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Customer Research and Trial Update Report
Electric Nation

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Contents

Glossary

Abbreviation	Term
BEV	Battery Electric Vehicle
EV	Electric Vehicle
E7	Economy 7
HV	High Voltage
NIA	Network Innovation Allowance
PIV	Plug-In Vehicle
PHEV	Plug-In Hybrid Electric Vehicle
REX	Range Extender Vehicle

1 Introduction

This report provides an update on the customer-facing aspects of Electric Nation ("the Project") – both the customer research questionnaires and trials of smart charging. As detailed below, the project aims to show the technical feasibility and benefits of smart charging and customer acceptance of the concept.

The smart charging trial was completed in December 2018. Previous milestone reports have contained analysis of the of the Recruitment, Baseline, Trial 1 and Trial 2 surveys. These can be found at: https://www.westernpower.co.uk/innovation/projects/electric-nation

This report contains analysis of the preliminary findings of the attitudes and charging habits from CrowdCharge participants in Trial 2 and GreenFlux participants in Trial 3. CrowdCharge trial participants were surveyed after they had experienced at least six weeks of demand management in Trial 2. GreenFlux participants were able to access the Trial 3 version of the app for at least five weeks before they received a survey link.

This report provides an update on activities which took place between November 2018 and January 2019. A final report encompassing the full customer trial will be published later in 2019.

The report authors would like to thank Impact Utilities, who are providing customer research expertise to the Electric Nation project, for their input and insight into Sections 2, 3 and 4 of this report and for providing graphics included in these sections.

1.1 The Electric Nation Project

Electric Nation is a Western Power Distribution and Network Innovation Allowance funded project. WPD's collaboration partners in the project are EA Technology, DriveElectric, Lucy Electric GridKey and TRL.

Electric Nation, the world's largest domestic smart charging electric vehicle (EV) trial, is revolutionising domestic plug-in vehicle charging. By engaging 500-700 plug-in vehicle drivers in trials, the project is answering the challenge that when local electricity networks have 40% - 70% of households with electric vehicles, at least 32% of these networks across Britain will require intervention.

The project is developing and delivering a number of smart charging solutions to support plug-in vehicle uptake on local electricity networks. A key outcome will be a tool that analyses plug-in vehicle related stress issues on networks and identifies the best economic solution. This 'sliding scale' of interventions will range from doing nothing to smart demand control, from taking energy from vehicles and putting it back into the grid, to traditional reinforcement of the local electricity network where there is no viable smart solution.

The development of the project deliverables is being informed by a large-scale trial involving plug-in vehicle drivers that will:

- Expand current understanding of the demand impact of charging at home, on electricity distribution networks, of a diverse range of plug-in electric vehicles - with charge rates of up to 7kW, and a range of battery sizes from 6kWh to 100kWh (All-Electric Ranges from 10 miles to 250+).
- Build a better understanding of how vehicle usage affects charging behaviour.
- Evaluate the reliability and acceptability to EV owners of smart charging systems and the influence these have on charging behaviour. This will help to answer such questions as:
    - Would charging restrictions be acceptable to customers?
    - Can customer preference be incorporated into the system?
    - Is some form of incentive required?
    - Is such a system 'fair'?
    - Can such a system work?

The results of this project will be of interest and will be communicated to the GB energy/utility community, to UK government, to the automotive and plug-in vehicle infrastructure industry and to the general public.

To be eligible to participate in the project Electric Nation participants are required to already have an EV, or to be about to take ownership of an EV. They must live in the WPD licence area (the Midlands, South West and South Wales). In return for taking part in the project the participants receive a smart charger. Trial participants are recruited via a recruitment campaign that has utilised social media, internet presence, traditional PR, attendance at EV events and creating links with EV retailers.

1.2 Purpose and Structure of Report

The purpose of this report is to provide an update on the progress of the trial aspects of Electric Nation, both the smart charging roll-out and customer research. It also sets out the next steps for the project.

The structure of the report and the contents of each section is as follows:

- Section 1: an introduction to the document and its purpose.
- Section 2: the customer research approach, the surveys which customers will complete, and data collected by the trial to date.
- Section 3: preliminary analysis of the CrowdCharge Trial 2 survey, including insight into the results from the survey of customers who have received the app.
- Section 4: analysis of the Greenflux Trial 3 survey results including insight into customer interaction with the customer interface with incentives.
- Section 5: describes the time of use tariff that was applied to both CrowdCharge and GreenFlux participants EV charging during Trial 3 and the reward structure used.

- Section 6: focuses on the third CrowdCharge algorithm and the level of interaction by participants with the CrowdCharge system.
- Section 7: describes the third GreenFlux trial, the impact this has had on group demand and charging behaviour, and the level of interaction between participants and the GreenFlux system during Trial 3.
- Section 8: gives a brief overview of the current status of decommissioning 'smart' elements of the chargers which have taken part in Electric Nation.
- Section 9: sets out the next steps for the project.

2 Customer Research and Data Collection

2.1 Customer Research

Customer research is one of the many data sources being gathered by the Electric Nation trial (others include charge point data, data from apps or demand control preference systems and participant enquiries). This research is being undertaken by Impact Utilities. These sources of information will be used to provide an answer to the overall customer objective of the trial:

> To prove which, if any 'Managed EV Charging to Support Local Electricity Networks' regime applied to trial participants is most likely to be satisfactory to all customers.

A condition of taking part in the Electric Nation trial[1] requires participants to complete a number of surveys during the course of the Project to enable the Project to understand participants' attitudes toward charging their EVs and their level of acceptance of varying degrees of managed charging. As the trial progresses and the level of managed charging/systems used to manage charging changes, the customer research will map any alterations in the participants' attitudes towards charging their vehicles and managed charging.

Participants contact details were collected by DriveElectric, the project partner responsible for participant recruitment and associated data protection[2], as part of the enrolment process. DriveElectric clearly explain to trial participants before they enrolled in the Electric Nation trial that they are obliged to complete customer research surveys. The graphic overleaf demonstrates the exchange of participant data between DriveElectric and Impact Utilities.

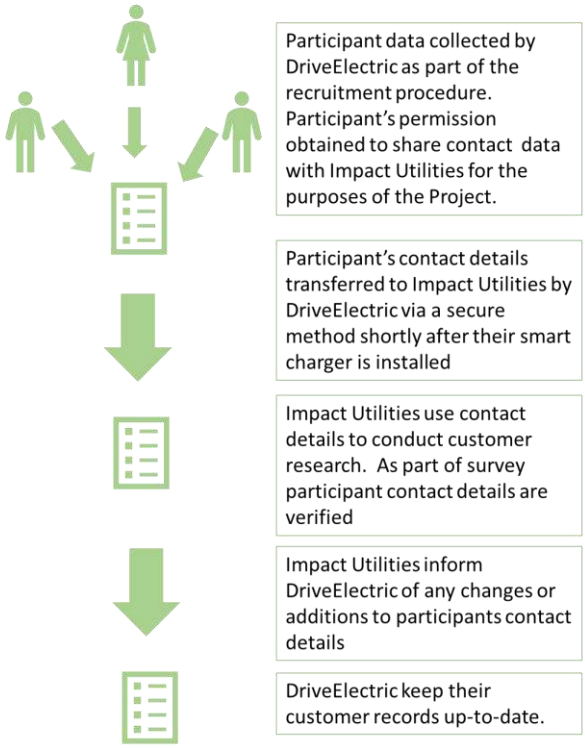
Shortly after the installation of a participant's smart charger they were asked to complete the Recruitment survey (see Appendix 1). This survey concentrated on collecting demographic and socio-economic data, information about the participants, their household, their plug-in vehicle (PIV) and their level of satisfaction with their smart charger installation experience. Until May 2018 participants were then (between 4 and 6 weeks after having their charger installed or after receiving their EV, whichever is later) asked to complete a Baseline survey (see Appendix 2) to obtain data on their charging behaviour, their satisfaction with this and their attitude towards having their charging managed. After May 2018 a large enough sample size (i.e. more than 100 survey returns) of the Baseline survey was collected, so participants were moved into demand management as soon as stable communications had been proven with their charge point.

[1] This condition is highlighted in project publicity literature, such as the Project website and brochure (which can be accessed via the Project website http://www.electricnation.org.uk

[2] The Projects Data Protection Strategy can be found at: http://www.electricnation.org.uk/wp-content/uploads/2016/11/NIA_WPD_013-CarConnect-Data-Protection-Strategy-FINAL.pdf -this is in the process of being updated to be compliant with GDPR.

Further surveys are conducted towards the end of each managed charging cycle, and then a final survey will be conducted at the end of the trial. The content of these trial surveys is very similar to the Baseline survey in Appendix 2 to allow direct comparison. Surveys enquiring about the participants' experience of using an app ask some questions directly relevant to that app so that feedback can be gathered, for example, about how easy the app was to use.

Figure 1: Exchange of participant data between DriveElectric and Impact Utilities



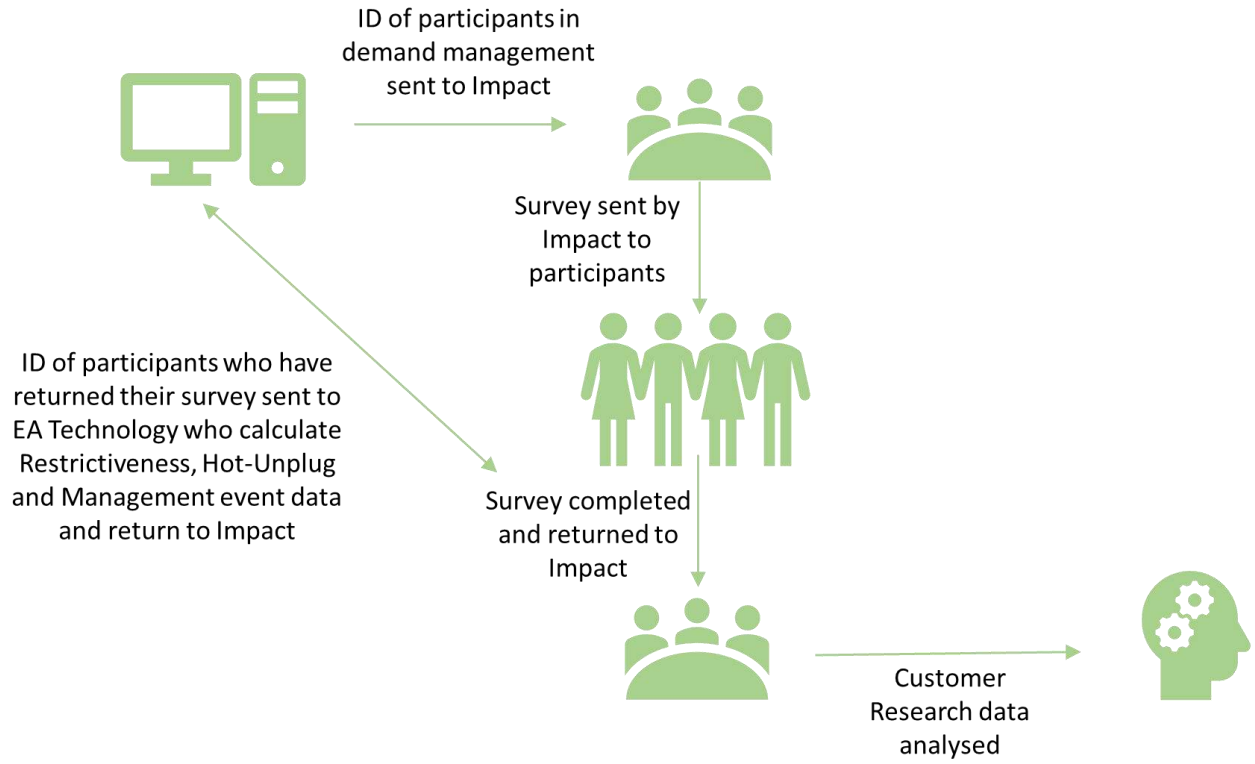
2.2 Surveys investigating attitudes to managed charging trials

As mentioned above, this report will be focused on providing interim analysis of the customer survey results from the CrowdCharge cohort of trial participants who received an app as part of Trial 2 and Greenflux participants who received and updated an app as part of Trial 3. The features of these apps are described in Sections 6 and 7 (CrowdCharge and GreenFlux, respectively). Not all project participants have been part of this demand management trial to date because of technical issues with their smart charger (mainly communications not working or configuration issues which cannot be resolved remotely – in most cases this does not prevent the customer charging but would prevent demand management from working at all or correctly)[3].

[3] These technical challenges have implications for future potential roll-out of smart charging. The experience gained in this trial is potentially valuable for future research, product development and future roll-out of smart charging. Findings of this type will be summarised and incorporated into the project's final reports.

