DELTA
Energy & Environment

CUSTOMER INSIGHT ON SMART CHARGING

FOCUS GROUP AND CO-CREATION WORKSHOP REPORT

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Contents

Executive summary

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

Providing peace of mind for the customer is critical to the acceptance of smart charging. This is achieved by providing the customer with a sufficient level of control over their charging.

The potential for financial gain, having control over the smart charging process and the 'peace of mind' associated with it were the primary drivers for participants preferring a market-led smart charging approach.

Participants were concerned that smart charging would reduce their control over their mobility – and this was the participant's primary barrier to smart charging acceptance.

Providing the priority charging option (option to override smart charging) is a key requirement for potential customers. Providing customers with this option is critical to overcoming barriers to smart charging uptake.

Almost half of participants were willing to change their charging behaviour for as little as £3 per month. However, only if peace of mind and control of their mobility can be guaranteed.

Customers feel that the DNO should manage EV charging during a grid emergency situation. Participants would rather their EV charging be interrupted than a localised power outage occurring.

Customers would like their service provider to make smart charging recommendations to them. These recommendations should provide insight on which smart charging tariff/package is best suited to the customer (similar to what telecom companies are doing today) as well recommendations which educate customers on the best practice for smart charging.

There were stark **differences between EV and non-EV drivers' preferred options,** with it being clear EV drivers were more educated on the topic. This, in addition to participant's consensus that smart charging is a complicated topic, indicates that **customer education is critical for smart charging acceptance.**

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:

- Focus groups - a total of three focus groups were held with a total of 20 prospective and 20 current EV drivers in May 2019.
- A co-creation workshop - one co-creation workshop (for 5 prospective EV drivers and 5 current EV drivers) was held in June 2019.
- Customer survey – an online survey with a sample size of 750 participants and c. 30 questions.

This report focuses on steps 1 & 2

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

Customer attitudes

The potential financial rewards were the primary driver for participants preferring the smart charging approach

Smart charging was preferred to upgrading the electrical infrastructure. Within smart charging, a market-led approach was preferred to a load-management approach.

The drivers and barriers for a market-led smart charging approach are outlined below:

- **The reduced cost to the customer was the primary driver** for participants preferring smart charging compared to upgrading the electrical infrastructure.
- **Having choice and flexibility with their smart charging and the peace of mind associated with this** were the primary drivers for participants preferring a market-led approach to smart charging.
- **Smart charging 'limiting' the control that customer's have over their mobility** was the participant's primary barrier to the acceptance of smart charging.

Almost all EV drivers were in favour of a market-led smart charging approach, while the opinions were divided among non-EV drivers. This was because:

- **EV drivers had a better understanding of the EV charging process and were therefore more aware** of the potential network impact of increased EV uptake than non-EV drivers. This meant they were more open to smart charging and aware that their charging habits might have to change.
- **Non-EV drivers struggled to understand the concept of smart charging** and had concerns over whether is would be technically possible. This lack of understanding is key barrier to smart charging.

These differences in opinion and the recognition that smart charging is a difficult concept for the general public to comprehend indicates that **customer education is critical for smart charging acceptance**.

Customers feel that the DNO should manage EV charging during a grid emergency situation

The majority of participants expected compensation for any emergency interruption as it is a disruption in service delivery.

When presented with the two options, the majority of EV and non-EV drivers would rather their EV charging be interrupted than a localised power outage occurring.

Three key customer preferences for a DNO intervention during a grid emergency situation:

- **Customers still wanted ultimate control and therefore would like to have the option to override the DNO managing their EV charging**. However, there was the recognition that this could defeat the point of the DNO intervention.
- **Customers were unhappy about having their household appliances managed** and would rather their EV charging be managed.
- If possible, **customers would like prior warning of this DNO intervention occurring**.

The majority of EV and non-EV drivers felt they should be compensated for enabling DNO intervention as it is a break/disruption in service delivery**.**

Interestingly, c. 30% of EV drivers in the focus group stated that if they still had sufficient range to complete their next journey then they did not need to be compensated.

