leading to the vehicle failing to charge when required. Although frustrating, this was not a regular occurrence and did not seem to deter people from smart charging. Some participants found it confusing having different apps for their vehicle, energy supplier, and the chargepoint.

Control over energy supplier

For some fleet managers, choosing an energy supplier was not within their remit, either as this was done by another colleague in the organisation, or they used chargepoints owned by a landlord or provided in a shared space.

"So actually, we can't change the tariff here, which again is bit frustrating, because maybe we would choose the [supplier] energy tariffs where you can get the cheap rate." (Prospective fleet manager)

Phase 2: Message Testing

Taking into account the findings from phase 1, as well as findings from the REA which looked into effective public messaging campaigns (Annex B and Annex C) and existing messaging around Smart Charging, we developed a set of messages based around the key consumer needs, preferences and levers identified above. These were presented in focus groups with consumers, who provided feedback and suggested amendments to the messages. A full set of guiding principles, including example messages, for each consumer group is provided in Annex A. The key feedback on each message type is given below, though not all messages are shown.

How it works

> Message 1: Smart charging is a way of charging your electric vehicle (EV) at times when demand for electricity is lower, for example at night, or when there is lots of renewable energy on the grid. **This can be done through a chargepoint, an app or a timer on the car.** By smart charging on an EV tariff, you could save money on your energy bill.

For many participants, this was the first time they had heard of "smart charging" as a phrase (although they understood the concept). As such, their feedback was that any introductory messages on how it works should be clear, simple, and concise. As well as explaining the concept of charging the vehicle while there is excess energy on the grid, participants needed to know that this could be done automatically (i.e. that they did not have to personally check the grid composition). Understanding was therefore improved when the sentence in bold was added in to Message 1.

Reactions to messages comparing to other smart tech (i.e. smart thermostats) were mixed, as some participants were not familiar with these technologies. However, it was felt to be important to include that in order to access EV time of use tariffs, participants would need a smart meter, as not all prospectives realised this at first. Most domestic respondents (in both the interviews and focus groups) had – or were planning to get – smart meters. A small number of respondents expressed negative views on smart meters.

Financial

> Message 2: Charging your car on a non-EV tariff could cost you over three times more than smart charging with an EV tariff!

> Message 3: Unlock savings with smart charging! Last year, Emma saved £500 by smart charging – imagine what you could save!

All participants felt that financial benefits were the key benefit to highlight in order to promote smart charging. However, participants wanted to make sure that this was backed up by evidence. Comparative savings, as described in Message 2 above, got better feedback than absolute savings as described in Message 3; where participants were unsure how Emma's

mileage and driving habits might compare to theirs. While these messages might encourage people to look into smart charging, participants wanted more details on specific tariffs in order to fully understand what they might be able to save.

Participants also homed in on the use of the word "could", and felt that this wasn't as motivational as "will" would be; however, it was understood that because everyone's energy usage varies, it wouldn't be possible for a message to guarantee a saving for everyone.

Tariffs

<div style="border:1px solid #4472C4; padding:10px;">

Message 4: Ready to take advantage of potential savings and environmental benefits with smart charging for your EV?

Step 1: Get a smart meter.

Step 2: Install a smart charger and download the app.

Step 3: Explore smart charging energy tariffs to maximise your financial benefits and charge in a greener way.

Step 4: Set your tailored charging schedule and get smart charging.

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<div style="border:1px solid #4472C4; padding:10px;">

Message 5: Did you know you can choose different EV tariff options?

Dynamic tariffs adjust based on real-time energy supply, so electricity prices vary per day or per hour and smart charging allows you to take advantage of when energy is cheapest and greenest.

Two-rate tariffs offer two different electricity rates depending on the time of day, with much lower rates at night.

Type of use tariffs offer one rate for your EV and another rate for your home electricity, regardless of when you charge your car.

Select the option that best suits your charging needs and lifestyle.

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Messages 4 and 5 were both well received by participants across all groups (following some iteration to make them visually clearer). For prospective drivers, message 4 helped them to understand what was needed for them to be able access smart charging. Message 5 was found to be clear, and the explanation of dynamic tariffs helped aid understanding more generally about how smart charging could be used to help balance the grid. Participants mentioned that visual representations might further aid understanding, and flow charts or decision trees might help them to choose the tariff that was right for them.

Certainty and convenience

> Message 6: All new chargepoints are required to have smart functionality, allowing you to charge and travel with confidence. **Keep it as simple as you want. Through your app or your chargepoint, set a schedule which can run automatically, or be tweaked as you wish.** You can also set minimum charge levels, guaranteeing that your EV is charged whenever you need it.

Participants were keen to know that they could rely on their car having enough charge for emergency situations. Using "whenever you need it" was more effective than "when you need it" to provide this certainty. Participants were concerned about the level of input required, asking whether you would need to set the app every time you plugged the car in; so, the message was iterated to state that the schedule could run automatically, or be tweaked (shown in bold above), which worked to reassure participants.