An important aspect of the Electric Nation trial is to monitor how participants' attitudes to demand management are altered by their experiences of demand management in the project. Therefore, it is important that the survey results are analysed in the context of the individual participants' experience of demand management. The flow of information and precise data that Impact Utilities will require to judge the impact of demand management on participants has been considered by the project team. This data and information flow is illustrated in the diagram below:

Figure 2: Data flow for trial 1 survey



Impact Utilities is informed by EA Technology of the ID of participants who have been invited to download the Crowd Charge and Greenflux apps. After Crowd Charge participants had access to the app for at least six weeks they would be issued the Trial 2 survey (for comparison against the first baseline survey as it contains many identical questions, however, at the end it also has questions specific to the app). Greenflux participants had access to the Trial 3 app for at least four weeks before they were sent a link to the survey (again, to aid comparison this survey has many identical to the Baseline survey and also includes additional questions specific to the app). Crowd Charge participants were allowed a lengthier trial period because these participants had to actively download the app which may have taken the participant a few days in comparison to the Greenflux app that automatically updated.

Impact Utilities issue these survey links to the relevant participants and encourage them to complete the survey, either online or by telephone according to the participant's choice. Impact Utilities will then inform EA Technology when a participant has completed their survey, so data can be generated about the impact of demand management on the

participant. Impact Utilities will then use this data to inform their analysis of the survey responses that they receive. A full analysis of this data will be undertaken at the end of the trial.

2.3 Data Collection

Recruitment for the Electric Nation trial (and, so, installations of smart chargers into participant's homes) started in January 2017. The final installations were completed in July 2018.

Trial survey 2 investigates participant attitudes to the second managed charging trial. This report contains analysis of the results from the CrowdCharge cohort. The second CrowdCharge algorithm was launched later than the corresponding Greenflux app and required six weeks to elapse between the date at which the participant was invited to sign-up to the app and the survey being issued as opposed to four for the Greenflux app because of differences in the way that participants receive and download the app. Preliminary results from the Trial 2 Greenflux survey were contained in the September 2018 Milestone report.

The CrowdCharge trial survey 2 has involved 293 trial participants who have had access to the CrowdCharge 'Journey Planner' app for at least 6 weeks. Response rates to this survey are summarised in the table below.

	Surveys Sent	Surveys completed
%	100%	57%
N	293	168

Table 1: Trial 2 surveys completed

Trial survey 3 analysis in this report investigates Greenflux participants' attitudes to a customer interface that used a financial incentive to reward trial participants for accepting charge management. The third Greenflux app was launched earlier than the corresponding CrowdCharge app thus allowing inclusion of preliminary results in this report.

The GreenFlux trial survey 3 involved 273 trial participants who have had access to the GreenFlux 'charging preference' app for at least 4 weeks. Response rates to this survey are summarised in the table below.

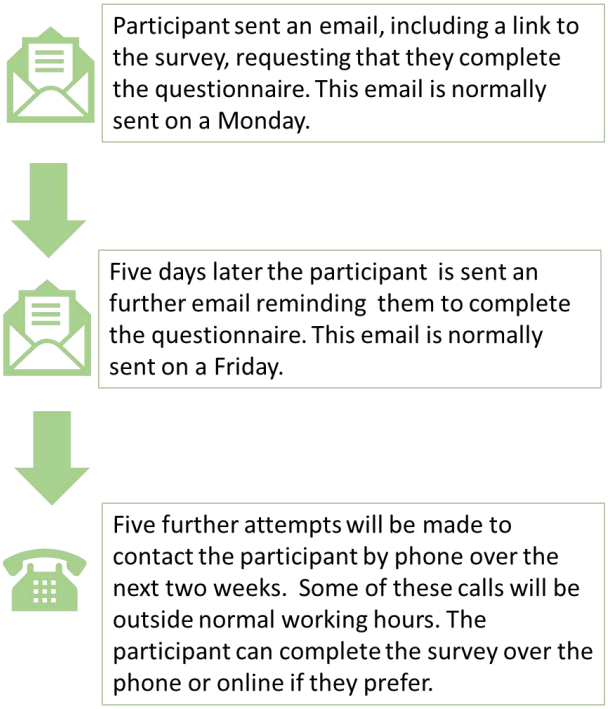
	Surveys Sent	Surveys completed
%	100%	76%
N	273	207

Table 2: Trial 3 surveys completed

It should be noted that surveys do not highlight the charging algorithm which the participant's charger has been managed under, or provide too much information about

being managed, to avoid biasing the results, as we are testing consumer behaviour and acceptance (which includes what changes are noticed/unnoticed by EV owners).

Figure 3: Procedure used to encourage participants to complete questionnaires



For all trial surveys, the participant is sent a link to the questionnaire by email (Appendices 4 and 5). If they fail to complete the survey within an allotted period, then the link will be re-sent with a further email reminding them to complete the questionnaire. If the participant still does not complete the survey, then the survey company will attempt to contact the participant by telephone. The participant will be telephoned several times over the following weeks.

Participants will receive a £10 voucher for an online store (Amazon) for completing each of the trial surveys. This excludes the Recruitment survey and Baseline survey. Completion of the Recruitment survey and the Baseline survey are an obligatory condition of trial participation and therefore not rewarded. Participants will not be eligible for the vouchers above if they do not complete the Recruitment and Baseline surveys.

3 Acceptability of the second demand management trial – Crowd Charge

Trial participants in the CrowdCharge cohort were sent invitations to register for an account for the 'Journey Planner' app during July and August 2018. The trial (Trial 2) is fully explained in Section 5 of the previous milestone report (August-September 2018). Two hundred and ninety-three participants were invited to register for an account for an app developed by CrowdCharge that gave participants the following functions:

- Ability to enter their future journeys into a planner, to enable the system to assess likely energy requirement for the immediate charging transaction or future charging transactions (such as daily commute).
- Ability to view charge point usage broken down by month/day of energy used (kWh)/cost (£).
- Ability to view breakdown of entered journeys by day, week and month and cost of these journey/electricity used.
- Ability to enter the current state of charge of participants EV to ensure the participant receives sufficient charge to complete next journey – required at the beginning of a charging transaction.

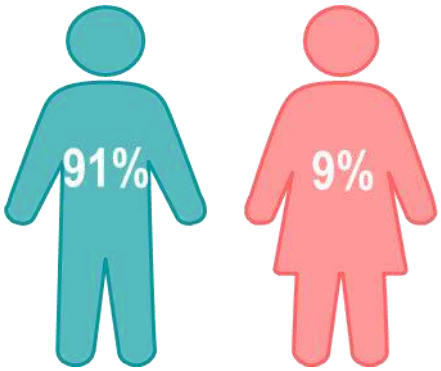
After a participant had been able to access the app for around six weeks, they were issued a survey by Impact Utilities (regardless of whether they took up the invitation and signed up for an account, or not). This survey is nearly identical to the Baseline survey issued to participants when they had completed 90 days of unconstrained charging although it also contains a number of questions specific to the app. These questions can be found in Appendix 3. If a participant had completed the Recruitment and Baseline survey, they were eligible for a £10 online voucher for completing this survey (this prompted participants to complete the missed surveys which provides general information such as socio-economic data to the project).

This section will provide an insight into the interim survey results at the point of writing. This data does not distinguish between the "charge at will" and "straight into demand management" groups at this time - A full analysis, including distinguishing differences between these two groups and levels of statistical confidence of the survey results, will be provided later.

3.1 Crowd Charge Cohort characteristics

The Crowd Charge Trial 2 cohort is similar in participant characteristics to the overall Electric Nation trial.

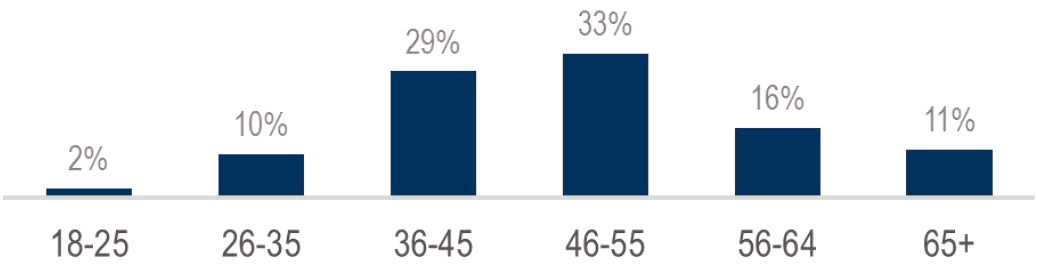
Figure 4: What is your gender? (Base – Crowd Charge - 293)



The Electric Nation trial group has 12% women and 88% men.

Participants were asked their age.

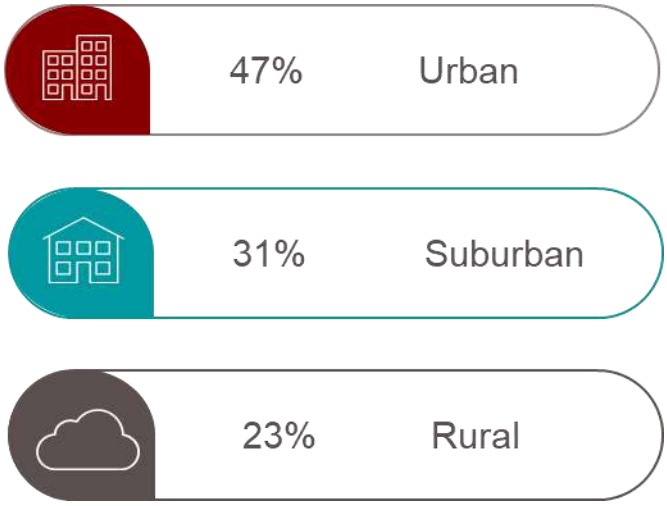
Figure 5: How old are you? (Base – Crowd Charge – 293)



Again, this is very similar to the characteristics of the project trial group.

The participants are spread across urban, rural and suburban areas (self-reported, i.e. their own perception of where they live)

Figure 6: Do you live in an urban, suburban or rural area? (Base – Crowd Charge - 293)

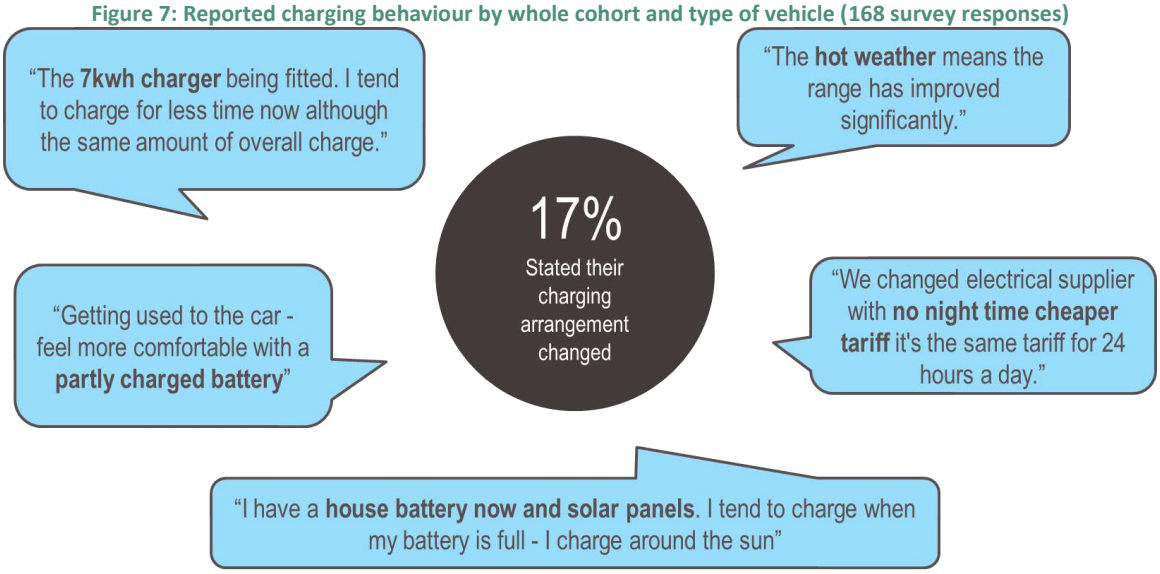


Again, this is similar to the characteristics of the overall trial cohort.

3.2 Reported change in charging behaviour

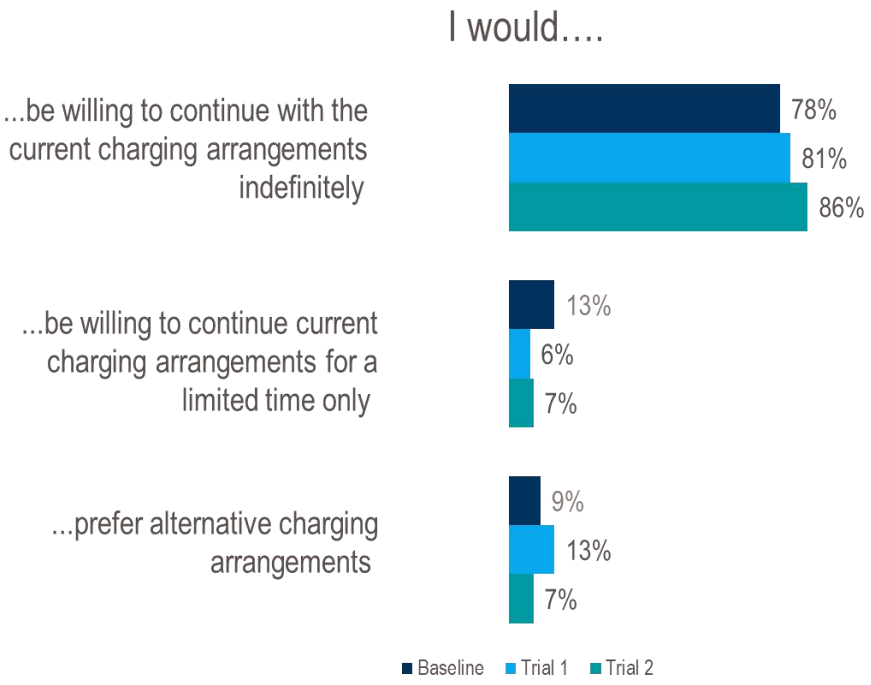
Participants were asked about their charging behaviour. Most reported that their charging behaviour has not changed substantially since Trial 1, where trial participants were subjected to charge management with no information and no app (only 17% have reported that they have changed their behaviour). Many of those who have changed their behaviour state that the change is not due to the app or the smart charging.