'They would have to manage that, because although, yes, I'm going to miss dinner, or whatever, I'm going to run out halfway through, versus London goes out, I think it's a no-brainer, isn't it?.' **– EV driver**

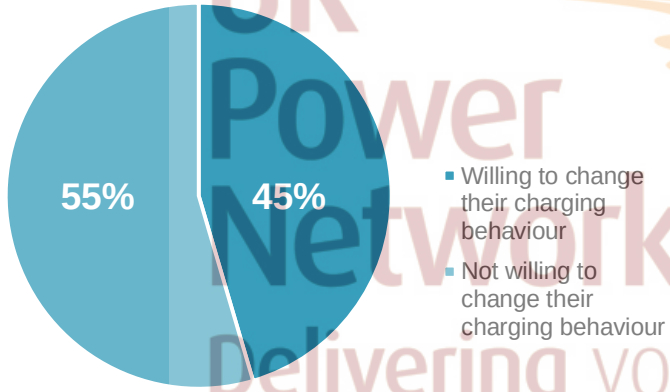
'Yes, I would take it [the compensation]… I will take a £20 refund and I will opt in [to the DNO intervention]'– **non-EV driver**

Smart charging reward

Almost half of participants were willing to change their charging behaviour for as little as £3 per month

However, peace of mind and control of their mobility must be guaranteed before customers will consider changing their charging behavior:

Percentage of participants willing to change their charging behaviour for £3 per month*



*n=33

These findings were taken from focus group participants but were consistent with the findings of the co-creation workshops. These results are indicative of opinion only.

There were minimal differences in the appeal of smart charging among EV and non-EV drivers. Therefore the overall high percentage of participants willing to change their charging behaviour indicates that **providing a reward for smart charging could have a material impact on electricity demand.**

Unwillingness to change behavior was due to:

- **The level of reward being too small**.
- **Control over their mobility and the associated peace of mind were more important factors**.

The results indicate that, if the level of reward is low, **emotive factors can be more influential drivers for charging behavior.** Therefore, a high-quality smart charging service is likely to be needed to provide customers with a sufficient level of control and peace of mind to encourage openness to changing behaviour for small rewards.

However, some customers simply won't change their behaviour – 30% of EV drivers from the focus group were not willing to change their charging behaviour for any level of reward.

'I stand by what I've said that I'd rather control, have some control of what I do than extra money.' **– non-EV driver**

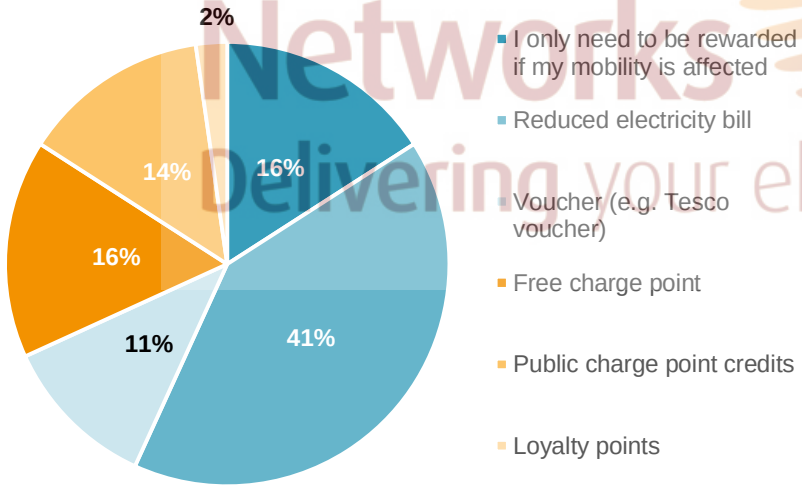
'Every little [sum of money] helps.' **– non-EV driver**

Participants would prefer to receive their reward in the form of a reduced electricity bill

It is important that the reward is delivered in a transparent manner for the customer.