Fleet managers also found this message reassuring as they had mentioned that drivers would just want to plug in when they returned from a shift, and not have to "faff about" with scheduling. Fleet managers felt this would work best if the chargers were all set and managed through one parent app.

Habit

> Message 7: Emma, a fleet manager in Guildford, uses smart charging to lower her company's energy costs and help balance the load on grid. She makes sure the drivers remember to plug in their vehicle at the end of their shift, using a reminder on drivers' key fobs and in the locker room. Smart charging makes sure the fleet is always charged up ready for the next shift, using the greenest energy and cheapest tariffs throughout the day and overnight.

> Message 8: All you have to do is remember to plug your car in, and your app will take care of the rest - making sure the car starts charging when the cheap rate kicks in. Why not add a reminder to your phone to check the car is plugged in before you head each night; or remember to plug in when you get back from work.

As participants across all groups reported that forgetting to plug in was a barrier (or potential barrier, for prospectives), we tested some messages which demonstrated ways to remember to charge; based on real-life examples given during the interviews. Some participants found using a case study a bit "cheesy", but most agreed that it was helpful to think about ways to remember to plug-in, despite having various different preferred routines for this. Fleet managers appreciated the assurance that drivers only need to plug-in at the end of their shift, and that they could rely on the technology to make sure the charging happened at the right times.

Environment and grid

> Message 9: Smart charging technology ensures your EV charges when there is a lot of renewable energy available and when demand is low, easing strain on the grid during peak hours. Help us move towards a greener, more stable energy future with smart charging.

> Message 10: By charging your fleet during off-peak hours your business isn't just saving costs, but also playing a vital role in balancing the UK grid. By helping contribute to a greener future for all, this could also help boost your company's green credentials.

Participants found messages that highlighted the environmental benefits and benefits to the UK grid to be motivating; although they were more effective when cost savings were also mentioned.

Messages which mentioned potential savings on infrastructure upgrades were met with mixed reviews; with some participants stating that infrastructure should be invested in anyway, or conversely, that it shouldn't be individuals' responsibility to manage a grid which had been badly invested in. Other participants, however, felt this was motivating, especially when considering that fewer pylons might be needed in their area.

Using some of the analogies that emerged from the interviews (i.e. "boiling kettles all at once") confused participants and led them to worry that off-peak charging might end up becoming peak once everyone starts driving EVs and lead to the same issues.

Safety and security

> Message 11: Your privacy matters. Rest assured, smart chargepoints meet strict security regulations, ensuring your data remains protected when smart charging. To find out more, read your chargepoint privacy notice.

We tested messages assuring participants about the safety and security of chargepoints, as this had been a concern a few had raised in the interviews. We wanted to explore whether they would reassure people, or whether they had the potential to backfire by introducing concerns that people had not previously thought of. Although some participants stated that they had not considered data security previously, they did not find that these messages made them more concerned. Other participants who were more concerned about data security and safety found them reassuring. Some participants noted that they would expect this as a "given" and so promotional messages should sign-post people to where they can find more information rather than provide full reassurances.

Information sources

Throughout the discussions, we asked participants where they would expect to see the messages. In general, participants stated that they would expect to see them from energy

suppliers, as they felt that the tariffs were a key component of smart charging and would usually expect to see information about tariffs from energy companies. Other sources, such as government and independent sources such as Energy Saving Trust were discussed (and generally perceived as trustworthy), though participants would be less likely to seek information on these sites compared to their energy supplier, or a comparison website for tariffs.

This is in line with findings from previous research[27] which suggest that energy suppliers and service providers are preferred sources of information. For ToU tariffs specifically, it was found that respondents had first heard of these through EV forums, and then gone on to seek further information through their energy supplier.[28]

Conclusion and discussion

In conclusion, smart charging was generally well supported by current EV drivers and fleet managers, and those looking to switch to an EV in the near future. Understanding of smart charging terminology was mixed, though general understanding of the concepts was high. The groups we talked to represented fairly early adopters and so may have had higher energy literacy than the general population; although participants felt that words like "grid" were common parlance.

Within our sample, smart charging behaviour differed between groups; while EV drivers who charged at home were generally smart charging, smart charging in the workplace was low. Likewise, smart charging by fleets was also low in depot and office settings; though managers of some smaller fleets which consisted of company cars did report that the drivers tended to smart charge at home.

The main misconceptions around smart charging stemmed from lack of understanding of the principles and technology; for instance, some participants worried that it would be more "faff" either having to set a charge on the app every time you plug in, or even thought they might have to manually plug and un-plug at the right times of day. Fleet managers did not want to put extra burden on drivers who would just want to plug-in and get home at the end of a shift. Ease and convenience were key needs for all participants, especially if cost savings were perceived as marginal, and so smart charging messaging needs to convey the simplicity of it; or that the cost savings are worth the small amount of set-up time.

