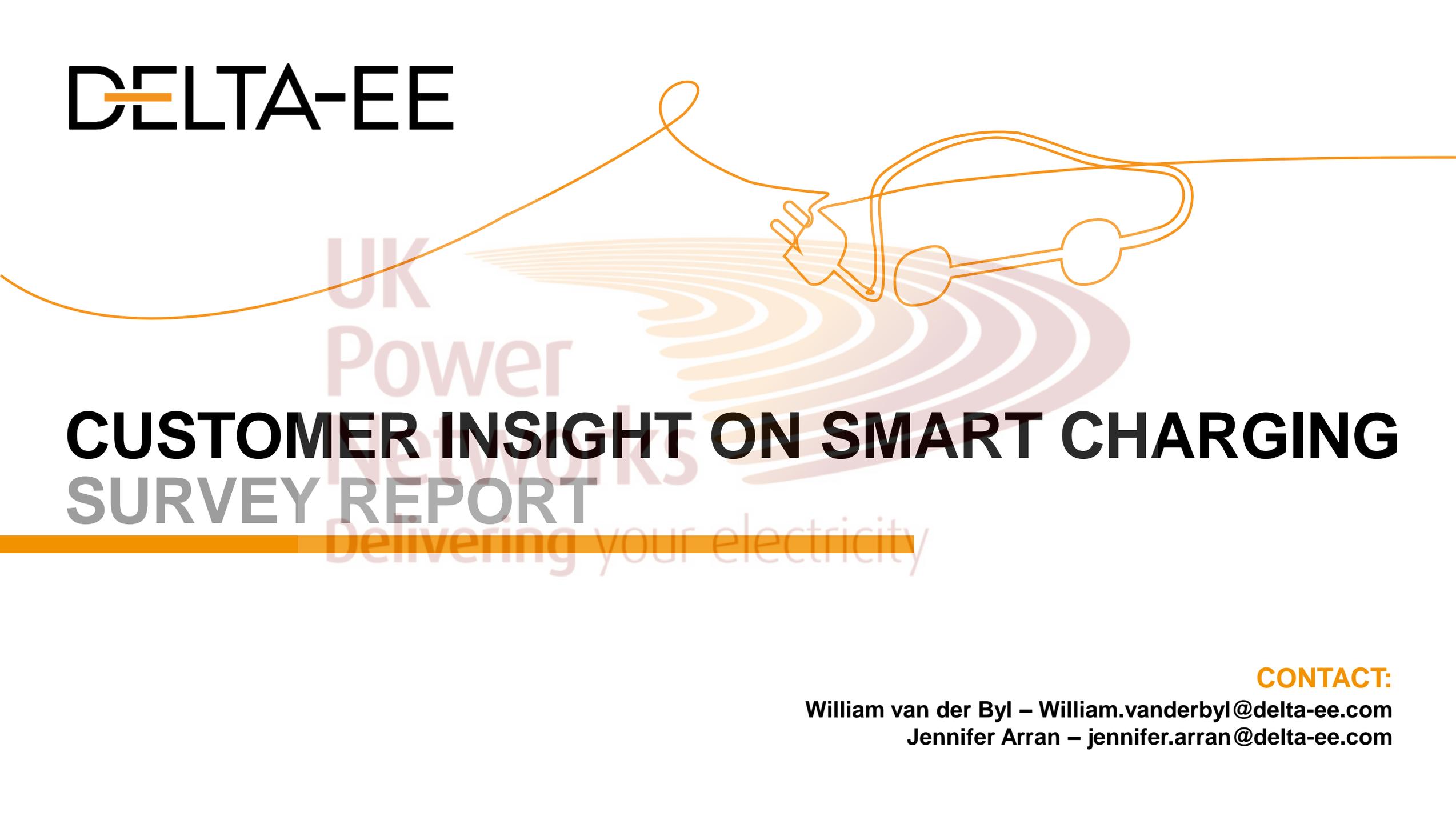


DELTA-EE



CUSTOMER INSIGHT ON SMART CHARGING SURVEY REPORT

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Executive summary



UK
Power
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Delivering your electricity

EV drivers are more likely to live in urban areas and use electric heating which could create EV demand ‘hotspots’

Executive summary (1/4)

Participant characteristics

EV drivers are more likely than non-EV drivers to:

- Live in urban areas with half of the EV drivers living in an urban area.
- Use electric heating with 4 out of 10 EV drivers using electric heating.

What does this mean for UKPN

EV demand ‘hotspots’ are more likely to be in urban areas: in addition to the greater population density in urban areas, we also see a greater prevalence of EV uptake with a significant percentage of these EV owners using electric heating which could cause network problems in the future.

EV drivers’ driving and charging characteristics

- The vast majority of EV drivers’ daily typical journeys are 60 miles or less.
- More than two-thirds of EV drivers only feel the need to charge their EV when the battery has 50 miles or less of range left.
- 9 out of 10 EV drivers have consistent driving habits.

Programming a customer’s smart charging schedule in advance is likely to be possible: customers are likely to plug their EV in to charge only a few times a week. This, combined with the consistent driving habits most drivers exhibit, will make the adoption of smart charging more straightforward and less risky.



A market-led smart charging approach* is the customer's preferred option to manage the increased load due to EV uptake

Executive summary (2/4)

Participant attitudes

Attitude towards smart charging:

- A majority of participants preferred a market-led approach to smart charging. 9 out of 10 participants are open to the idea of smart charging.



What does this mean for UKPN

The market-led smart charging approach is the customer's preferred method of managing the increased electrical load due to EV uptake. This was preferred to: (1) upgrading the electrical infrastructure and (2) a load-management approach to smart charging.

Attitude towards managing emergency situations on the network:

- 85% of participants would like to reduce their electrical demand to avoid having a power outage.
- 6 out of 10 participants would prefer to reduce their electrical demand by having their EV charging paused but 1 in 4 participants would rather their household appliances be turned off.



Customers would likely trust their DNO to act in an emergency situation on the grid: they prefer third party intervention over a possible power outage, with the preferred intervention method being the pausing of one's EV charging.

*Please see slide 34 for the definition of a market-led smart charging approach.

This reward level which customers expect from smart charging is unlikely to be commercially prohibitive

Executive summary (3/4)

Key elements of the smart charging proposition (1/2)

The smart charging reward

£4

- More than two-thirds of participants would allow smart charging to occur for £4 or less per month (under the condition that their mobility is not impacted).
- Out of these participants, half of them would allow smart charging to occur for no compensation.

Smart charging service provider



- Participants have similar preferences for a wide range of smart charging service providers. However, energy suppliers and DNOs are, marginally, the two preferred smart charging providers.
- The DNO is, by a small margin, the first choice smart charging service provider for EV drivers.

What does this mean for UKPN

The rewards that customers expect for allowing smart charging are unlikely to be prohibitive: while customers will need to be rewarded, their expectations on the size of payment broadly align with what the market is already delivering.

Educated customers are more likely to have a positive perception of their DNO: customers who are more engaged with their energy may have a better understanding of who their DNO is and what they do. These customers are more likely to have a positive perception of their DNO.

Providing customers with the ability to override smart charging is likely to be a critical customer requirement

Executive summary (4/4)

Key elements of the smart charging proposition (2/2)

Overriding the smart charging process



- More than 9 out of 10 participants rated being able to override the smart charging process as important.
- 6 out of 10 participants are not willing to pay to override smart charging.
- EV drivers have a higher willingness to pay than non-EV drivers

What does this mean for UKPN

Providing customers with the ability to override smart charging is likely to be critical to the acceptance of smart charging. However, charging customers to be able to override smart charging is a contentious issue for customers, and something a majority will not pay additionally for.

Automation of the smart charging process



- 45% of participants would prefer the smart charging process to be automated.

The preference for automation improves the prospect of EVs being useful for load shifting. From a network perspective this is an encouraging result as automation should result in an increased reliability and certainty of response from smart charging.

Research overview and methodology



UKPN's smart charging strategy is to support a market-led approach to maximise market freedom for EV charging

This research aimed to provide UKPN with customer insights on smart charging to assist with developing this strategy.

The objectives of this research were broken down into two primary aims:

- Provide customer insight to inform and shape the design of UKPN's Shift Project (a trial project to develop their smart charging strategy). This includes insight into how customers will respond to smart charging as a concept as well as the different elements of a market-led smart charging proposition.
- Gather primary evidence on customer perception of a market-led approach to smart charging – to understand both the value of this approach (as this is not the preferred approach by all UK electricity system stakeholders), and gather insight on how customers engage with the complex concept.

The research objectives were achieved by gathering customer insight using a three step process:

1. Focus groups – a total of three focus groups were held with a total of 20 prospective and 20 current EV drivers in May 2019.
2. A co-creation workshop – one co-creation workshop (for 5 prospective EV drivers and 5 current EV drivers) was held in June 2019.
3. Customer survey – an online survey with a sample size of 750 participants and c. 30 questions. The participant type breakdown was as following:
 - Current EV drivers: 236
 - Prospective EV driver (looking to purchase an EV within 5 years) with off-street parking: 414
 - Prospective EV driver with on street parking: 100

This report focuses on step 3

A more detailed research overview and methodology description can be found in Appendix B.