A reduction in their electricity bill was, by some margin, the focus group participants preferred method of receiving their reward*

Q: How would you like to be rewarded for allowing smart charging to occur? [choose one option]



The key participant requirement is that **the reward is communicated to the customer in a transparent and easy to access manner.**

> 'On the bill, yes. Right.' **– non-EV driver**

> 'I imagine for the inconvenience, the potential inconvenience of your car not being charged exactly when we want it, the price per unit [of electricity] would be less.' **– EV driver**

* These findings were taken from focus group participants but were consistent with the findings of the co-creation workshops.

Elements of the smart charging proposition

Providing the ‘priority charging option’ (option to override smart charging) is a key requirement for potential customers

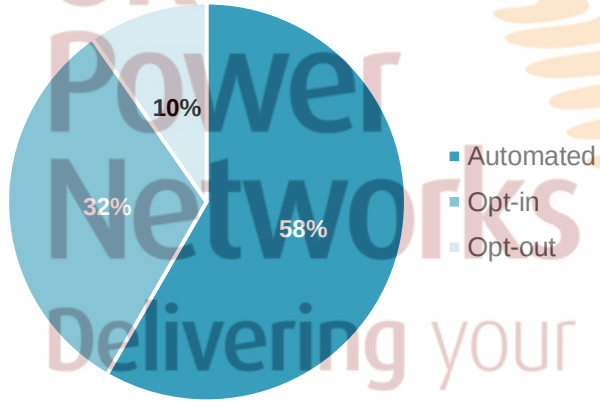
The majority of EV and non-EV drivers were in favour of having the priority charging option as it provides the customer with a sense of control and peace of mind. Overall it is most likely that the option would be taken up in ‘emergency’ situations only:

- **‘Peace of mind’ is the primary driver for customers in favour of priority charging**. Customers consider this an ‘insurance policy’ or comfort blanket. Even if the option is not taken up, it gave them confidence that their mobility requirements would be met in any unexpected or emergency circumstances.
- **Equitability was a primary concern for participants if ‘priority charging’ is made available.** Given the probability that it will cost extra to use, participants were concerned that certain socio-economic groups may be excluded from using it, or may be forced to think twice about using it in an emergency.
- **Abuse of the function (by those that can easily afford it) was also a concern** as well as some participants being unhappy about being ‘penalised’ (i.e. having to pay more) for changing their schedule. For example if they have to use their EV earlier than anticipated and thus had to use the priority charging (which is more expensive) option to ensure their EV has sufficient range.
- **Both EV and non-EV drivers expected to only use the priority charging option in uncommon or ‘emergency’ situations**. This indicates that it will be the exception, not the norm, for households to override smart charging.

Participants prefer the smart charging process to be automated

This is an encouraging result from a networks perspective as an automated process could result in more EV loads being shifted.

The majority of EV and non-EV drivers prefer the smart charging process to be automated*



Q: Where along the scale [participants shown image] would you be accepting of how smart charging can occur?

A higher percentage of EV drivers, than non-EV drivers, preferred this option. Therefore, as customers become increasingly educated and comfortable with the charging process we expect the percentage of customers who prefer this option to increase**.**

Primary customer drivers for an automated smart charging process:

Reduced hassle factor for the customer as an automated process increases the 'ease of use'.

Higher potential financial reward due to the increased probability of being involved in smart charging events.

Reduced control over the smart charging process was the primary customer barrier

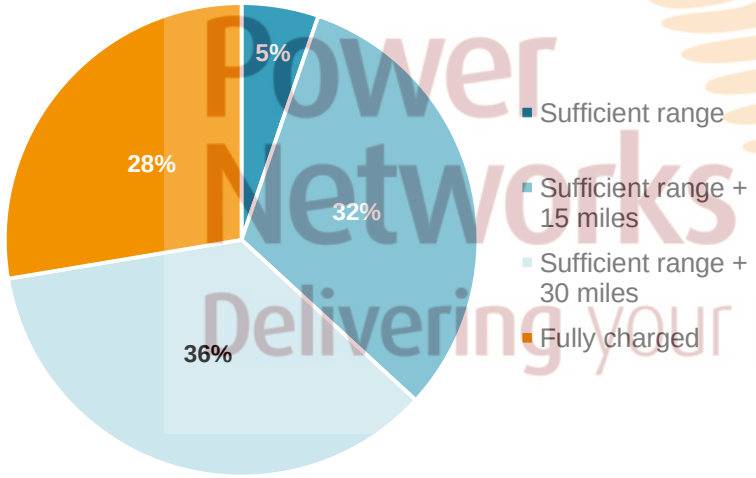
Participants were hesitant to reduce the amount of control they have over the charging process. The less control they have the less peace of mind they have.