Figure 7: Reported charging behaviour by whole cohort and type of vehicle (168 survey responses)



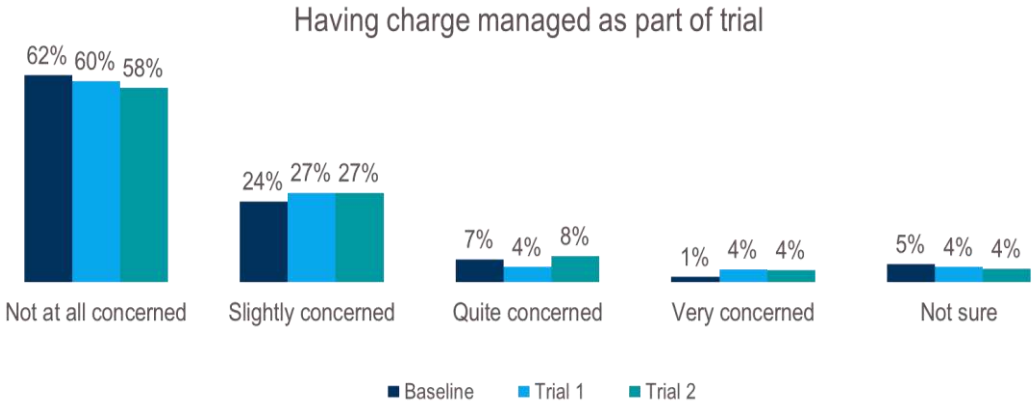
Most participants are still willing to continue with their current charging arrangements indefinitely.

Figure 8: Which statement best describes your attitude to changing your charging behavior… Base: Crowd Charge Baseline (206) Trial 1 (134) Trial 2 (168)



Participants' willingness to continue with current charging arrangements has increased slightly as the trial has progressed.

Figure 9:How do you feel about having your charging arrangements managed as part of the trial? Base: Crowd Charge Baseline (206) Trial 1 (134) Trial 2 (168)



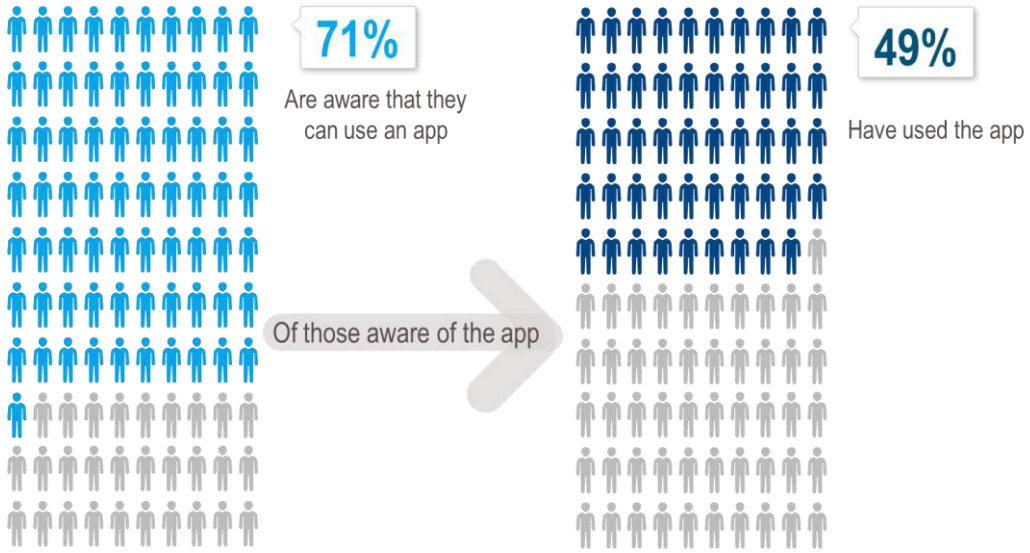
Trial participants still have few concerns about having their charge managed as part of the trial. 85% of participants have no or only slight concerns.

3.3 Participant attitudes to the app

Crowd Charge trial participants who responded to the survey were asked about the app that they were given access to.

Trial participants were asked if they were aware that they could access an app.

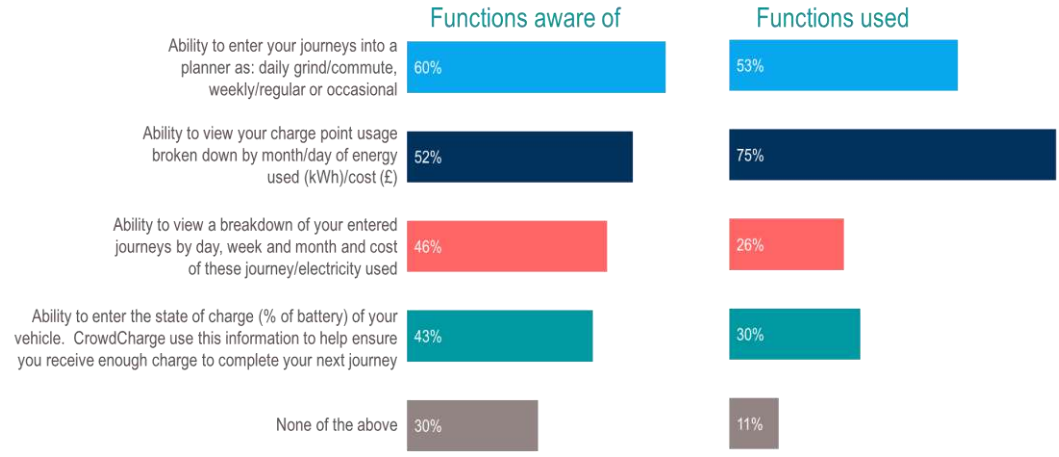
Figure 10: Are you aware that you can access an app to interact with your smart charging system? Base:168, Have you used the app? Base:199



The majority of Crowd Charge trial participants who responded to the survey were aware of the app. However, only around half of those aware of the app had used it.

Participants who had stated that they were aware of the app were asked if they knew about its various functions and if they had used them.

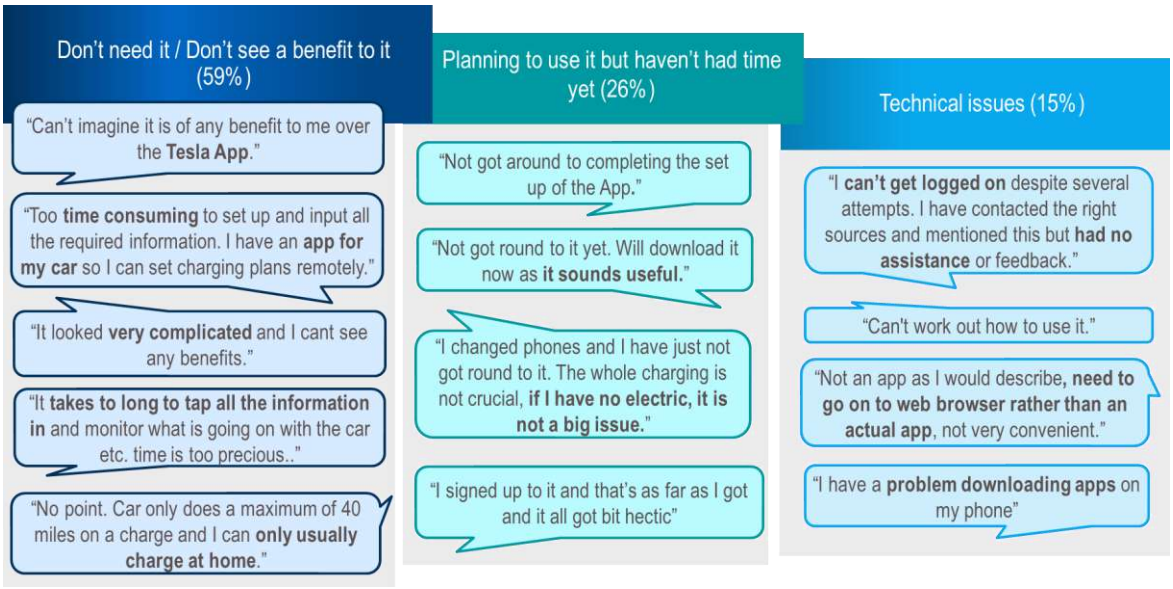
Figure 11: Are you aware of the app's functions? Have you used them? Base: All aware of app 119. Base: All app users 53



Awareness of some of the apps functions was low. Amongst participants who had used the app, viewing charging history was the most used function.

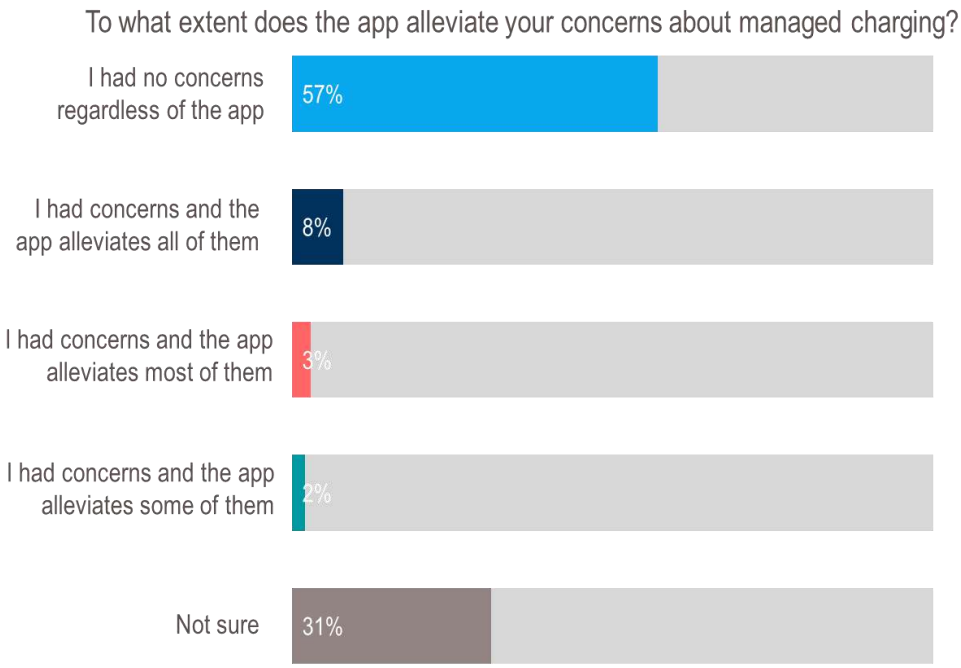
The free text responses below were provided by respondents who were aware of the app but did not use it. They add context to their decision not to use it:

Figure 12: Reasons why Crowd Charge participants didn't use the app (Base: 61)



Trial participants who were aware of the app were asked to what extent the app helped to alleviate any concerns that they had about managed charging.

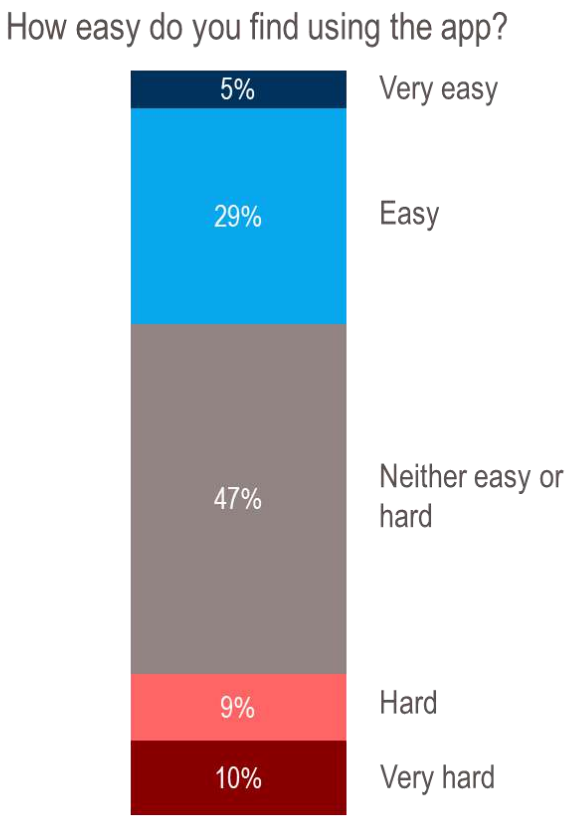
Figure 13:To what extent does the app alleviate your concerns about managed charging? Base: 119



Over a half of participants did not have any concerns about managed charging prior to receiving the app.