Survey participant characteristics

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The logo for UK Power Networks features a stylized graphic of concentric, curved lines in shades of orange and brown, resembling a power line or a signal wave, positioned to the right of the text.

EV drivers and non-EV drivers* had differing characteristics and demographics.

Section summary in 1 slide

*Here, and throughout unless stated otherwise:

- (1) EV drivers are categorised as owners of fully electric vehicles and owners of plug in hybrid vehicles. N = 236.
- (2) Non-EV drivers are categorised as owners of petrol/diesel vehicles and non-plug-in hybrid vehicles. N = 514.

1. EV demand 'hotspots' are more likely to be in urban areas

- EV drivers are more likely to: (1) use electric heating and (2) live in an urban area than non-EV drivers. The combination of these two factors could result in demand 'hotspots' occurring.
- However, programming/implementing a smart charging schedule could be more straightforward than anticipated given that nearly half of EV drivers rated their driving habits as 'very consistent'.

2. EV drivers are likely to plug their EV in to charge only a few times a week

7 out of 10 EV drivers only feel the need to charge their EV when the battery has 50 miles or less of range left. Given that the vast majority of EV drivers' journeys are typically below 60 miles, this indicates that EV drivers are likely to plug their EV in to charge only a few times a week.

3. EV drivers are likely to be more environmentally conscious

EV drivers are more likely to 'try and do everything possible to minimise their environmental impact' than non-EV drivers.

EV drivers are also more likely to: (1) be younger and (2) have higher incomes than non-EV drivers.

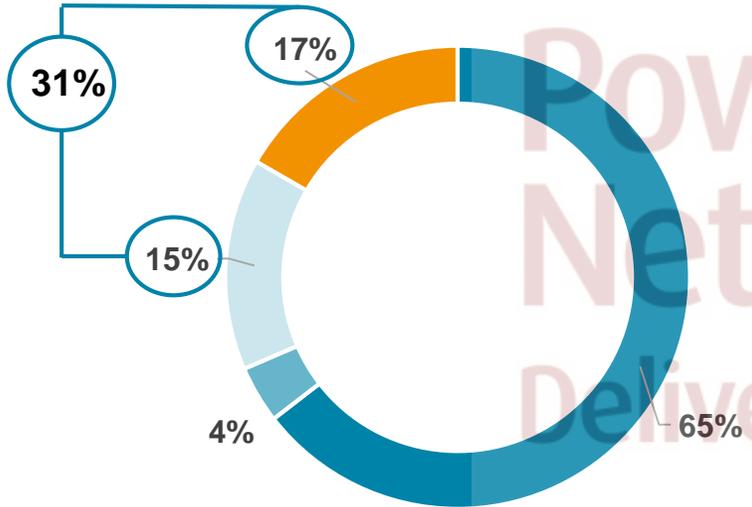
- More than half of EV drivers are under the age of 35 and earn more than £48k per annum.

Approximately 1 in 5 survey participants owned a fully battery electric vehicle (EV)

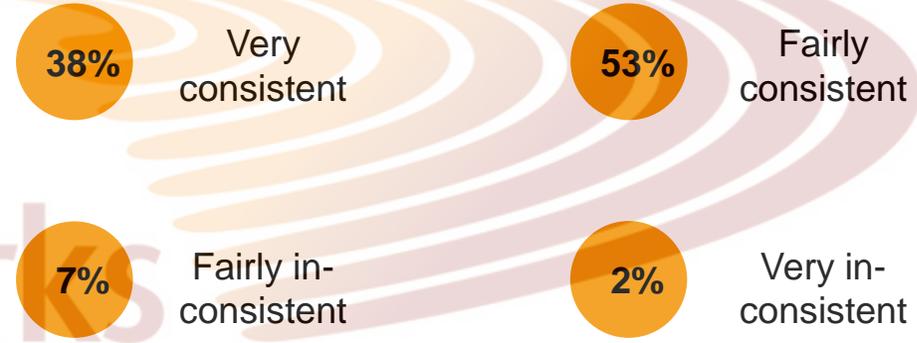
Just under half of EV drivers rated their driving habits as 'very consistent' compared to just over a third of non-EV drivers

Just under a third of participants own a plug-in vehicle**

9 out of 10 participants have consistent driving habits



- Petrol or diesel car
- Hybrid car (cannot be plugged in)
- Plug-in Hybrid
- Fully electric car



The vast majority of participants have access to off-street parking

- Off-street parking in my driveway or garage
- Off-street parking in a shared or private parking lot
- On-street parking



72%



10%



17%*

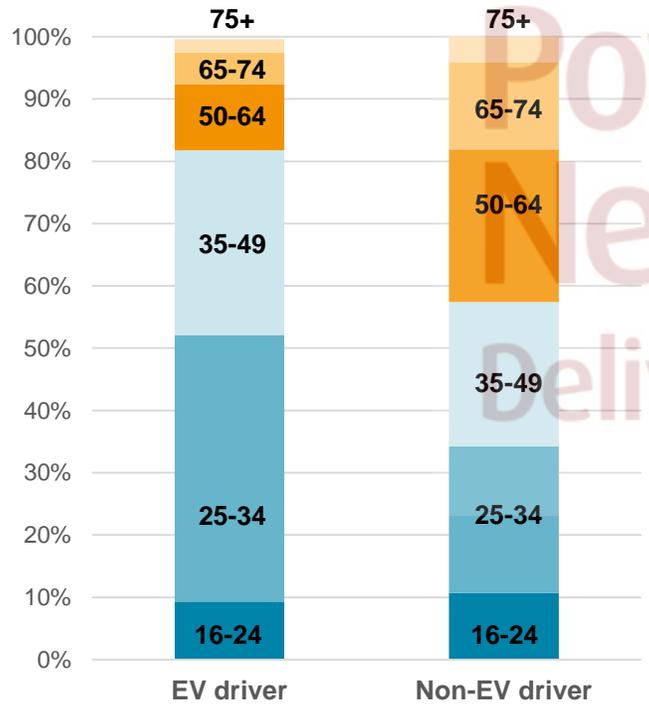
*Doesn't add up to 100% due to rounding

**12% of participants owned more than one vehicle. The breakdown above is based on the lowest emission vehicle owned by the participant (e.g. if an participant owned an EV and a petrol or diesel vehicle, they were categorised as an EV owner)

EV drivers are more likely to be younger, earn a higher income and be more environmentally conscious than non-EV drivers

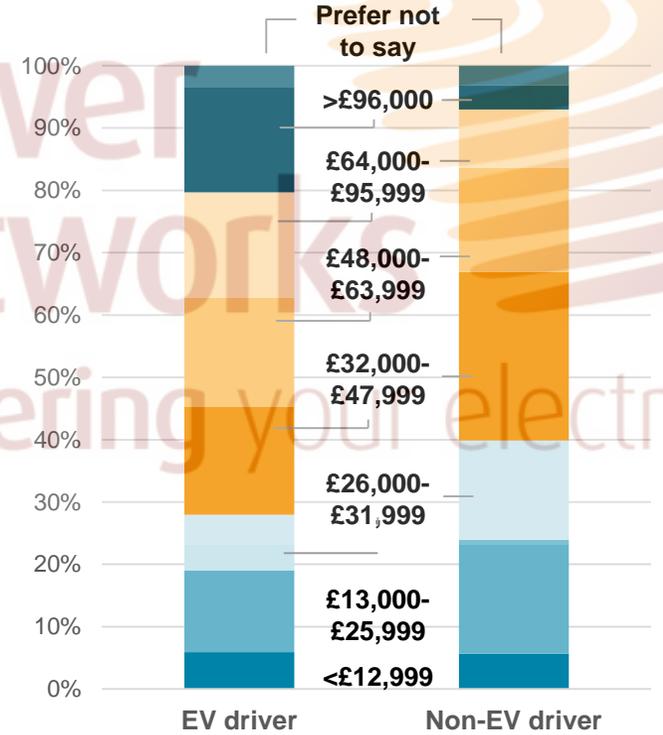
Participant age bands

More than half of EV drivers are under the age of 35.



Participant income bands

More than half of EV drivers earn over £48k per annum.



9 out of 10 participants consider themselves to be environmentally conscious



40% of participants do everything possible to minimise their environmental impact (i.e. I go out of my way to minimise my environmental impact).



51% of participants do what they can to minimise their environmental impact (i.e. I try to minimise my environmental impact but don't go out my way to).