*This graph only represents the opinions of the focus group participants and does not include the opinions of the co-creation workshop participants.

Peace of mind is the determining factor when it comes to the amount of range required per charge

Participants don't necessarily require a fully charged battery, only a sufficient amount of range to provide them with peace of mind.

The majority of EV and non-EV drivers did not require a fully charged battery*



Q: Where along the range scale [participants shown image] would you be comfortable?

*This graph only represents the opinions of the focus group participants and does not include the opinions of the co-creation workshop participants.

The primary driver behind participants preferences was, again, peace of mind. Having sufficient range (which is hard to define and depends on personal circumstances) for their next journey and in unexpected/emergency situations were key requirements for participants.

These findings don't provide direct insight into how customers will charge their EVs, but it does indicate that when customers plug their EV in, they don't necessarily require their EV to be fully charged by the end of the charging session.

'…you wouldn't go to a petrol station every day just because you used 30 miles.'
– EV driver

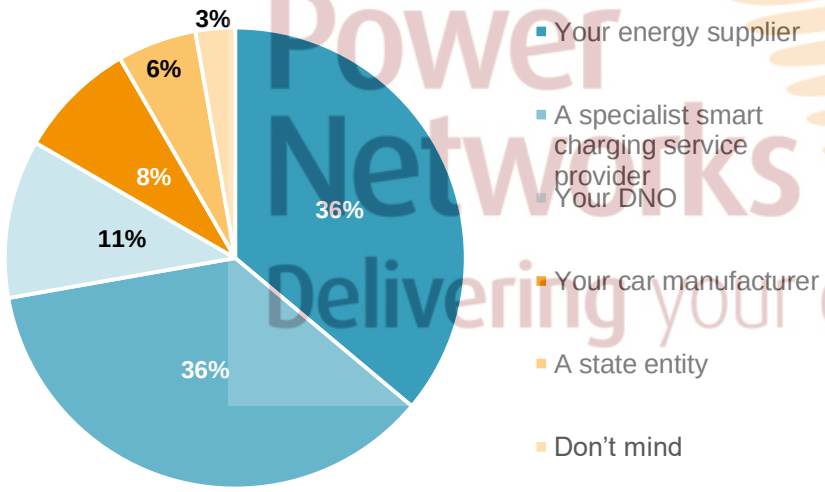
'…it's just that added comfort that if you have those unexpected additional journeys or if you feel that you want to do something else, that 30 miles I think would cover it.'– **non-EV driver**

Customer proposition preferences

Energy suppliers and specialist smart charging companies are the preferred smart charging service providers

Familiarity and trust are key for the customer - customers are familiar with and have an existing relationship with their energy supplier but would also trust companies specialising in a specific service (e.g. smart charging).

Smart charging service provider preferences were similar for both EV and non-EV drivers



Q: Who would you trust to be your smart charging service provider?

*This graph only represents the opinions of the focus group participants and does not include the opinions of the co-creation workshop participants.

- **Trust is the primary driver due to smart charging being an unknown and unfamiliar concept.** As customers become more educated and familiar with smart charging we expect them be open to a wider range of sales channels.
- **Energy suppliers are sometimes 'un-popular' but their familiarity also means they are highly trusted**. Customers regularly interact with them on energy, and would trust them with complex energy related concepts such as smart charging.
- **As smart charging is viewed as a highly complex 'specialist' concept – specialist smart charging service providers are also a preferred supplier.** This is based on the assumption that specific companies that are experts in the technology will also have the expertise and skills to deliver a high quality service.