Participants who had used the app were asked how easy they found it to use.

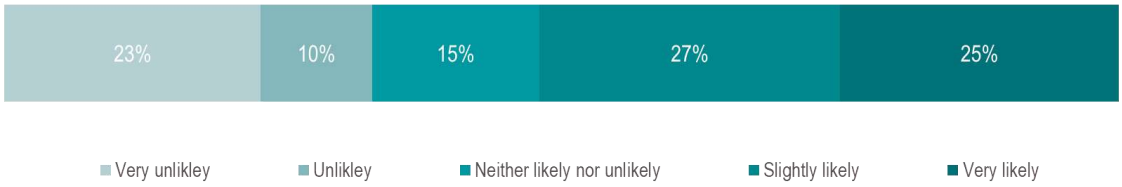
Figure 14: How easy do you find using the app? Base: 58



A third of participants who have used the app think that it is easy to use. However, a fifth found it hard to use.

Survey respondents were then asked if they would continue to use the app.

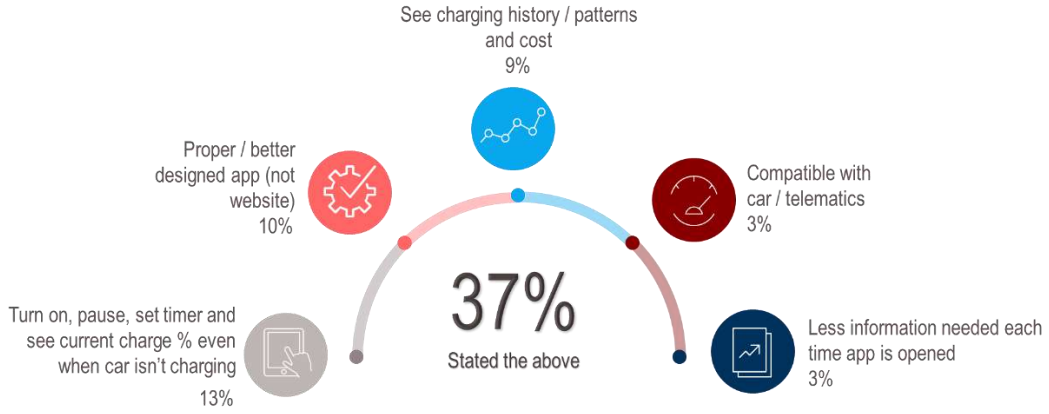
Figure 15: How likely are you to use the app going forward? Base: 168



52% of CrowdCharge participants stated that they were likely (based on 'Very likely' and 'Likely' responses) to continue using the app and around a quarter stated that they were very unlikely to continue to use it.

Participants were asked to identify other functions that they would like from their app. Most Crowd Charge participants who responded to the survey didn't expect to see any other functions on their app (or hadn't used it). The chart below shows the most common suggested features:

Figure 16: Are there any other features that you expected to see on the app? (Base 119)



63% of participants stated that they didn't expect to see any other functions on the app or they hadn't used it.

3.4 Conclusion

Satisfaction with current charging arrangements among the Crowd Charge trial participants has remained steady across Trial 2 and the project lifetime. Acceptability of the charging arrangements has also remained high and is consistent with the baseline and Trial 1 results.

Most participants still have few concerns about having their charge managed as part of the trial.

The majority of cohort participants were aware of the app (71%). However, only 35% of those who are aware of the app have used it (49% of the 71%).

Among participants who have used the app, viewing charge point usage is the most used function.

4 Acceptability of the third demand management trial - Greenflux

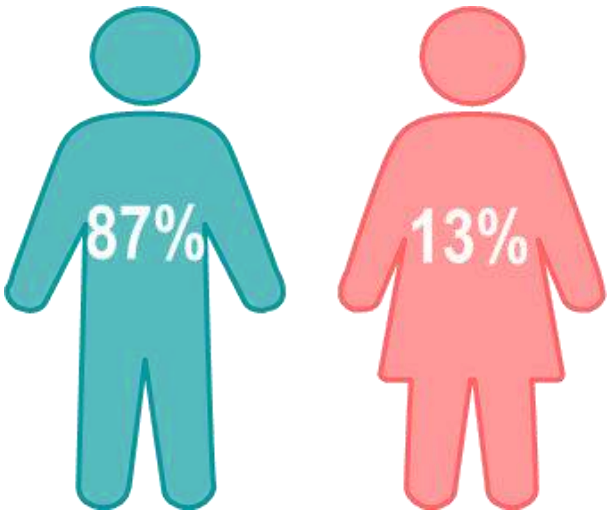
Trial participants in the Greenflux cohort were sent details of the second version of the app on 10th October 2018, including details of how to download the app. Participants who had already installed the app during Trial 2 did not need to take further action, as the app would automatically update between 10th and 18th October 2018. The trial (Trial 3) is fully explained in Section 7. 273 participants were provided with this app developed by GreenFlux that gave participants the option to request 'High Priority' for a chosen charging session or to select that their EV be charged in a session that minimise the cost, optimise the time and cost or optimise time (i.e. start charging as soon as plugged in). After a participant had been able to access the app for around five weeks, they were issued a survey by Impact Utilities. This survey is nearly identical to the Baseline survey issued to participants when they had completed 90 days of unconstrained charging although it also contains a number of questions specific to the app. These questions can be found in Appendix 3. If a participant had completed the Recruitment and Baseline survey they were eligible for a £10 online voucher for completing this survey.

This section will provide an insight into the interim survey results at the point of writing. This data does not distinguish between the "charge at will" and "straight into demand management" groups at this time - A full analysis, including distinguishing differences between these two groups and levels of statistical confidence of the survey results, will be provided later.

4.1 Greenflux Cohort characteristics

The Greenflux Trial 3 cohort is similar in participant characteristics to the overall Electric Nation trial.

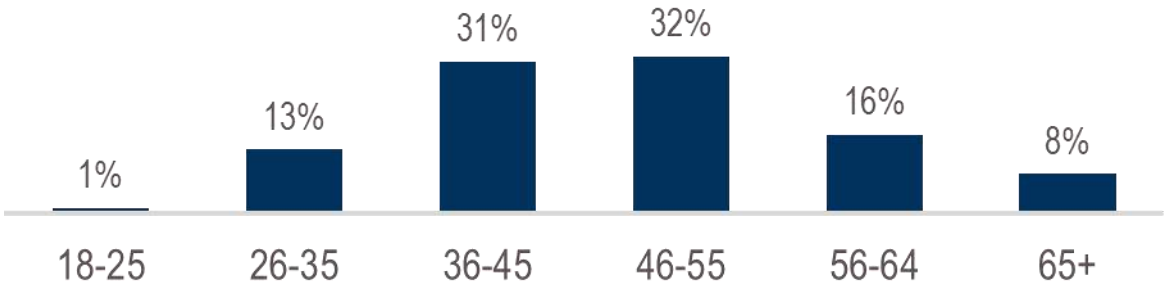
Figure 17: What is your gender? (Base - Greenflux - 322)



The Electric Nation trial group has 12% women and 88% men.

Participants were asked their age.

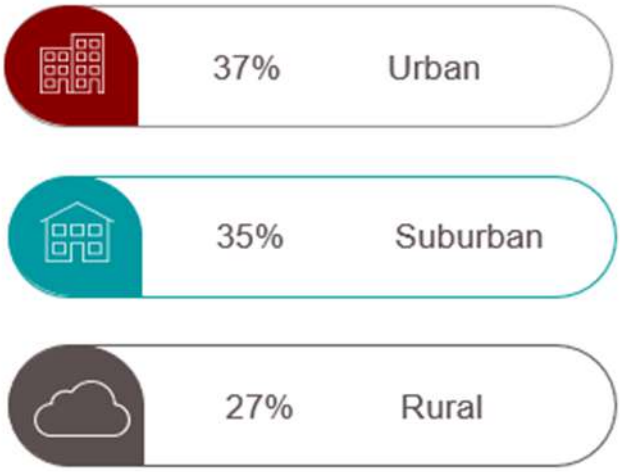
Figure 18: How old are you? (Base - Greenflux - 322)



Again, this is very similar to the characteristics of the project trial group.

The participants are spread across urban, rural and suburban areas (self-reported participant's perception of where they live).

Figure 19: Do you live in an urban, suburban or rural area? (Base - Greenflux - 322)

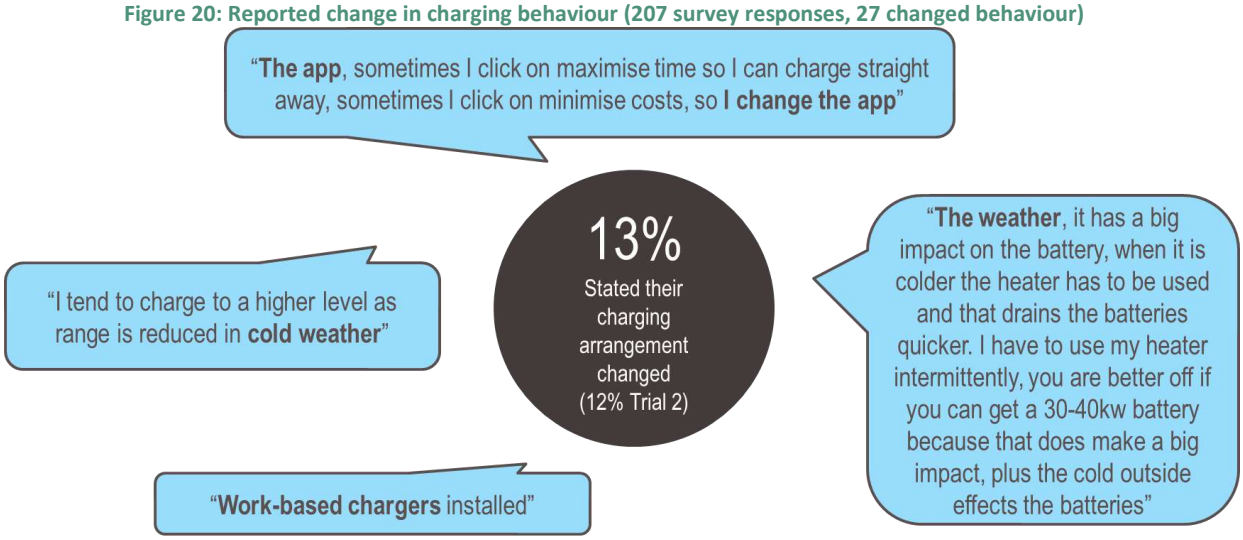


Again, this is similar to the characteristics of the overall trial cohort.

4.2 Reported change in charging behaviour

Participants were asked about their charging behaviour. They reported that their charging behaviour has not changed substantially since Trial 2 (only 13% have reported that they have changed their behaviour). Those who have changed their behaviour mentioned the app and the weather as some of the reasons for the change.

Figure 20: Reported change in charging behaviour (207 survey responses, 27 changed behaviour)



Most participants (78%) find the current charging arrangements acceptable. The table below summarises acceptability and satisfaction across the project among the GreenFlux cohort.

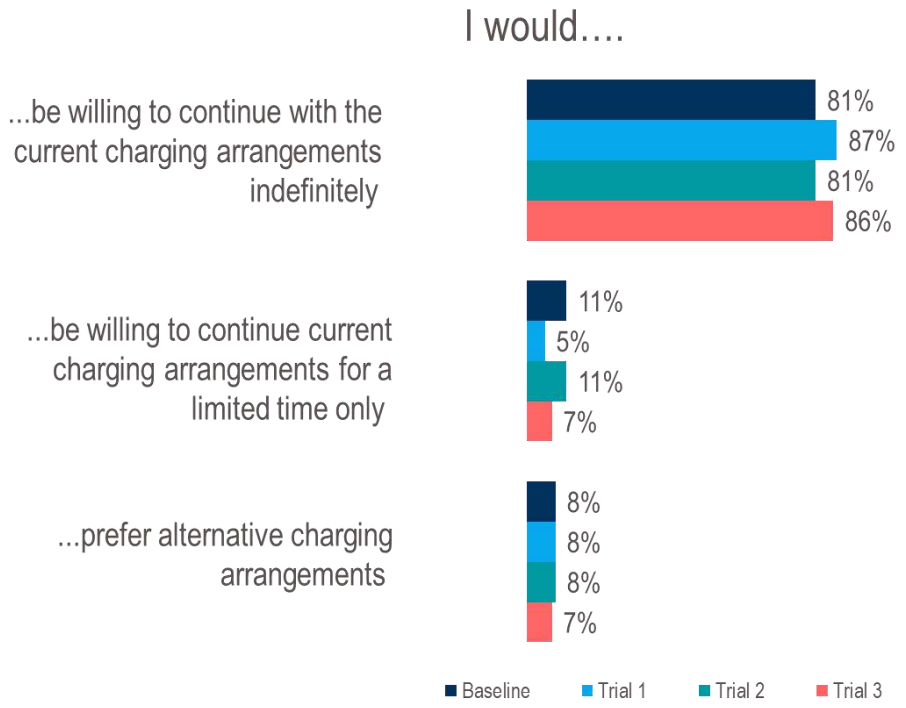
	Satisfaction (%)	Acceptability (%)
Trial 3	78	78
Trial 2	75	75
Trial 1	75	77
Baseline	77	75

Table 3: Satisfaction and acceptability across the three trials (Score 8,9 and 10 out of 10), base all (207)

Satisfaction and acceptability have remained consistent across the project. The proportion of participants who find charging arrangements satisfactory is lower - 69% - among those who drive an EV with a battery smaller than 10kWh.