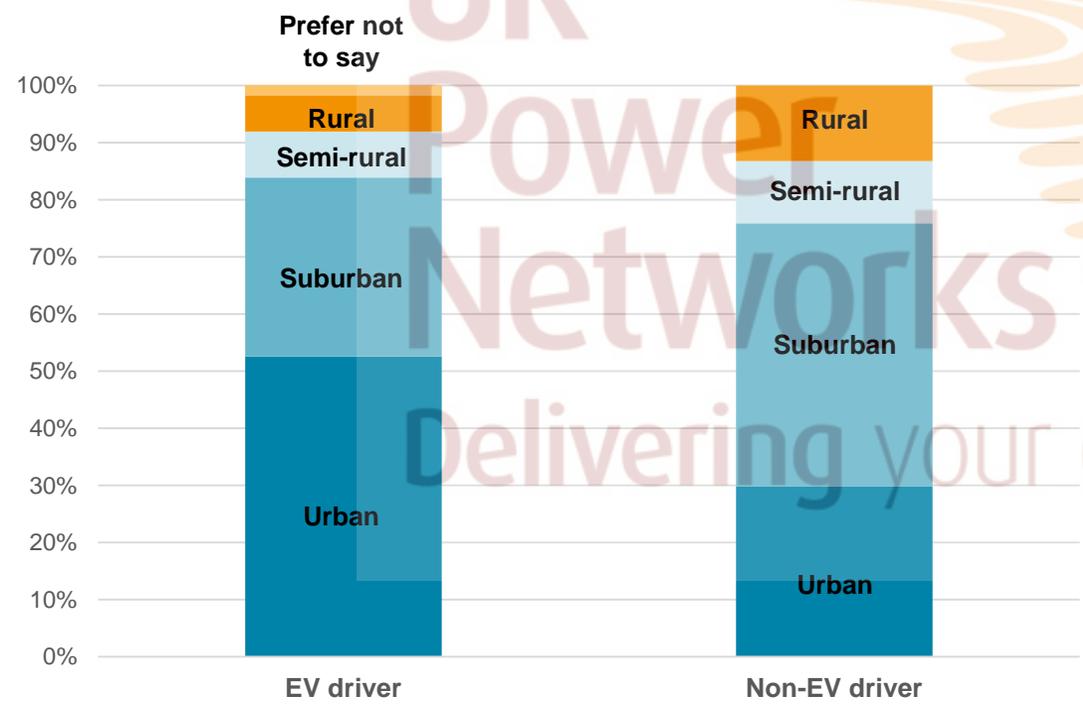


8% of participants either don't know how to minimise their environmental impact or are not interested in doing so.

EV drivers (49%) are more likely to do everything possible to minimise their environmental impact than non-EV drivers (36%).

EV drivers are more likely to live in urban areas and use electric heating than non-EV drivers

More than half of EV drivers live in an urban area compared to just under one-third of non-EV drivers



More than half of purely battery electric vehicle owners (excluding plug-in hybrids) use electric heating



61% of participants use a gas boiler to heat their home (compared to 82% in the UK).



28% of participants use a some form of electric heating (51% of purely battery electric vehicle drivers (excluding plug-in hybrids) use electric heating).



11% of participants use another technology (e.g. oil boiler, LPG, biomass etc.).

More than 1 in 4 survey participants use electric heating compared to less than 1 in 10 people overall in the UK

Less than 1 in 4 full battery electric drivers* leave their vehicle plugged-in overnight

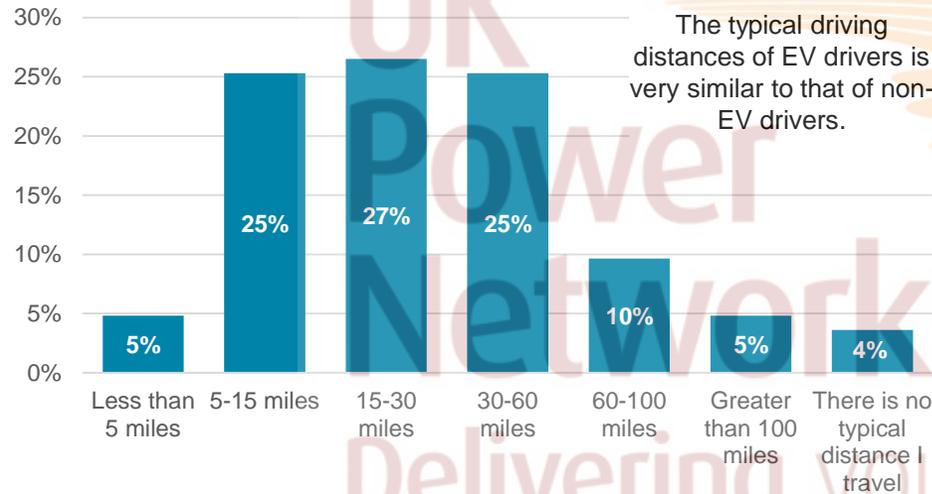
*In this slide, EV drivers are categorised as owners of fully electric vehicles and do not include owners of plug in hybrids vehicles. N = 83

1. The vast majority of EV drivers' daily journeys are typically below 60 miles

EV drivers' typical journey distances

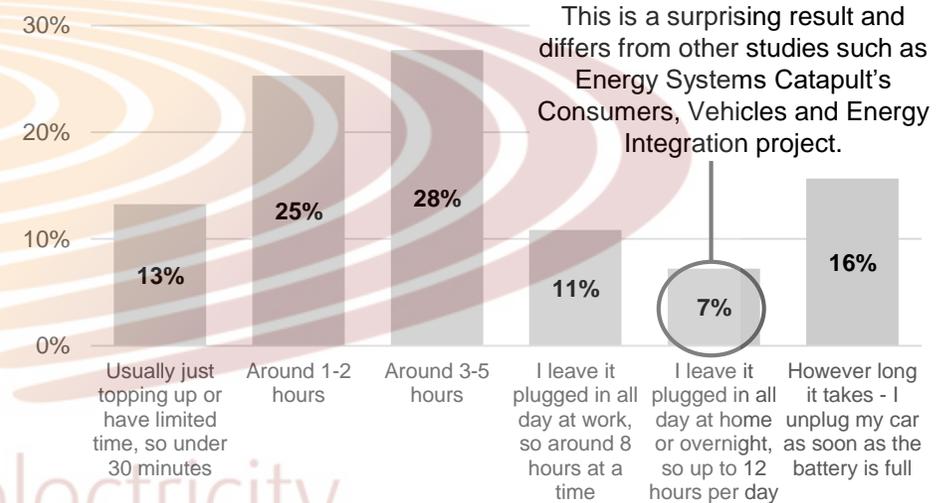
Q: How far do you drive on a typical day when you use your electric vehicle?

N = 83



2. The majority of EV drivers leave their EV plugged in for 1-5 hours

EV drivers' typical charging times



Q: When you plug in your vehicle to charge, how long do you leave it plugged in for on average?

N = 83

3. More than two-thirds of EV drivers only feel the need to charge their EV when the battery has 50 miles or less of range left

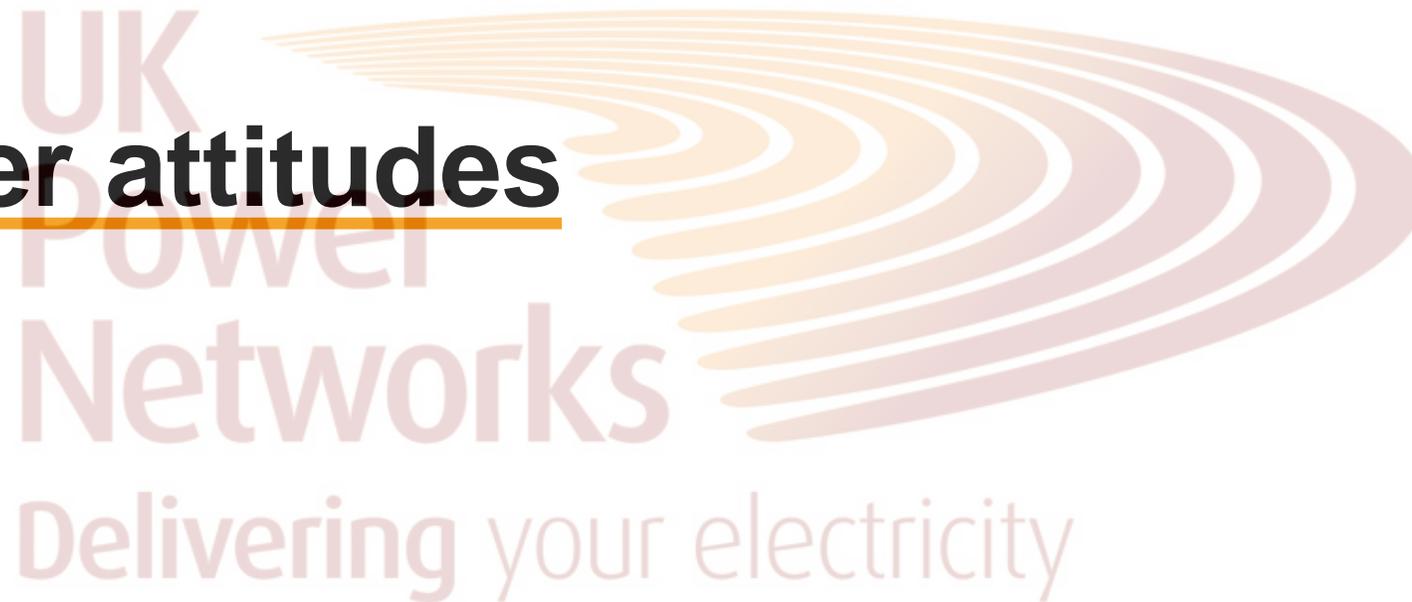


Q: At what point do you feel like you need to charge the battery of your electric vehicle?