Financial information must be provided to the customer but they would also like choice and flexibility over what other information they receive

In addition to financial information being provided, customers would also like their service provider to make smart charging recommendations to them.

Financial information is the key topic to be communicated to the customer

This can be segmented into two different types of information:

1. **Information on their financial reward** received from allowing smart charging to occur.
2. **Information to support them in making an informed decision on whether to charge** their EV prior to charging. This includes the following information about the charging session:
   - Predicted cost
   - Amount of charge provided
   - Time taken

Different customers want different things in terms of communication:

Customers would like to be provided with a large amount of choice akin to a 'build your own' communication interface. This will provide customers with flexibility in the type of information they receive (in terms of topic and depth of information provided) from their service provider as well as flexibility in the frequency they receive it.

Customers would like their service provider to make smart charging recommendations to them:

These recommendations should include information on:

- **Which smart charging package/tariff is best suited to the customer**. This is similar to how telecom companies (e.g. GiffGaff) provide recommendations on which mobile phone package/bundle is best suited to them.
- How to **improve one's smart charging habits**.
- Tips on how to **save money with smart charging**.

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 only due to be published in a couple of weeks)

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

The 9 key similarities* between the three studies are:

Customers are willing to change their charging behaviour for a relatively small financial reward.

The majority of customers **prefer a smart charging option which provides them with personal control.** This indicates that a market-led approach is preferred compared to a load-management approach.

The financial aspect of smart charging is one of the key topics customer's would like communicated to them.

Customer convenience and peace of mind are two critical customer considerations for smart charging acceptance and uptake.

The financial aspect of smart charging is one of the key topics customer's would like communicated to them.

Customers want ultimate control and therefore would like to have the option to override the smart charging process.

Customers will **fully charge their vehicles whenever possible.**

The **reward associated with smart charging is considered low** by some customers.

Smart charging is **a complicated topic and customer education is required.**

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

Appendix A

Relevant participant quotes

Relevant participant quotes (1/3)

Smart charging vs upgrading the electrical infrastructure

‘Smart charging is essential if electric car consumption increases in the speed we want it to. Currently I don’t consider when I charge my car and its very much on a “need to” basis but that is because so few people currently have electric cars.’ **– EV driver**

‘Mine is financial reward. I can understand environmental impact. I wouldn't need that to motivate me. That would be, to me, is a natural by-product of doing it.’ **– EV driver**

Market-led vs load-management approach

‘I am very happy with the market led approach as it helps the customer to have flexibility on how they want to charge their EV and also with a lot more control.’ **– EV driver**

‘…when it comes to the operators, you just don't know what's going to happen. Like you said, there might be a fixed price. It might not be a price I like, though, and it might be locked in for a period of time. There's no trust there.’ **– non-EV driver**

DNO intervention in an emergency situation

‘They would have to manage that, because although, yes, I'm going to miss dinner, or whatever, I'm going to run out halfway through, versus London goes out, I think it's a no-brainer, isn't it?.’ **– EV driver**

‘…you're damn right, I want compensation. If they say they are providing a service and they do not provide it….’ **– non-EV driver**

‘I think if you're compensated that cost is clawed back somewhere else and you end up paying anyway .’ **– non-EV driver**

Relevant participant quotes (2/3)

Smart charging reward

‘Every little helps.’ **– non-EV driver**

‘I stand by what I've said that I'd rather control, have some control of what I do than extra money.’ **– non-EV driver**

‘…between £3 and £9, it's just not a big enough incentive for me to consider it.’ **– non-EV driver**

Priority charging

‘Priority charging is a must as may have to go out in emergency’
– EV driver

‘I think that I would use this rarely in a charging emergency. Having an additional cost might limit the over use of it.’
– EV driver

‘That's putting tiers back into society. We've spent hundreds of years trying to get rid of.’ **– non-EV driver**

Required level of battery charge

‘…you wouldn't go to a petrol station every day just because you used 30 miles.’
– EV driver

‘…it's just that added comfort that if you have those unexpected additional journeys or if you feel that you want to do something else, that 30 miles I think would cover it.’– **non-EV driver**

Relevant participant quotes (3/3)