Cost was a key driver for all groups, though participants did also mention environmental benefits as a motivating factor. Messages that conveyed a "win-win" for the wallet and the environment were well received.

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[27] TRL Report (citizensadvice.org.uk)
[28] PWC. (2020). Energy consumers' experiences and perceptions of smart 'Time of Use' tariffs. https://www.ofgem.gov.uk/publications-and-updates/energy-consumers-experiences-and-perceptions-smart-time-use-tariffs

Differences between participants at different stages of their journey were apparent in levels of understanding of smart charging, although interest in energy topics was also a predictor of understanding. Participants who were still exploring EVs tended to be more focused on the vehicles themselves rather than thinking too much about charging; although the fact that most of the current drivers were already smart charging suggests that the prospective drivers might be a better target for promotional messages.

For fleet managers, there were not big differences between those who currently had EVs and those who were still exploring them; they were all quite new on the journey and making the shift slowly. Although understanding of the concept was good, fleet managers didn't immediately see how it would apply to their fleet. Currently, smart charging is not being fully utilised due to lack of awareness of business tariffs or concerns about the inconvenience of setting it up and doing it. There is a big potential to increase smart charging amongst fleet vehicles, particularly within fleets where vehicles are left for long periods between shifts. Likewise, there may be a potential for company car drivers who charge at home to maximise smart charging behaviour; although many fleet managers were not sure how their employees charged, and so it is possible that they are already smart charging. Fleet managers did claim that "the bottom line" was important to them, and so messaging highlighting potential savings could be motivational, although specific information about business tariffs, and reassurances about ease, might be more helpful for time-pressed fleet managers.

Smart charging in workplace settings was low, with challenges reported around chargepoint functionality, fitting charging in around shifts, and the number of chargepoints available. Participants who charged at work were open to the idea of smart charging, as long as the savings would be passed down to them, though felt that it would be the responsibility of the office manager to arrange it. As such, this could be a key group to conduct further research with to understand the potential opportunities for charging at work more clearly. Although the fleet managers did give some insight into this, the responsibility for purchasing chargepoints and selecting energy tariffs did not always fall under their remit (for example, some shared carparks or rented space in depots).

Key feedback on the messages supported previous research which found that the greater the understanding of smart charging, the more appealing consumers found it to be. Indeed, the ordering of the messaging did influence participants' views of the messages. Despite cost savings being a primary motivation, these messages were more effective when presented after the "how it works" messages – indicating that consumers need to understand the concept in order to see the benefits. The messaging around tariffs helped aid understanding further.

Research limitations and notes

Due to the qualitative nature of the research, and thus relatively small sample, the findings cannot be taken as representative of the population, though they do give an in-depth insight into a range of consumer needs and preferences around smart charging.

The messaging framework provided in Annex A should be taken as a set of guiding principles, rather than a set of "oven-ready" messages. Due to the range of needs, barriers and levers

identified in the research, we tested a range of different messages to ascertain how they resonated, rather than focusing on a few messages and refining them to perfection.

Further research and recommendations

Energy Saving Trust recommends that further research would be beneficial to quantify the feedback on the messages, as feedback was only obtained from a small sample through the focus groups. A larger-scale survey would enable DESNZ to narrow down the most resonant messages for further refinement. We would recommend further refinement could be done in partnership with likely messengers, such as energy suppliers, motoring press, independent advice organisations, with messages tested experimentally (e.g. through A/B testing) with different audiences. Energy suppliers are a key source of information for participants, and so we recommend working closely with this group in particular to trial dissemination of messages. EV forums are also a widely cited source of information, which could be explored further as a platform for trialling messages.

Further research into workplace charging could be conducted to gather wider views from other actors in the space, who may be key to facilitating greater levels of workplace charging - such as office managers or site managers for shared carparks and depots, and managers whose roles include the procurement of energy suppliers.

Further research with fleets would be beneficial to understand in more depth the different ways that fleets operate and where there are potential opportunities for smart charging in different settings. Some fleet managers struggled to see how smart charging would work for their specific circumstances, and so case studies could be a useful resource to develop to showcase smart charging in different settings. More information to support fleets could include information or signposting to specific business tariffs, as awareness was low on tariffs that could work (especially for businesses with high energy usage).

Likewise, support with making decisions on tariffs could also help domestic EV drivers and prospectives; some of whom were unsure whether higher peak energy rates would offset the savings from cheaper off-peak rates. As such, an interactive tool or flow-chart could help others decide which tariffs would be best for their energy use patterns.

This publication is available from: www.gov.uk/government/publications/electric-vehicle-smart-charging-improving-consumer-understanding-and-awareness

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