N = 83

2% = unsure

Customer attitudes



A market-led smart charging approach is the participants' preferred option to manage the increased load due to EV uptake

Section summary in 1 slide

1. The vast majority of participants were open to the idea of smart charging

- 9 out of 10 participants thought that an increase in EV uptake may cause network issues.
- 3 out of 4 of participants were happy with the idea of a third party managing their vehicles charging.

It is likely that these two above points are correlated and that the openness to the idea of smart charging is, to some extent, driven by the high awareness of the potential network issues EV uptake may cause.

2. The majority of participants preferred a market-led smart charging approach

- Nearly two-thirds of participants preferred smart charging over an infrastructure upgrade. The two primary drivers for this preference were:
 - The environmental benefits
 - The potential financial gain
- The majority of participants prefer a market-led approach to smart charging compared to a load management approach. The two primary drivers for this preference were:
 - A market-led approach being the most logical option
 - The potential to save money

3. 85% of participants would like to reduce their electrical demand to avoid having a power outage

- The majority of participants would like to reduce their electrical demand by having their EV charging paused. However, 1 out of 4 participants would rather their household appliances be turned off than their EV charging paused.
- 4 out of 10 participants expected to be compensated in this situation. This is likely due to the expected inconvenience caused in this situation.

More than 9 out of 10 participants were open to the idea of smart charging

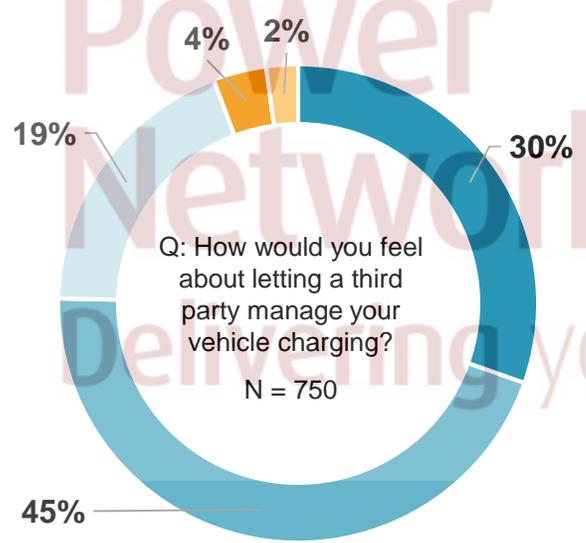
EV drivers* are more aware of the potential network issues EV uptake could cause than non-EV drivers

3 out of 4 participants were 'quite' or 'very' happy with a third party managing their vehicle's charging

9 out of 10 participants thought that an increase in EV uptake may cause network issues

The high openness to smart charging may be correlated to the high awareness of potential network issues due to EV uptake.

Q: Imagine everyone on the street that you live on had an electric vehicle (EV) and they all tried to charge their vehicles every evening as soon as they got home from work. Do you think this would be a problem for the local electricity network?
N = 750



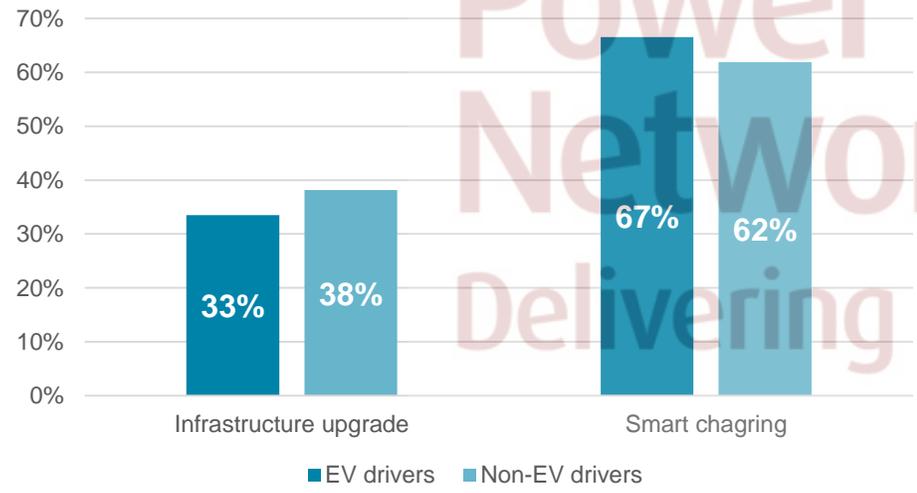
*Here, and throughout unless stated otherwise, EV drivers are categorised as owners of fully electric vehicles and owners of plug in hybrids vehicles
N = 236

- Very happy
- Quite happy
- Neither happy nor unhappy
- Quite unhappy
- Very unhappy

Nearly two-thirds of participants preferred smart charging over an infrastructure upgrade

1. The primary drivers for smart charging were the environmental benefits and the potential financial gain.
2. The primary concerns towards smart charging were having insufficient range and not being able to charge their vehicle when wanted

Both EV and non-EV drivers strongly preferred smart charging over an infrastructure upgrade



Primary drivers for smart charging*

*Only detailing results from participants who chose smart charging over infrastructure upgrade



Environmental – ‘I think this is the greener option and will help decarbonise power and transport’

Financial – ‘I think I will save money this way’

Primary concerns towards smart charging

- **(1) insufficient range and (2) not being able to charge their vehicle when wanted** were stated by 26% of participants as their primary concerns
- **The organisation not acting in their best interests** was stated by 21% of participants as their primary concern

EV driver insight:

EV drivers were less concerned than non-EV drivers about (1) insufficient range and (2) charging their vehicle when wanted.

This indicates that (1) insufficient range and (2) not being able to charge their vehicle when wanted are more likely barriers to EV uptake than barriers to smart charging.

Q: In the future there will not be enough electricity grid capacity to support everyone using electricity to run their normal appliances and charge their EVs at the same time. One option to address this would be to upgrade the networks. The other option is to utilise smart charging or other technology to manage the loads on the grid. Which would you prefer?

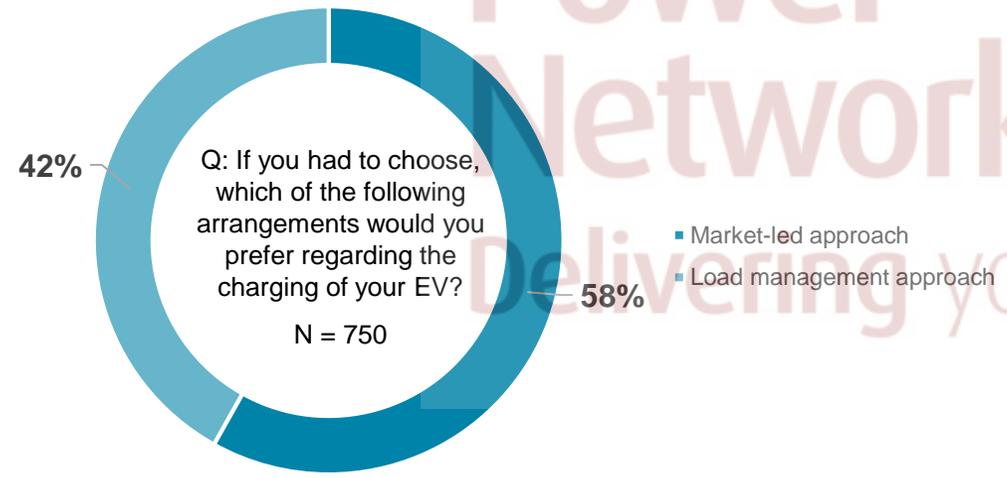
N = 750

The majority of participants prefer a market-led approach to smart charging compared to a load management approach

Saving money and it being the most logical option were ranked as the two primary drivers for preferring this smart charging approach

7 out of 10 lower income participants (annual income <£19,000) preferred a market led approach

This is likely due to the market-led approach offering a larger opportunity to save money on EV charging.



EV drivers and non-EV drivers had exactly the same preference split between the market-led and load-management approach.

The primary drivers for a market-led approach*

*Only detailing results from participants who chose market-led over load management



The participants who preferred a market-led approach ranked the primary drivers in exactly the same order as the participants who preferred the load-management approach.