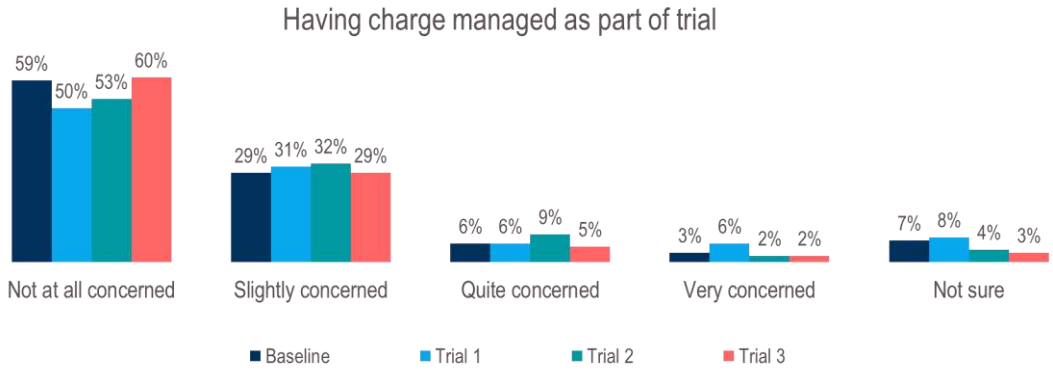
Most participants are still willing to continue with their current charging arrangements indefinitely.

Figure 21: Which statement best describes your attitude to changing your charging behavior… Base: GreenFlux Baseline (290) Trial 1 (144) Trial 2 (230) Trial 3 (207)



Willingness to continue with current charging arrangements remains high, comparing Trail 1 and Trial 3. The dip in "willingness to continue with current arrangements" and related rise in "willing to continue…for a limited time only" during Trial 2 needs further investigation.

Figure 22:How do you feel about having your charging arrangements managed as part of the trial? Base: GreenFlux Baseline (290) Trial 1 (144) Trial 2 (230) Trial 3 (207)



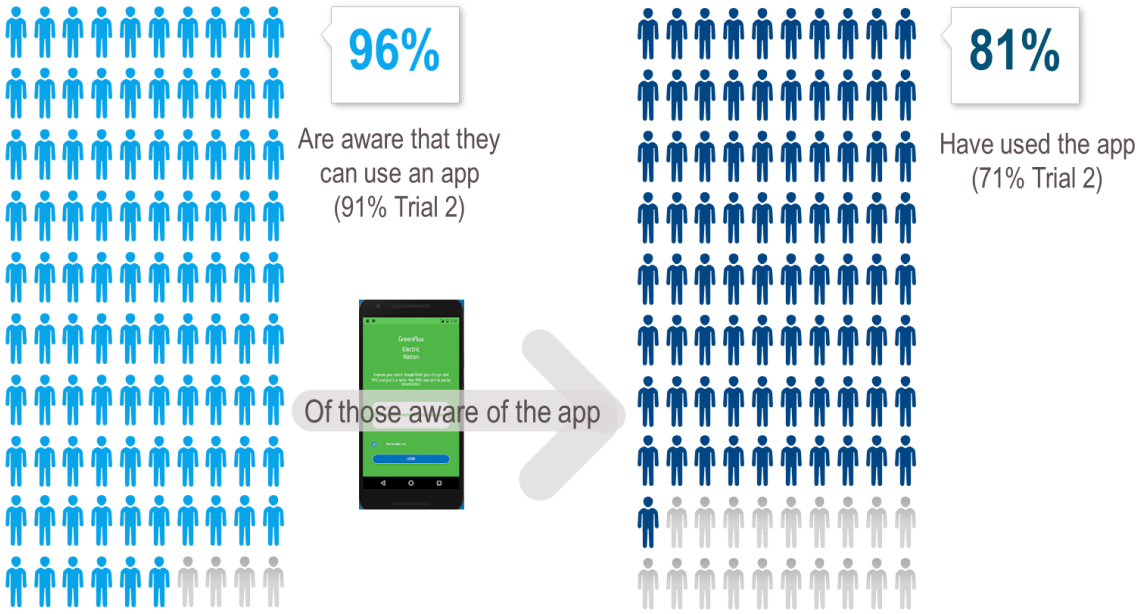
Trial participants still have few concerns about having their charge managed as part of the trial. 89% of participants have no or only slight concerns.

4.3 Participant attitudes to the app

Greenflux trial participants who responded to the survey were asked about the app that they were given access to.

Trial participants were asked if they were aware that they could access an app.

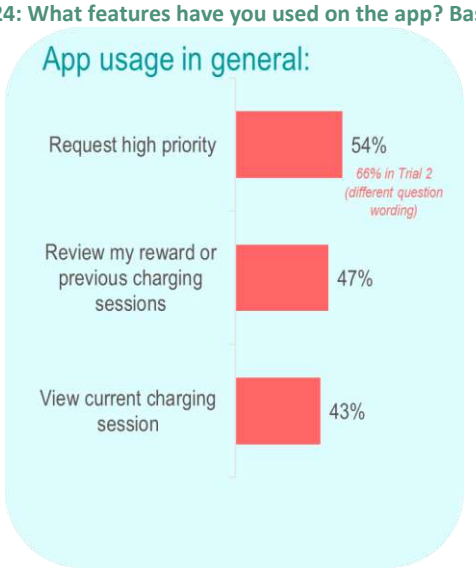
Figure 23: Are you aware that you can access an app to interact with your smart charging system? Base:207, Have you used the app? Base:199



Most Greenflux trial participants who responded to the survey were aware of the app and had used it. App usage has increased since Trial 2 (from 71%). 85% of participants were aware that the app had been recently updated.

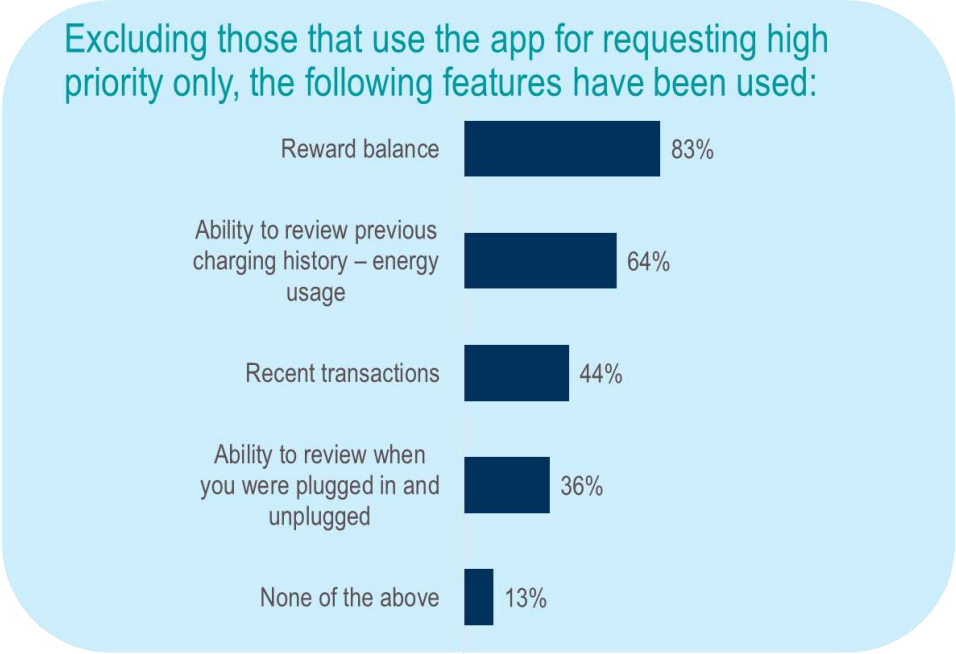
Participants who had used the app were asked which features they had used. Beyond requesting a high priority charge, the rewards balance and checking the previous charge history were the functions most used.

Figure 24: What features have you used on the app? Base: 135



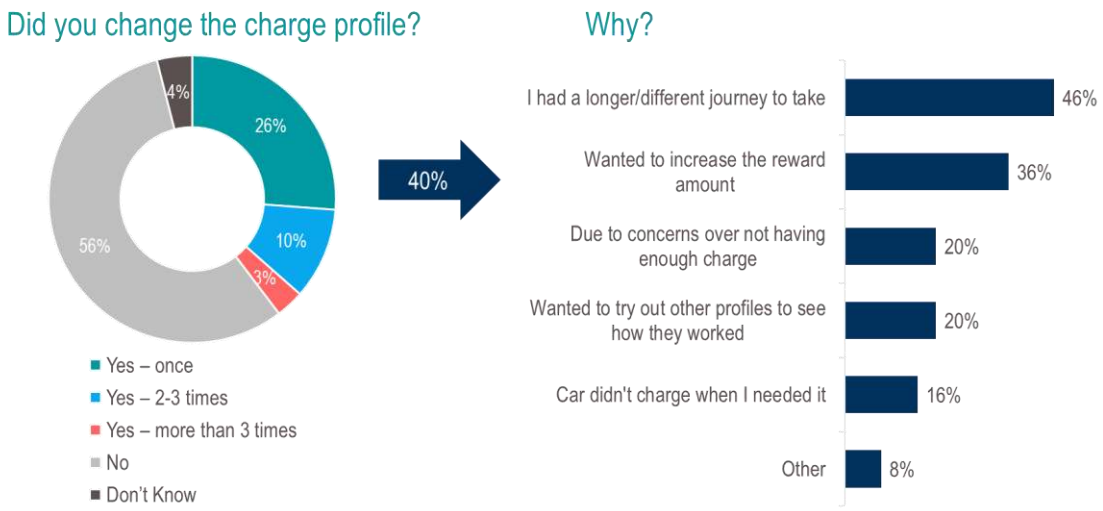
Excluding participants who had only used the app to request a high priority charge, the following features had been used:

Figure 25: Excluding app users who only requested high priority, which features have been used? (49)



Participants who had changed their charge preference were asked why.

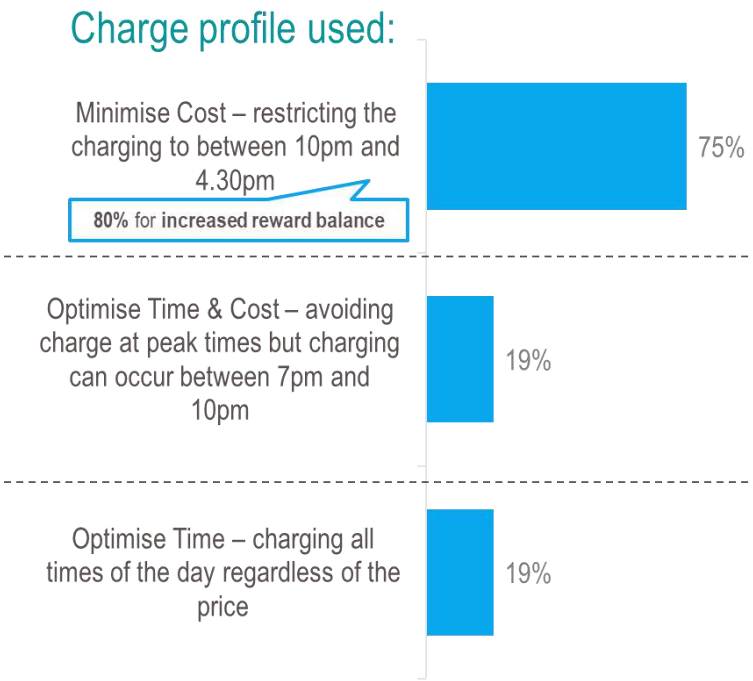
Figure 26: Did you change the charge profile (base 126)? Why (base 50)?



A third of participants who used this function of the app did so to increase their reward.

Participants who had used the app to review their charging preferences were asked which charge profile they had used.