How smart charging occurs

'I'm not sure I would check my phone or want to be woken up to make the decision on whether to opt in or not'– **EV driver**

'It's annoying enough having to think about your phone being charged; you know that one night you forget to charge your phone it's mayhem the next day – I'd rather automated.' **– non-EV driver**

Preferred smart charging service provider

'Whereas if it all came through my energy supplier, OVO, or whoever it is, then I'm kind of used to that. I have some kind of communication with them already.'
– EV driver

'… a specialist smart charging service provider, because they know the ins and outs of it, probably are ahead of the game in all the updates and knowing everything. All the others are just bringing on an extra service to their core services.'
– EV driver

Information customer receive from their smart charging service provider

'having the flexibility [of what information you can receive] is important'
– EV driver

'Yes, like Giffgaff do, for example. They'll tell you every month whether you're on the right plan or you're on the wrong plan..'
– EV driver

Appendix B

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.

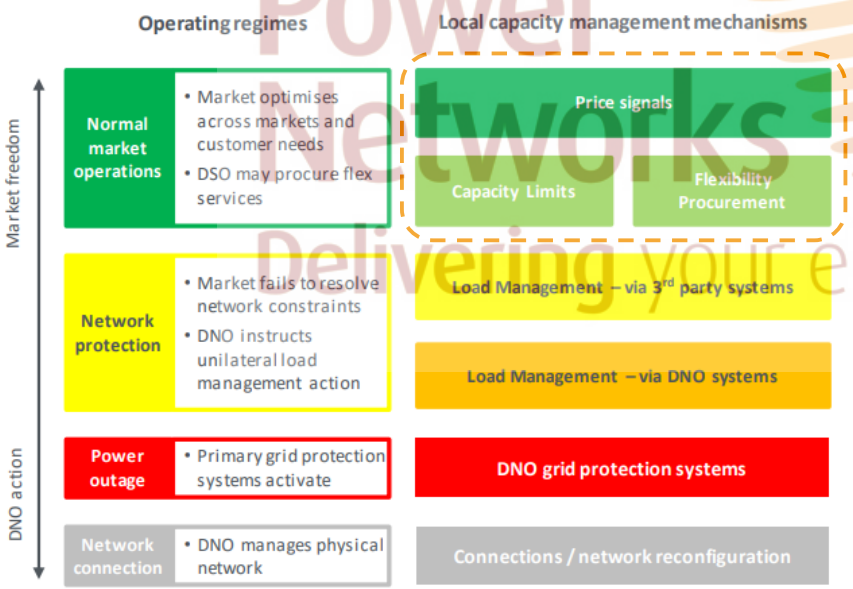
For example, when the overall power demand is too high on the electricity grid, the DNO can actively activate smart charging to manage the total power demand on the electricity grid.

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:

1. Customer attitudes

e.g. How do customers feel about smart charging

2. Customer remuneration

e.g. What is the minimum value which will trigger a response from the customer

3. Level of customer control

e.g. Do customers require the option to over-ride smart charging?

4. How is smart charging delivered to the customer

e.g. Is it an automated or opt-in process?

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 on-line focus group (for 20 current EV drivers)

The focus group 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, still to be carried out, will aim to gather the views of a much wider audience of both EV and non-EV drivers. The online survey will consist of an online survey with a sample size of 750 participants and c. 30 questions.

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 1 & 2

Report overview

Focus of this report

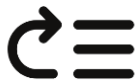
This report details the findings from the focus groups and the co-creation workshops. The customer research delivered insight on customer preferences on 10 key topics:

A smart charging vs an infrastructure upgrade approach

A market-led vs infrastructure upgrade approach

Preference differences between EV and non-EV drivers

DNO intervention in an emergency situation on the network



Customer preferences for priority charging (option to override smart charging)

Customer reward for enabling smart charging to occur

How smart charging occurs (i.e. level of automation)

The required level of battery charge by the homeowner

Customer's referred smart charging service provider

Customer communication with the smart charging service provider

Appendix C

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 only due to published in a couple of weeks)

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 1/2

- **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 over-ride 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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