Nearly two-thirds of participants would prefer their EV to be paused during an emergency situation on the grid

4 out of 10 participants expected to be compensated in this situation. This is likely due to the expected inconvenience caused in this situation.

85% of participants would like to reduce their electrical demand to avoid having a power outage

61% My EV is automatically paused

25% I would rather my household appliances be turned off

30% of EV drivers chose this option compared to 23% of non-EV drivers.

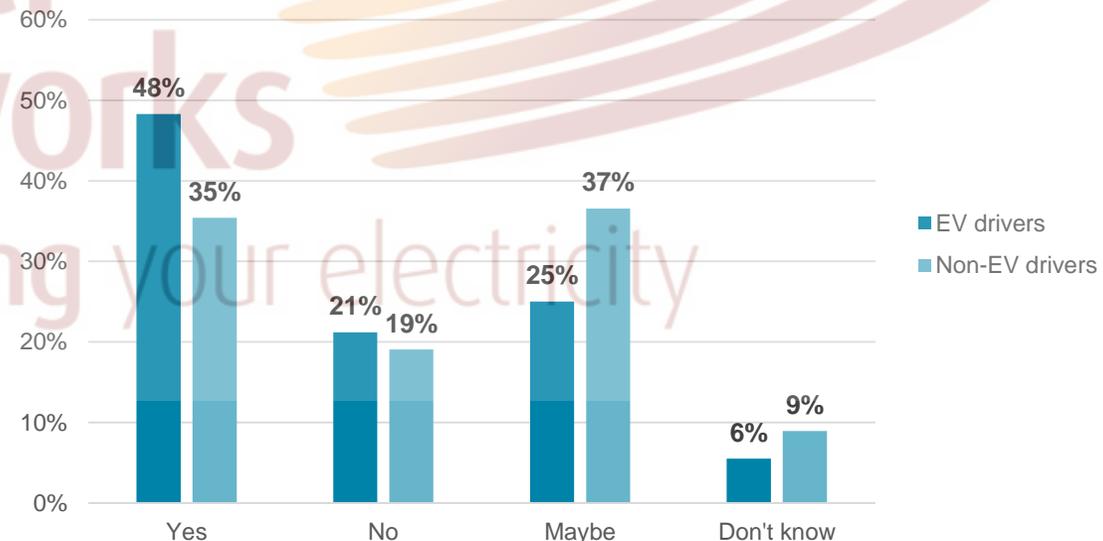
14% No-one interferes with my EV charging and the power might go out

Q: Imagine an emergency situation which results in there being insufficient power for everyone on your street to charge their EV and use electricity for cooking, lighting, washing etc. If you had to choose between the following three options, what would be your preferred outcome?

N = 750

The topic of compensation resulted in split opinions amongst participants indicating no strong preference one way or another

Almost half of the overall sample expected some form of compensation but 1 in 5 participants did not expect to be compensated.



Q: If, your EV charging is automatically paused to prevent the power being cut, would you expect compensation for this?

N = 750

EV driver insight
Non-EV drivers were more open to their EV charging being paused but were more likely to expect compensation for this pause compared to non-EV drivers.

Smart charging reward



More than one-third of participants would allow smart charging to occur for no compensation

However, EV drivers are more likely than non-EV drivers to require compensation for allowing smart charging to occur

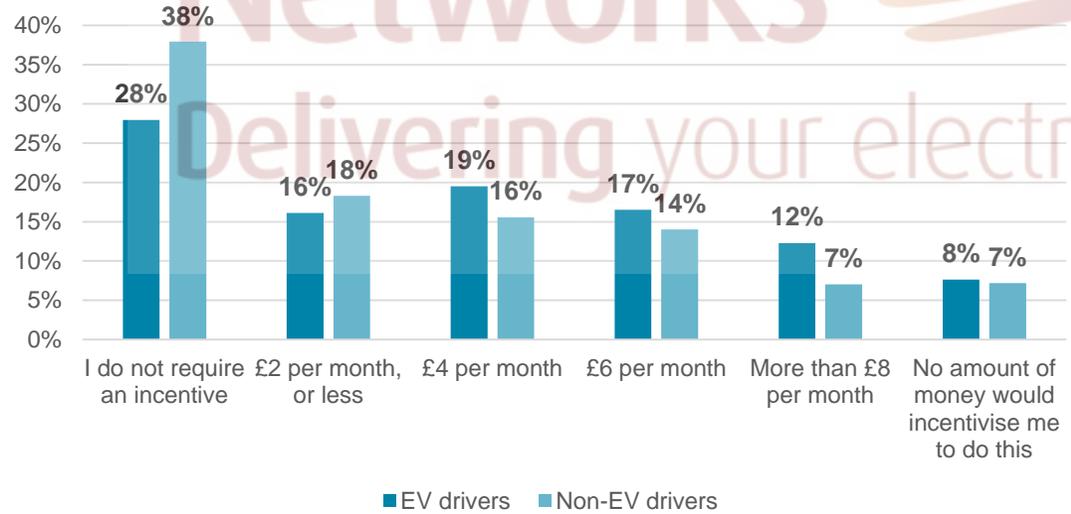
7 out of 10 participants would allow smart charging to occur for £4 or less per month

This is encouraging as the payment level of £4 per month is in line with what is currently provided by the market.

For reference: (1) it is similar to the average monthly savings for customers on the Octopus Agile tariff, and (2) it is less than the average monthly reward for the average Jedlix customer (a European smart charging service provider).

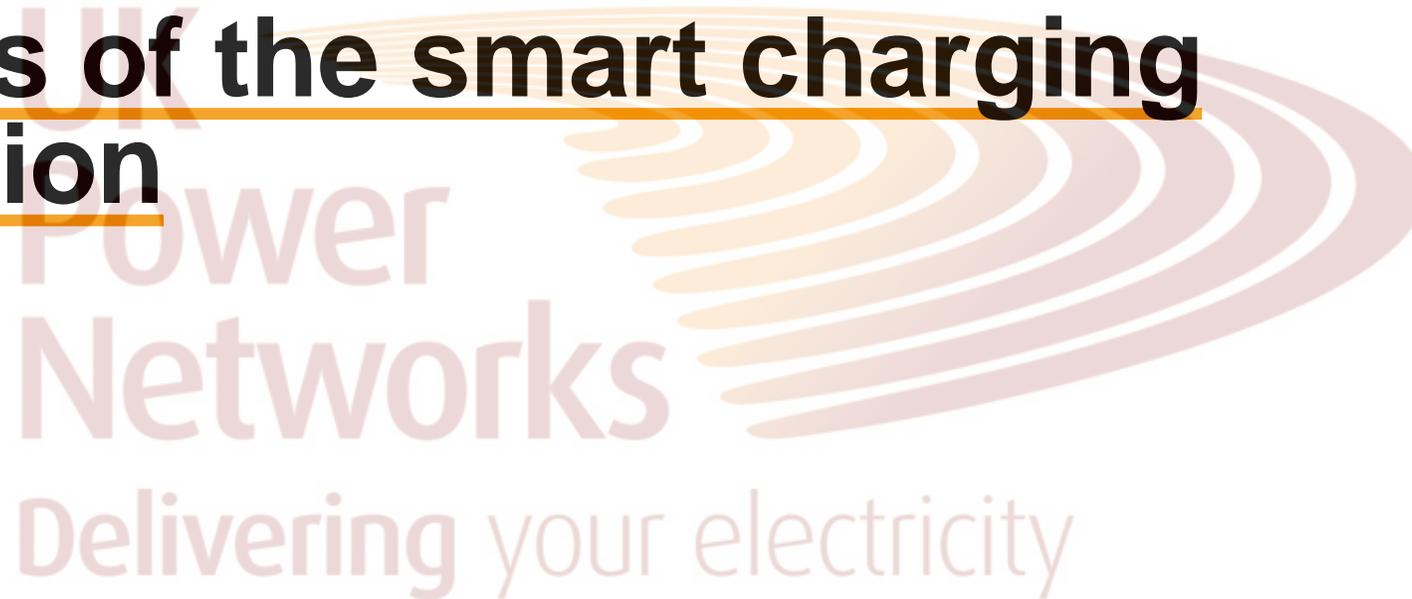
Q: What is the minimum payment that would incentivise you to allow an organisation to manage your EV charging? This would be so they can reduce the strain on the electricity network and save you money. Your car will have enough range for your next journey.

N = 750



- For drivers who are happy to receive no compensation for allowing smart charging to occur, the awareness that they are providing an environmental or social benefit may be sufficient in itself. However, this decision was made under the condition that their mobility is not impacted.
- Rural and semi-rural drivers were more willing to allow smart charging to occur for no compensation than urban and suburban drivers.
- Compensation expectations between £2 - £8 per month were largely similar between EV and non-EV drivers.