Figure 27: Please tell us which charging preference you have used so far (Base 135)



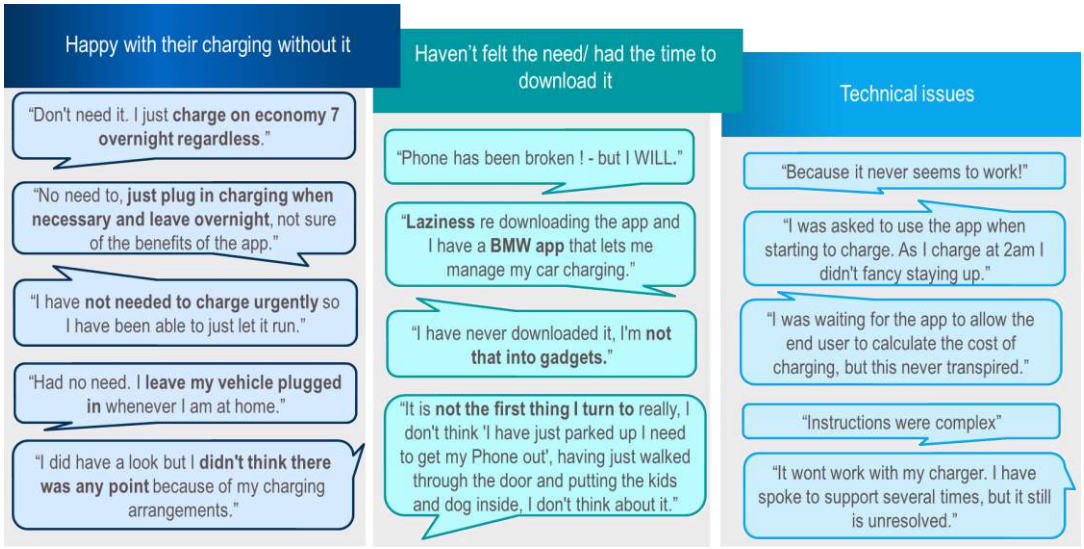
The most popular profile was the off-peak, Minimise Cost charging preference.

88% of participants found the charging preference reward structure easy to understand.

Participants who hadn't used the app were asked if they were aware that they were automatically put on the default, Optimise Time profile. 62% were aware that they had been.

Some of the free text responses provided by respondents who were aware of the app but didn't use it are provide below to add context. These are similar to the responses from Trial 2.

Figure 28: Reasons why Electric Nation participants didn't use the app (37)



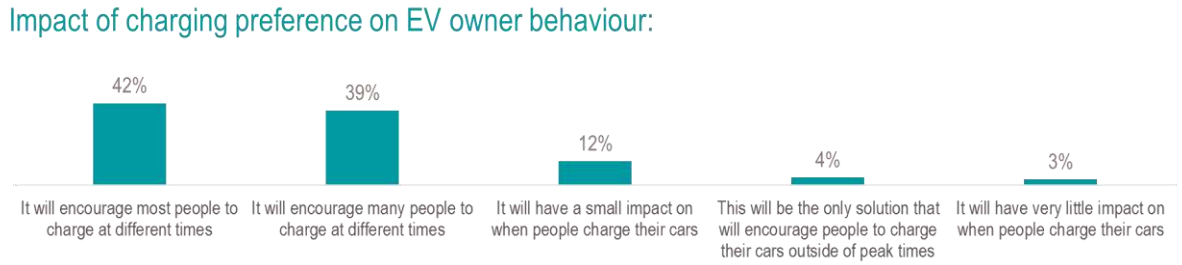
Survey respondents were then asked if they would continue to use the app.

Figure 29: How likely are you to use the app going forward? Base: 207

86% of GreenFlux participants stated that they were likely (based on 'Very likely' and 'Likely' responses) to continue using the app and around three fifths stated that they were very likely to continue to use it.

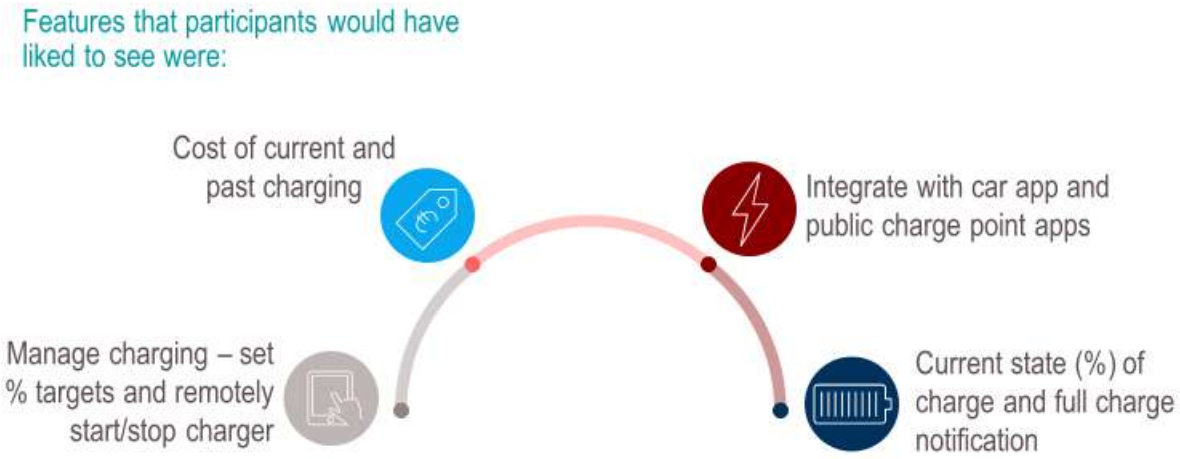
Most participants thought that the availability of similar charging options would change charging behaviours of EV owners in the future.

Figure 30: Impact of charging preference on charging behaviour (Base 106)



Participants were asked to identify other functions that they would like from their app. 68% of Greenflux participants who responded to the survey didn't expect to see any other functions on their app. The chart below shows the most common suggested features:

Figure 31: Are there any other features that you expected to see on the app? (Base 106)



4.4 Conclusion

Satisfaction with current charging arrangements among the GreenFlux trial participants has remained steady across Trial 3 and the project lifetime. Acceptability of the charging arrangements has also remained consistently high.

Three quarters of cohort participants were aware that the app had been updated and 81% have used the new version of it.

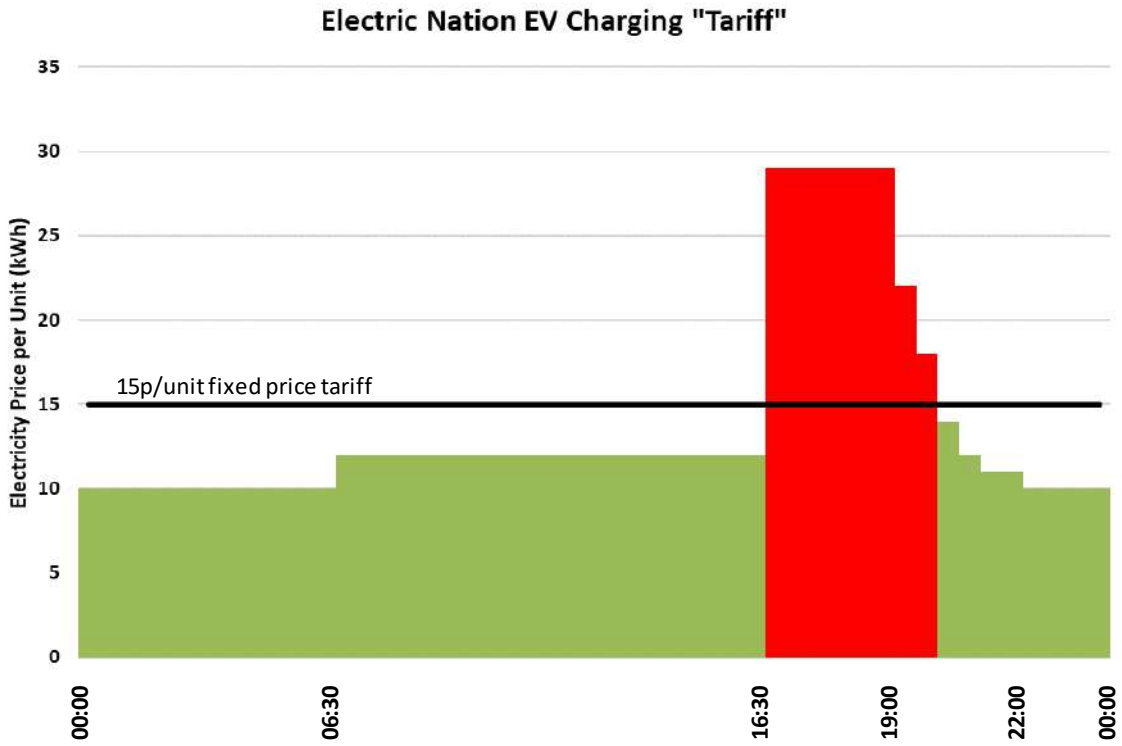
Two thirds of participants have changed their charging preference at least once, however 20% of these participants only did so to see how the different profiles worked. Other participants changed their preferences to ensure that they had sufficient charge for unexpected trips or to plan for long journeys. 36% of participants who changed their charging preferences wanted to earn a larger reward. Most participants found the charging preference reward structure easy to understand.

5 Algorithm 3 – Time of Use Tariff/Reward System

5.1 Introduction

Trial 3 introduced elements of time-of-use pricing for both CrowdCharge and GreenFlux participants. The way in which this system was implemented differed between the two demand management providers and these are described in more detail in the following sections. A common tariff structure was implemented by both providers, shown below.

Figure 32: Electric Nation Simulated Time of Use Tariff



All Trial 3 participants began the trial with a £10 reward. Each charge session was analysed to calculate a 'cost' associated with the energy. Each unit of energy consumed during times when the price was more than 15p/kWh (the horizontal line above) decreased the reward value (i.e. charging during the red zone above would result in the reward being deducted 18p per kWh consumed in charging). Each unit consumed when the price was less than the flat rate increased the reward value (i.e. charging between 22:00 and 06:30 added 5p/kWh consumed in charging). If participants eroded their reward value to nothing or even a negative balance, they were not penalised in anyway.

6 Algorithm 3 - CrowdCharge

6.1 Introduction

CrowdCharge Trial 3 made use of the same journey planning/data entry portal which was deployed in Trial 2, with the main changes being made to the algorithm to move charging away from peak price periods.

Trial 2 introduced a web-based app, whereby participants could enter journey plans. The system allowed participants to enter three different types of information:

- Current state of charge of their vehicle
- Regular journey plans (e.g. a Monday – Friday commute)
- Occasional journeys

Journeys were specified in terms of a start and end point, and time of departure. This then provided the CrowdCharge system with an estimate of the energy required to meet the participant's requirements (using a starting state of charge value hierarchy i) telematics, ii) user entry via the web app, iii) estimation from historical data, or iv) a conservative assumption). If demand management was required (i.e. if there was insufficient capacity to allocate 32A to all active chargers) then the available current was shared based on relative energy requirements. For example, if demand management was active at 16:30, then a vehicle with a planned journey of 80 miles departing at 20:30 that evening would receive a larger current allocation than one travelling 20 miles at 7:30 the next morning. In Trial 2 chargers received a full allocation (32A) when demand management was not required, so most vehicles were fully re-charged overnight, regardless of their journey plans.

In Trial 3 the CrowdCharge system also incorporated the time of use tariff described above and aimed to optimise charging based on a combination of driver requirements (using app entries as per trial 2), capacity management, and delivering the required energy at the lowest overall cost. Trial participants were incentivised to take part via receiving at cash reward (Amazon voucher) based on the price achieved by the CrowdCharge system compared to the cost of supplying the energy required on a flat rate tariff. Example scenarios are described below:

- A participant connects their vehicle when they arrive home in the evening peak. They enter a journey plan with a time of departure of 7:30 the next morning. The system will therefore shift the charging, which is done overnight, as the energy is not required until the following morning. By entering a journey plan the participant will increase the reward they earn for this charge event, as at the EV will be charged during the lowest price overnight period.
- A participant connects their vehicle when they arrive home in the early evening (say 6pm), but no journey plans have been entered. The CrowdCharge system assumes the vehicle is required a few hours later, so peak time energy is used, decreasing the reward balance.
- A participant connects their vehicle when they arrive home in the evening peak (say 5:30pm). They enter a journey plan with a departure time of later that evening (say

30 miles at 8pm). In this case the CrowdCharge system would use peak time energy to ensure that the energy requirement is met. By entering a journey plan the system will prioritise charging this vehicle if demand management is required.

The updated system was launched to a pilot group of 20 participants on 6th November. It was then rolled out to a total of 245 (including the 20 pilot participants) participants on 13th November. It was operational until 17th December.

An analysis of the impact of Trial 3 on group demand (i.e. in the form presented for GreenFlux in Section 7.2) will be completed using the analysis database and this work is underway at the time of writing. These results will be included in the final project report.

6.2 Participant Interaction with the CrowdCharge App

In order to use the CrowdCharge app, participants first had to complete a registration process. Once this was complete, they could then enter different types of information (regular journeys, one off journeys and state of charge values) at any point during Trial 2 or 3 (including during a transaction, where if a journey was required immediately after the charging session was completed). An analysis of this information will be used to show the level of interaction between participants and the CrowdCharge app, alongside their customer research responses. However, owing to issues in the data provided by CrowdCharge, an analysis of app usage is not possible at this time – analysis will be provided in the project's final report. In this report it is only possible to provide an update on the increase in user registrations for the CrowdCharge app.