Elements of the smart charging proposition



Providing customers with the ability to override smart charging is likely to be a critical customer requirement

Section summary in 1 slide

1. More than 9 out of 10 participants rated being able to override smart charging as at least 'somewhat' important

- **EV drivers found this option more important than non-EV drivers.** This further reinforces the insight that providing customers with the override option is critical as drivers that have EV experience place higher importance on it.
- **Paying to override smart charging is a contentious issue with a mixed response from participants**
 - 6 out of 10 participants are not willing to pay to override smart charging - but there is no clear consensus on this topic.
 - £1.50 is the maximum amount participants are willing to pay per override.

2. Participants have similar preferences for a wide range of smart charging service providers

- **When considering the survey sample as a whole, energy suppliers were the preferred choice with DNOs being a close second** (this result is surprising as DNOs do not have a direct customer relationship). However, there was no overwhelmingly clear preference for a particular smart charging service provider.
- **Customers place a higher value on service quality than price when it comes something as important as their mobility.**
 - Service quality, trust and value for money are the three most important factors for choosing a smart charging service provider.

3. A range of smart charging information should be made available to the customer

- **Participants have no clear preference on what smart charging information they would like communicated to them** indicating that a range of information should be made available to the customer.
- **Participants prefer the smart charging process to be automated.**
 - **The increased reliability and certainty of response resulting from an automated smart charging process** is key for DNOs when managing network constraints and planning network upgrades.

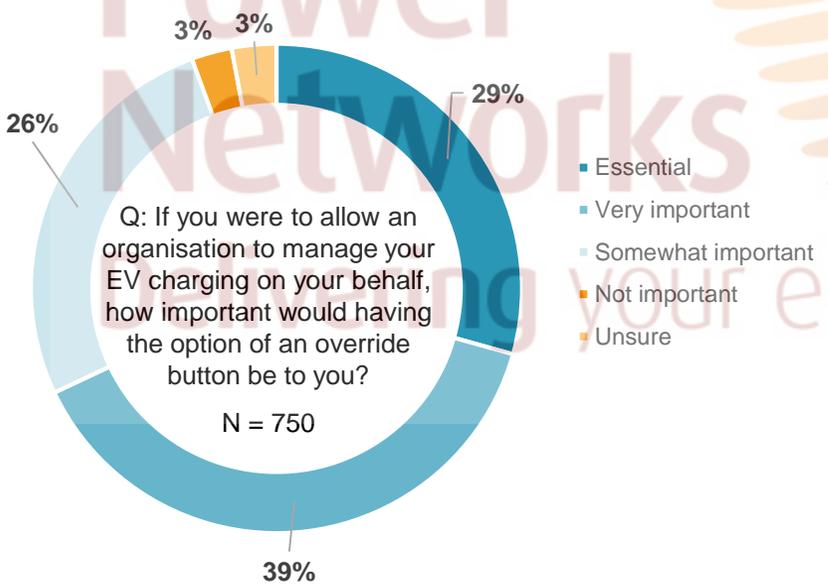
Providing customers with the ability to override smart charging is likely to be a critical customer requirement

More than 9 out of 10 participants rated being able to override smart charging as at least 'somewhat' important

94% of participants felt that the override option is important to some degree

7 out of 10 participants rated the override option as 'very important' or 'essential'.

- EV drivers found this option more important than non-EV drivers. This further reinforces the insight that providing customers with the override option is critical as drivers that have EV experience place higher importance on it.
- EV drivers who had longer typical journey distances and very consistent driving habits placed higher importance on the override option. This may be due to these customer types having less flexibility/room for error with recharging their EV.



Paying to override smart charging is a contentious issue with a mixed response from participants

EV drivers had a higher willingness to pay than non-EV drivers with more than half of the EV drivers willing to pay to override smart charging

6 out of 10 participants are not willing to pay to override smart charging

However, there is no clear consensus on this topic.

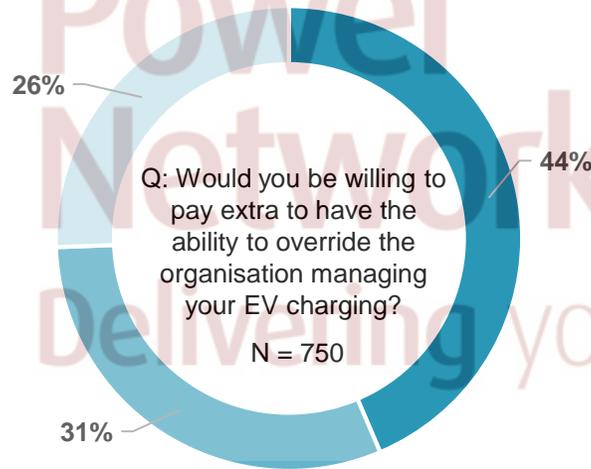
£1.50 is the maximum amount participants are willing to pay per override

*Only detailing results from participants who stated that they were willing to pay to override smart charging

Q: What is the maximum you would be willing to pay to have the ability to override the organisation managing your EV charging?

N = 327

EV driver insight:
EV drivers who had longer typical journey distances and 'very consistent' driving habits had a higher willingness to pay to override smart charging



- Yes
- No, any extra cost is too much
- No, I feel that it is unfair for me to have to pay extra to have this option

- Less than 2 out of 10 participants were willing to pay more than £1.50 per override.
- The younger participants (<35) had a higher willingness to pay to override smart charging.
- Lower income participants (<£31,999 per annum) were more likely to feel that being forced to pay to override smart charging was unfair.



Where willing to pay 50p per override

Were willing to pay £1.50 per override

Were willing to pay £3 per override

Participants prefer the smart charging process to be automated

This is an encouraging result from a network perspective as an automated process should result in an increased reliability and certainty of response from smart charging

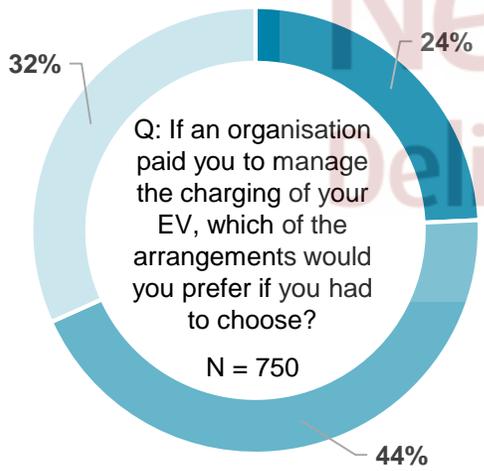
Although automation is preferred, there was no overwhelmingly clear customer preference on the best way to deliver smart charging

The increased reliability and certainty of response resulting from an automated smart charging process is key for DNOs when managing network constraints and planning network upgrades.

There was no clear preference on what smart charging information participants would like communicated to them

The lack of consensus from participants indicates that a range of smart charging information should be made available to the customer.

What information customers would communicated to them:



- I must be asked for permission every time the organisation wants to manage my EV charging
- I would prefer my charging to be managed automatically.
- I would prefer to manually manage my charging

- 30% Real time information about each charging session
- 24% Summary of monthly charging costs, energy use and instances when your charging was managed
- 22% Actual cost of the charge – provided after each charging session
- 17% Predicted cost of the charge – provided before each charging session

Q: If an organisation is managing the charging of your EV, what – if any – information would you like to be communicated to you?
N = 750

Participants have similar preferences for a wide range of smart charging service providers