6.2.1 App Registrations

All Trial 3 participants had also taken part in Trial 2 and were invited to the app as part of the launch of Trial 2, during July and August 2018. A further reminder was sent to those who had not responded before the beginning of Trial 3, advising participants that by registering for an account they would be eligible for a reward based on the time at which they charged their car.

The number of customers who signed up (during Trial 2, or only after the additional email was sent) or declined the invite are summarised in the table below:

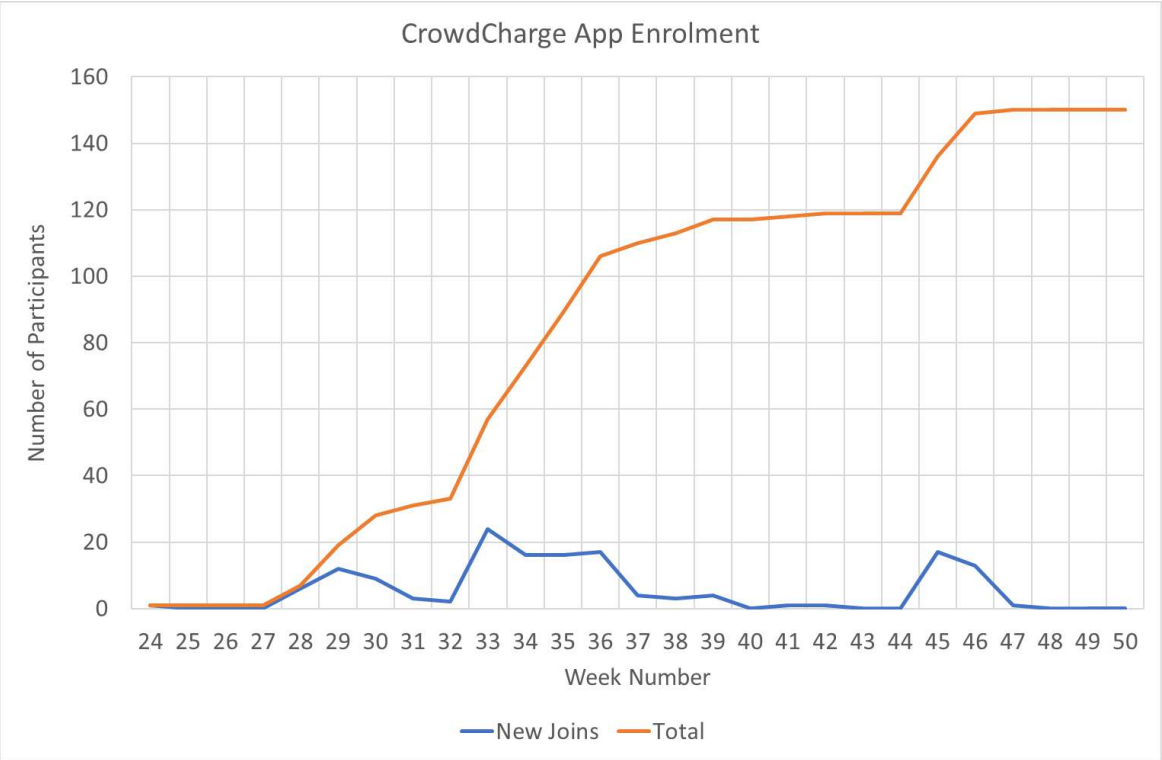
Response	Number of Participants	% of Participants Invited
Replied to decline invite	2	0.8%
No response from participant	93	38%
App setup complete during Trial 2	119	49%
Signed up for App Account in Trial 3 Only	31	13%
Total	**245**	**100%**

Table 4: Level of Uptake of CrowdCharge App (Trial 2 and 3)

This shows that the additional incentive to signing up to the app encouraged a further 31 participants (13% of the Trial 3 group) to register for an account.

The progress of signing participants up to the app is shown graphically below ("New Joins" means number of participants signing up in a particular week).

Figure 33:CrowdCharge App Enrolments (Trial 2 and 3)



This shows a good level of interest in signing up for the app – resulting in 61% of the cohort eventually signing up to the app. The number of new enrolments varies in each week due to the batch process used to invite participants to join the second trial, with a second increase when the additional reminder was sent just prior to the launch of Trial 3.

Sign-up rates are summarised by PIV type and vehicle battery capacity below.

Category		Number of Invited	Number Signed Up (during Trial 2 or 3)	% Signed Up
All Participants		245	150	61%
PIV Type	Battery Only	123	75	61%
	Plug-in Hybrid	95	58	61%
	Range Extender	27	17	63%
Battery Capacity	Less than 10kWh	73	41	56%
	10 to 25kWh	63	44	70%
	25 to 35kWh	60	36	60%
	35kWh plus	49	29	59%

Table 5: Sign-Up Rate for CrowdCharge Participants - by PIV Type and Battery Capacity

This shows minimal variation in sign-up rates between the three different PIV types. Sign-up rates are highest amongst those with a 10 to 25kWh battery capacity, although the reasons behind this difference are not clear. Participants' reasons for signing up to the app (or not) were included in the Trial 3 survey and will be reported on in the final project outputs.

7 Algorithm 3 - GreenFlux

7.1 Introduction

The previous version of the GreenFlux app (deployed in Trial 2) allowed participants to request 'high priority' for their charge session, which greatly reduces the probability that their charge session will be constrained at any point. There was no disincentive applied to discourage participants from requesting high priority, and no other mechanisms encouraging participants to change the time they charged their cars (apart from those already on a time of use tariff).

The third trial (algorithm 3) introduced an element of time of use pricing, which may encourage participants to move consumption away from the peak, reducing the need for curtailment actions. The trial enabled this to be managed within the GreenFlux system, or the participant may achieve this by using a timer on their car to delay charging until the off-peak rate begins.

Participants were incentivised via a simulated ToU tariff (using the same tariff as for CrowdCharge, see Figure 32), which applied only to their EV charging, and was converted to a reward voucher value at the end of the trial.

All participants began the trial with a £10 reward. Each unit of energy consumed during times when the price was more than 15p/kWh (the horizontal line above) decreased the reward value (i.e. charging during the red zone above would result in the reward being deducted 18p per kWh consumed in charging). Each unit consumed when the price was less than the flat rate increased the reward value (i.e. charging between 22:00 and 06:30 added 5p/kWh consumed in charging). If participants eroded their reward value to nothing or even a negative balance, they were not penalised in anyway.

During Trial 3 group demand was managed against the available network capacity, using the same scaled profiles which were used in previous stages of the trial. Demand management was enacted if necessary (i.e. if it was not possible to give all chargers either 16A or 32A, depending on the nominal rating of the vehicle). The degree to which demand management was required shows the extent of the shift in demand between Trial 2 (no ToU tariff) and Trial 3. Management would also have occurred outside of the traditional peak period if a new peak in demand had been created which exceeded the capacity of the network. Further details of this are given in Section 7.2.

Participants could manage their preference for when their vehicle charged using an upgraded version of the GreenFlux app, via by selecting one of three options:

- To "minimise charging cost"
    - In which case the system paused charging during peak and taper tariff period (only charging between 22:00 and 16:30)
- Or "optimise time and cost"

  - In which case the system only paused during the peak tariff period but would bring a charger on to charge during taper tariff (charging from 19:00 to 16:30)
- Or "optimise time" (default option, to prevent unexpected changes to charging)
  - In which case system treated the charger as normal priority and charging started immediately and is not paused at any time (except where WPD capacity limit smart charging action was required)

This charging preference could be made and changed at any time (even during a charging transaction) and would remain in place for all subsequent transactions, unless the preference was changed.

The app was made available to all Trial 3 participants from October 17th onwards. All participants were emailed with details of the new app, including instructions for how to download it, and their login details.

7.2 Impact of Algorithm 3 on Group Demand and Requirement for Demand Management

Time of use tariffs such as that applied in Trial 3 have the potential to change the pattern of demand from EV charging, as customers move their charging to avoid times of high price (or aim to maximise their reward value). This can be seen in two ways using the data from Trials 2 and 3: firstly, the amount of time for which demand management was required, and secondly, the average demand from EV charging.

For the purposes of comparison between Trials 2 and 3 three distinct groups have been used for analysis:

- GFAppPilot08: the last part Trial 2, involving a group of 264 participants. This group was active between 06/09/2018 and 10/10/2018 and operated using the 'SpringCombo' seasonal profile (described in previous quarterly reports).
- GFTariffPilot01: the first part of Trial 3, involving a group of 274 participants. This group was active between 10/10/2018 and 15/11/2018, also using a 'SpringCombo' profile (as above).
- GFTariffsPilot02: the later part of Trial 3, involving the same group of participants, but using a winter profile of available capacity (the most restrictive). This was active between 15/11/2018 and 16/12/2018.

7.2.1 Requirement for Demand Management

Previous quarterly reports have shown the proportion of days, at each time of day, where demand management was active – i.e. the times at which there was insufficient network capacity to allow charging by all active chargers at their maximum rate. The graphs below replicate this approach, for weekdays (Figure 34) and weekends (Figure 35), comparing the three groups described above.

Figure 34: Amount of Management - GreenFlux Trial 2 vs. Trial 3 (Weekdays)

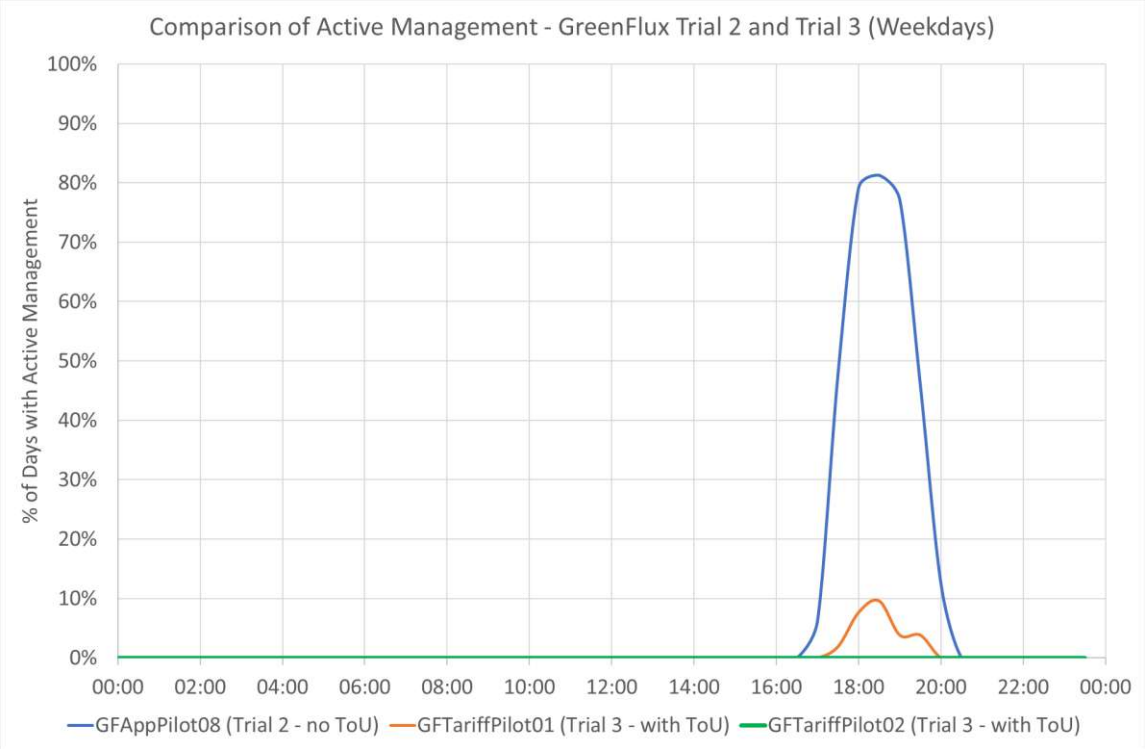
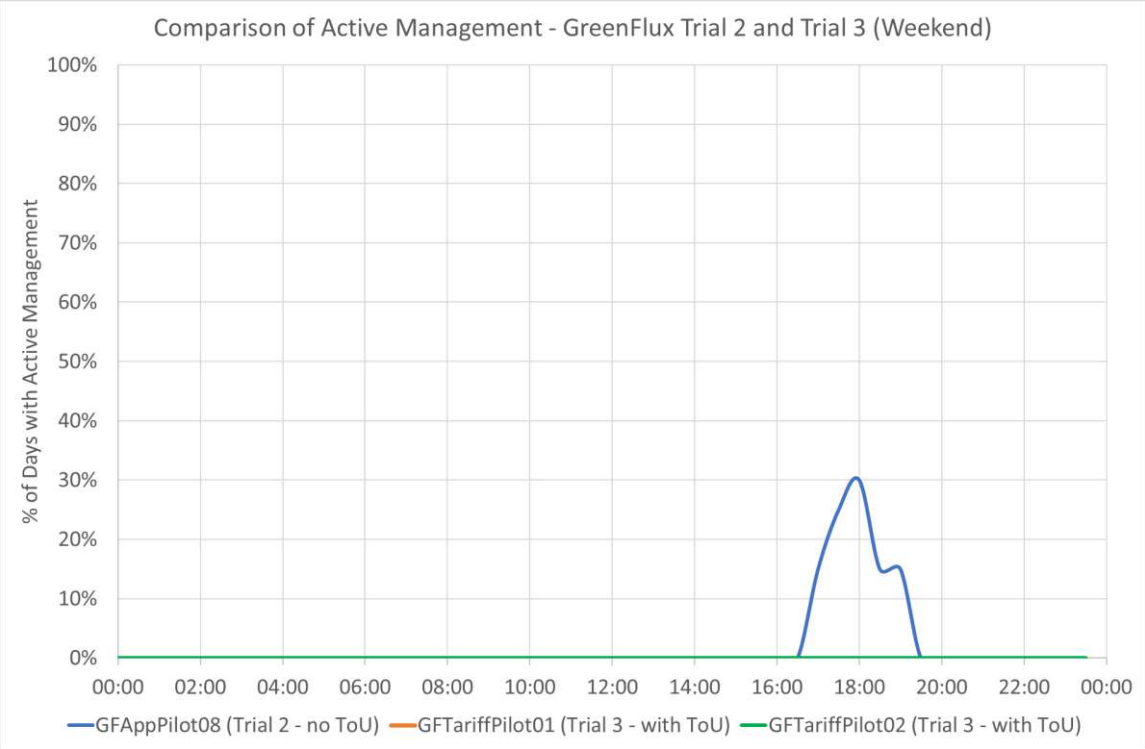