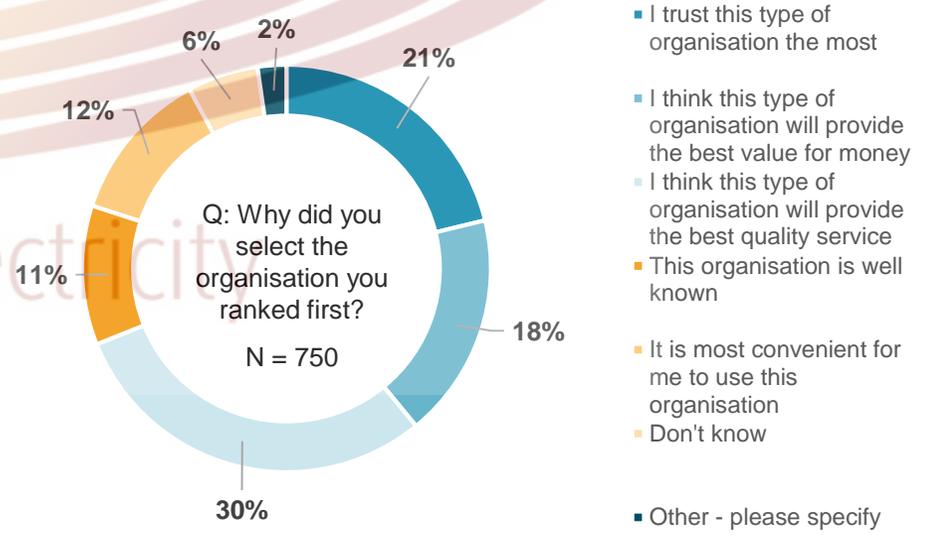
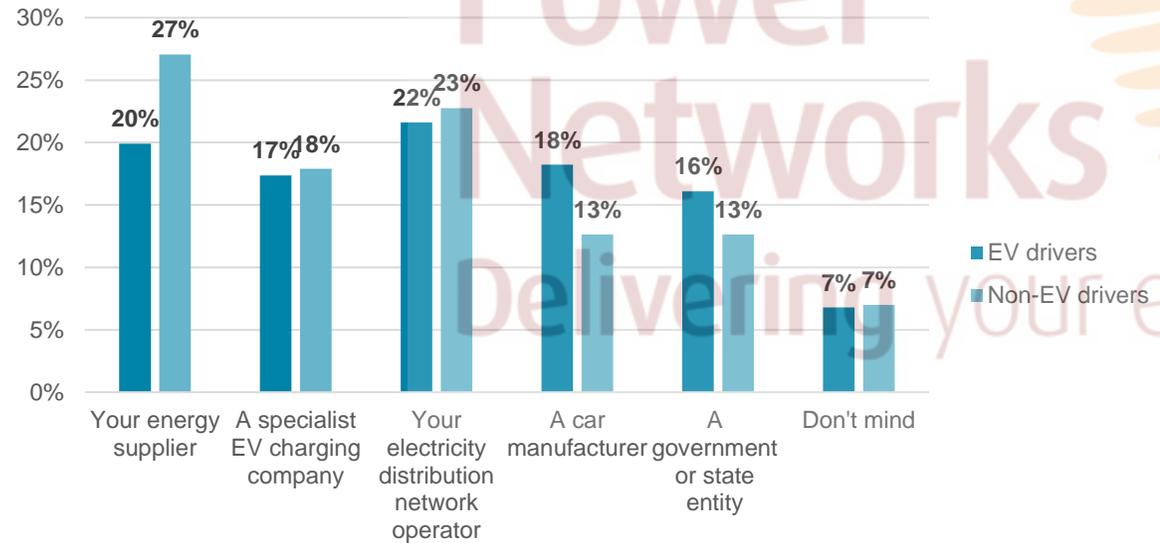
Service quality, trust and value for money are the three most important factors for choosing a smart charging service provider

Overall, participants marginally preferred energy suppliers and DNOs as their smart charging service providers

EV drivers marginally preferred their DNO as their smart charging service provider whereas non-EV drivers preferred their energy supplier.

Customers place a higher value on service quality than price when it comes something as important as their mobility

This is indicated by service quality being ranked as a more important factor than value for money.



Q: If an organisation were to help manage your EV charging, which of the following types would you trust the most to do this for you?

N = 750

DNOs are, by a small margin, the preferred smart charging service provider for EV drivers

Convenience and value for money were the primary drivers behind EV drivers choosing their DNO as their preferred smart charging service provider

Primary drivers for participants selecting their DNO as their preferred smart charging service provider:

EV drivers

- (1) convenience and (2) service quality.

Non-EV drivers

- (1) Service quality and (2) value for money

This is a surprising result given that DNOs do not have a direct customer relationship

Customers are typically unfamiliar with who their DNO is and what their DNO does. Therefore, it could be considered surprising that customers would trust their DNO to be their smart charging service provider.

However, research suggests customers are more likely to feel positively about their DNO when they either: (1) have a better understanding of who their DNO is and what they do*, or (2) have interactions with them**.

The selection of DNOs as the preferred smart charging supplier for EV drivers could be a result of these participants being more engaged in general with their energy usage (e.g. Delta-EE customer research found that EV owners are more likely to switch their energy supplier than the average UK customer) and their own impact on the network, but also more aware of the role of the DNO.

*Research by Northern Powergrid and Impact on addressing customer concerns about smart meter data sharing

**The Freedom Project. The majority of interactions customers had with their gas and electricity distribution network operators were positive.

Both EV drivers and non-EV drivers think their DNO will provide a high quality service

DNOs were the the second choice smart charging service provider for non-EV drivers (in addition to them being the preferred smart charging service provider for EV drivers).

Service quality was the primary driver for non-EV drivers, and the secondary driver for EV drivers, in selecting their DNO as their preferred smart charging service provider. This indicates that both EV drivers and non-EV drivers think their DNO will provide a high quality service.

These results also indicate that EV drivers place a higher value on convenience than non-EV drivers. Convenience was the primary driver behind EV drivers selecting their DNO as their preferred smart charging service provider.

Despite this, it is important to remember that, overall, service quality, trust and value for money were selected as the three most important factors for choosing a smart charging service provider by both EV and non-EV drivers.

Comparison of findings to other customer research studies

Comparing findings to the following reports:

1. Citizens Advice – Smart electric vehicle charging: what do drivers and businesses find acceptable?
2. Energy Systems Catapult (ESC) – Consumers, Vehicles and Energy Integration (full report yet to be published)

The Delta-EE research findings align with the findings from Citizens Advice's and ESC's customer research

The 7 key similarities* between the three studies are:



Customers are aware of the potential network issues an increase in EV uptake may cause and are open to the idea of smart charging (provided there is some benefit (e.g. financial) to the customer.



Customers value control of the charging process (e.g. by allowing customers to set their charging requirements or by providing the option to override a smart charging event)



A market-led approach as opposed to a load-management approach is preferred by customers.



Customers would like a range of information about their charging sessions. This information must allow them to make decisions in the moment (e.g. real-time charging information) and to assess whether they are benefiting from smart charging (e.g. monthly smart charging summaries).



The environmental benefits and potential financial gain are the strongest drivers when it comes to smart charging.



Customers would like their smart charging service provider to make automated decision on their behalf.



Customers value assurance of sufficient range for their next journey prior to plugging their vehicle in with the possibility of a smart charging event occurring.

*Appendix B details the key findings from the two studies.

Appendix A

Research overview and methodology



Research overview

Smart charging is one of the solutions to offsetting network reinforcement needs caused by the electrification of transport

There are a range of approaches to smart charging with no consensus amongst DNOs as to which is the preferred approach. The two approaches at the opposite ends of this range are:

1. A market-led approach to smart charging

This approach uses price signals to end-users to incentivise shifting of the EV charging load. Therefore, the cost of charging an electric vehicle is subject to price-based mechanisms (i.e. the higher the electricity demand on the network, the costlier it is to charge your EV).

For example, if you were to charge an EV at 18:00 when the overall power demand is high, it would cost more than if you decided to charge an EV at 22:00 when the overall power demand is low.

This is UKPN's preferred approach.

2. A load management approach to smart charging

This is an intervention led approach where the DNO takes an active role in managing the overall power demand of households (by curtailing EV charging) under specific circumstances.

For example, when the overall power demand is too high on the electricity grid, the DNO can actively activate smart charging to manage the total power demand on the electricity grid.

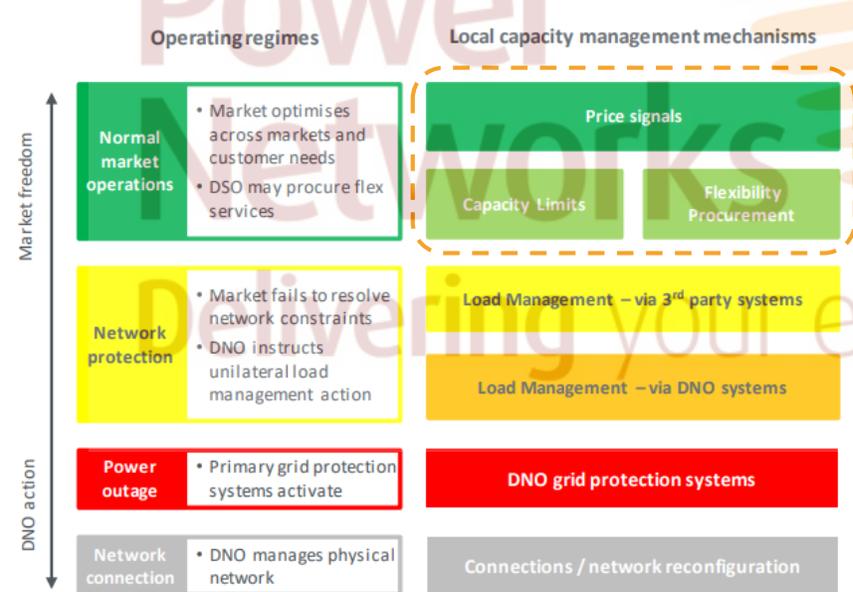
Research overview

UKPN's strategy is to support a market-led approach to smart charging

UKPN want to maximise market freedom for EV charging. To support this, UKPN have developed a hierarchy of smart charging mechanisms

The preferred approach for UKPN is to enable smart charging through price signals sent to customers.

The market-based approach is to be developed through UKPN's Shift project. The project aims to:



- 1 Develop and trial customer propositions
- 2 Understand customer response to these propositions and the network impacts in a controlled environment
- 3 Develop and test processes, system components and commercial arrangements to enable these propositions
- 4 Develop a scalable solution
- 5 Inform Ofgem's longer-term access and network charging reform

Delta-EE's involvement

Research overview

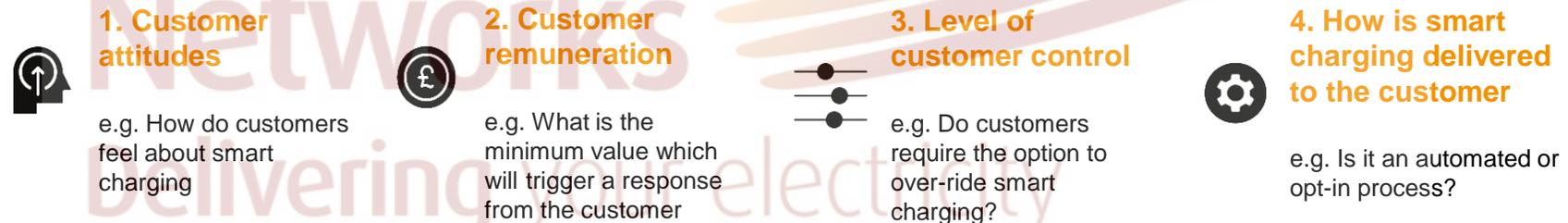
This research aimed to provide UKPN with customer insights on smart charging

This aim was broken down into two primary research objectives

1. Provide customer insight to inform and shape the design of UKPN's Shift project

To maximise market freedom for EV charging, an acceptable and appealing customer proposition is required. Therefore, insight into how customers will respond to smart charging as a whole as well as the different elements of a market-led smart charging proposition is valuable.

This customer insight was focused around four topics/themes:



2. Gather primary evidence on customer's perception of a market-led approach to smart charging

The customer insight is valuable as this is not the preferred approach by all UK electricity system stakeholders (e.g. other DNOs). Furthermore, this insight can be used to help inform Ofgem's longer-term access and network charging reform.

Research methodology

Achieving the research objectives

The research objectives were achieved by gathering customer insight. This customer insight was gathered using a three-step process

1. Focus groups

A total of three focus groups were held with prospective and current EV drivers during May 2019. There were:

- Two in-person focus groups (for 10 prospective EV drivers per group)
- One online focus group (for 20 current EV drivers)

The focus groups were an open forum where those invited could share their key concerns, objections and attractions of smart charging. The focus groups provided an opportunity for UKPN to ask current and prospective EV drivers open questions and following these up with probing questions to dig into reasons why particular opinions or views are held.

2. Co-creation workshop

There was one co-creation workshop (for 5 prospective EV drivers and 5 current EV drivers) held during June 2019.

The co-creation workshop enabled the research team, supported by a facilitator, to work with customers in an agile format to iterate smart charging propositions. The workshop allowed us to explore critical elements of the smart charging proposition with customers to gain a deeper level of insight into customer attitudes towards smart charging.

3. Customer survey

Online customer research aimed to gather the views of a much wider audience of both EV and non-EV drivers. The online survey consisted of an online survey with a sample size of 750 participants and c. 30 questions. The participant type breakdown was as following:

- Current EV drivers: 236
- Prospective EV driver (looking to purchase an EV within 5 years) with off-street parking: 414
- Prospective EV driver with on street parking: 100

The quantitative online research enables customer propositions to be explored with a representative sample of potential customers. This should yield further data and insights.

This report focuses on step 3

Report overview

Focus of this report

This report details the findings from the online survey. The customer research delivered insight on customer preferences on 10 key topics:

- | | | | |
|--|---|--|--|
| | Customers awareness of potential network issues resulting from an increase in EV uptake and their openness to the idea of smart charging | | Customer attitudes towards overriding the smart charging process and their willingness to pay for the ability to override |
| | A smart charging vs an infrastructure upgrade approach | | Customer reward for enabling smart charging to occur |
| | A market-led vs infrastructure upgrade approach | | How smart charging occurs (i.e. the level of automation) |
| | Intervention in an emergency situation on the network | | What information the customer receives from their smart charging service provider |
| | Preference differences between EV and non-EV drivers | | Customer's referred smart charging service provider |

Appendix B



Additional key findings from other customer research studies:

- 1. Citizens Advice – Smart electric vehicle charging: what do drivers and businesses find acceptable?**
- 2. Energy Systems Catapult (ESC) – Consumers, Vehicles and Energy Integration** (full report yet to be published)

Key findings from Citizens Advice's customer research (1/2)

On behalf of Citizen's Advice, TRL (a consultancy) conducted ten workshops with EV and non-EV drivers

The aim of this research was to get the participants views in relation to: (1) being flexible in their energy use; (2) various options for facilitating smart EV smart charging; (3) what provisions (if any) would make those options more (or less) acceptable and compatible with their needs.

The key findings were:

- Generally, participants understood and accepted the need to be flexible in their energy use, so as to accommodate the increased demands on the electricity network that are likely to result from increased EV adoption.
- Some participants believed that EV drivers should be responsible for helping balance electricity supply and demand, while others felt this responsibility should lie with National Grid, energy suppliers, or the government.
- Findings from this research indicate that there will be no 'one-size-fits-all' smart charging option. EV drivers will require a number of offers to choose from, depending on their needs and behaviours, and additional guarantees and information to encourage them to adopt smart charging.
- When deciding which smart charging options were most suitable for them, participants were most likely to consider factors relating to saving money and the environment, with EV drivers placing greater emphasis on being environmentally friendly than ICE vehicle drivers.
- Convenience of use and the assurance of a minimum level of charge for upcoming journeys were also key considerations.
- Having control over charging (e.g. via the ability to set charging preferences and to override scheduled charges) was important to the majority of household participants.

Key findings from Citizens Advice's customer research (2/2)

- In relation to the provision of information, many participants said that they would like to **receive notifications or information about costs of electricity and EV charging, compensation for services (e.g. allowing the grid access to energy stored in their EV battery), and their vehicle's current state-of charge.**
- Participants said that **the provision of guarantees would be an important factor when making decisions about smart charging options**, such as guarantees about the cost of electricity bills and the effects of using a service or scheme on the health of EV batteries.
- Participants from **rural locations were concerned that a lack of internet and mobile signal** where they lived meant that they would find it difficult to use some of the options, such as smart charging technologies.
- Participants who had **mobility difficulties or young children** expressed concerns that their irregular charging routines would make it difficult to plan their electricity usage.

Key findings from ESC's customer research (1/2)

The ESC have been conducting a three-year study into how drivers might use electric vehicles and the resulting impact on the energy system

The Consumers, Vehicles and Energy Integration (CVEI) study gathered in-depth data from EVs and charge points as well as conducting surveys with EV owners to understand attitudes, perceptions and choices.

The following findings reflect the views of those EV owners that were surveyed:

- One of the key findings of the customer research was that up to **95% of Battery Electric Vehicles (BEV) drivers would be happy to use 'smart charging'** – if it cut their energy bills.
- **Currently, most users charged their vehicles (BEVs and plug-in hybrid vehicles (PHEVs)) at home, overnight, following a well-established routine.** This included charging during peak times for the electricity system (4-7pm) - unless there is an incentive not to do so.
- **Smart managed charging was shown to be highly successful in shifting charging away from peak times** of electricity demand between 4-7pm and into the overnight period relative to unmanaged conditions.
- There was a general preference among both BEV and PHEV users for **fully recharging their vehicles whenever possible.**
- **Mainstream consumers prefer smart charging over simply plugging in and charging straightaway,** even if the saving from doing so was relatively low (e.g. £12 a year).
- **Participants were not generally enthusiastic about either time of use or managed charging tariffs,** seeing little benefit unless reductions in charging costs of between 25% and 60% could be achieved. Even such savings were not generally seen as important, as the cost of plug-in vehicle (PiV) charging is perceived as already low.

Key findings from ESC's customer research (2/2)

- **Two-thirds of participants expressed a preference for time of use tariffs over managed charging tariffs**, based on simplicity, retention of personal control, and reduction of perceived risk that vehicle would not be fully charged at the end of the planned charging period.
- Those that favoured managed charging tended to be BEV Innovators, who saw **advantages to society as a whole** that perhaps aligned with their symbolic motivations for having a BEV in the early market.
- **Managed charging propositions are unfamiliar to current internal combustion engine (ICE) drivers, and will require clear explanation at recruitment** (to ensure informed consent) and in briefing prior to participation. This should include information on whether/how users could override the managed charging system when they felt this was required
- **Mandatory use of smartphone apps to manage charging behaviour and interaction with third parties involved with EV owner charging activities may deter many**, especially older current ICE vehicle owners, from using ToU or managed charging.

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