Figure 35: Amount of Management - GreenFlux Trial 2 vs. Trial 3 (Weekend)



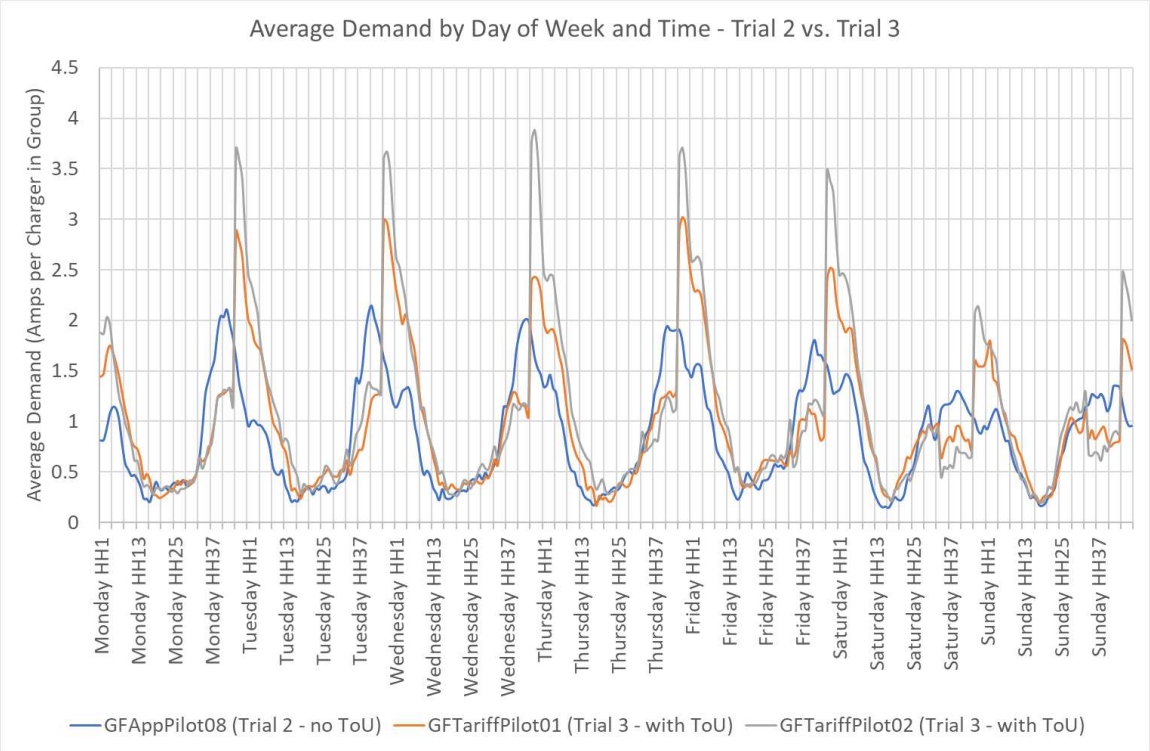
This shows a substantial decrease in the amount of management that was necessary – with no demand management at any point during GFTariffPilot01 or GFTariffPilot02(despite this using the most restrictive profile for available capacity - a winter profile). A small amount of management occurred in the first Trial 3 group on weekdays. However, this occurred during the first week of the trial when limitations still applied to the number of app

installations which would automatically update, and whilst participants were still getting used to the system. No management occurred in Trial 3 from 18th October onwards. This would appear to indicate that the time of use-based reward was successful in moving demand for EV charging to times of the day where sufficient network capacity was available.

7.2.2 Group Demand

Each individual charger reports the current being drawn every three minutes when it is in use. Within the database this is averaged across 15-minute periods (in keeping with the GreenFlux algorithm) and then aggregated up to show the group demand. This is equivalent to the demand which would need to be supplied from the substation to which a group of customers were connected. These figures for group demand have been averaged to show demand both by day of the week, and weekday/weekend. In both cases the total demand is divided by the number of chargers in the group so that Trial 2 and 3 are directly comparable.

Figure 36: Average Demand by Day of Week and Time (Trial 2 vs. Trial 3) - GreenFlux



NB: HHxx denotes the Half Hour number during a 24-hour day, there are 48 half hours starting HH1 (00:00 - 00:30).

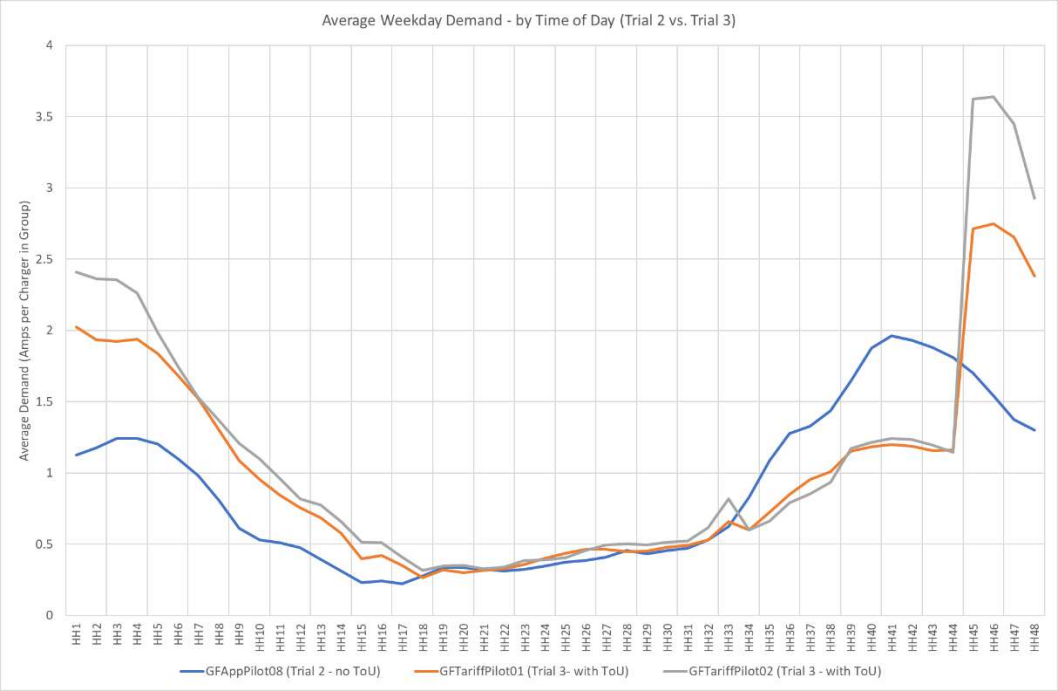
This shows a considerable difference in demand between Trial 2 (blue) and Trial 3 (orange and grey). Across all days of the week a new, higher peak has been created when the off-peak rate begins. The height of this peak is likely to be due to the clustering of charging beginning as soon as the lowest cost rate begins (at 22:00), rather than naturally spreading over the previous peak period (17:00 – 19:00) due to diversity in plug-in times. However, this new peak is still within the available network capacity as no management took place at

this time. If management had been necessary this would have occurred, and there is still sufficient 'spare' capacity to deliver the energy required overnight.

This graph also allows some comparison of demand by the day of the week. The day of the week with the highest peak load varied through the three periods shown above, although Fridays are generally lower than other weekdays, potentially as drivers do not need to charge their cars in advance of a commute the next day.

This data has then been aggregated further to compare weekday (Monday – Friday) and Weekend (Saturday and Sunday):

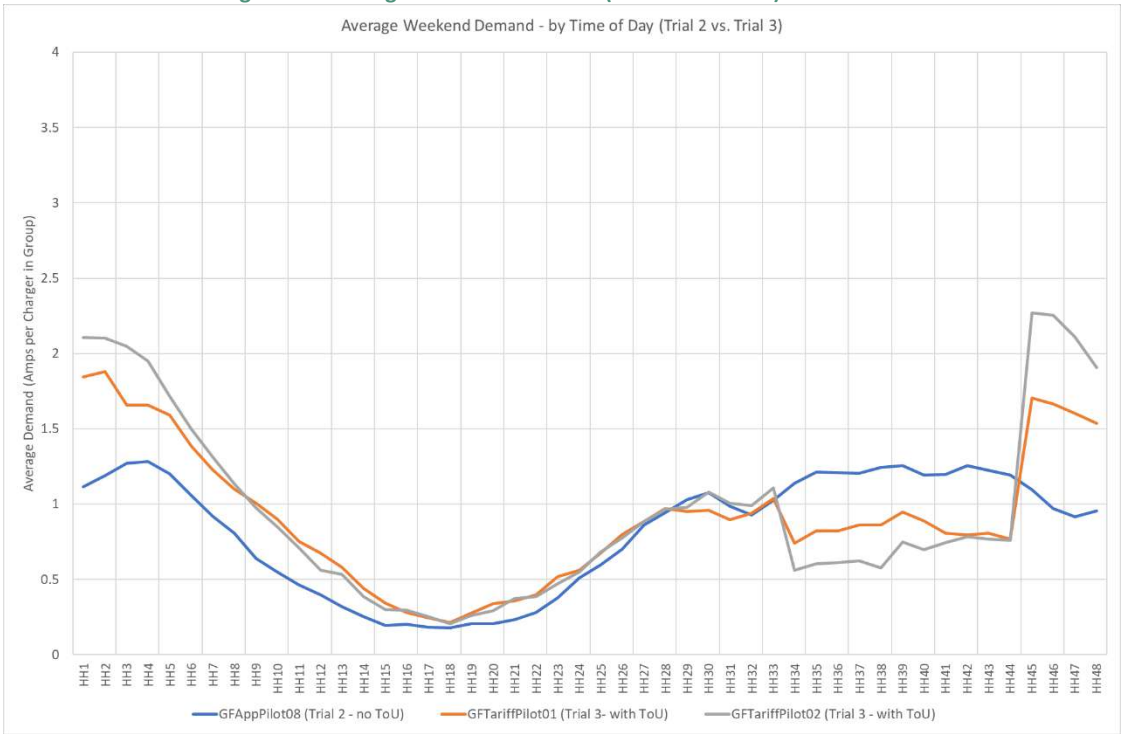
Figure 37: Average Weekday Demand (Trial 2 vs. Trial 3) - GreenFlux



NB: HHxx in Figure 39 and Figure 40 denotes the Half Hour number during a 24-hour day, there are 48 half hours starting HH1 (00:00 - 00:30).

The steep rise in demand between HH44 and HH45 for both Trial 3 datasets is caused by the large proportion of participants that selected Optimise Cost and so had their start of charge delayed to 22:00 or their charge interrupted between 16:30 and 22:00. This steep rise in demand could cause other issues in the real world, such as voltage drop as charge demand suddenly increases. This is quite manageable through timed/phased charge start/restart over a period of time (akin to that used for night storage heaters – the radio teleswitch).

Figure 38: Average Weekend Demand (Trial 2 vs. Trial 3) - GreenFlux



This shows the same movement, and increase in size, in the peak demand between Trial 2 and Trial 3 as participants move their charging to the off-peak (cheap/maximum demand) period. GFTariffPilot02 (grey line) was in operation from mid-November to mid-December, so the increase in the size of the peak between this group and GFTariffsPilot01 (mid-October to Mid-November) may be due to seasonal effects increasing demand.

7.3 Participant Interaction with the GreenFlux App

There are three main ways in which participants can interact with the app, as follows:

- Download the app from either the Play Store or Apple App Store. It is not possible to relate downloads to individual participants, however using the total number of installations gives an indication of the level of interaction at this level. Participants have also indicated whether or not they downloaded the app as part of the customer research (see Section 4.3 and Figure 23)
- Request high priority for an individual charging session in order to limit the likelihood that their charge session would be curtailed.
- Alter their charging preference from the default option to maximise their reward and potentially revert back to 'optimise time' if an immediate charge is required.

The sub-sections below explore the level of engagement with each of these three methods.

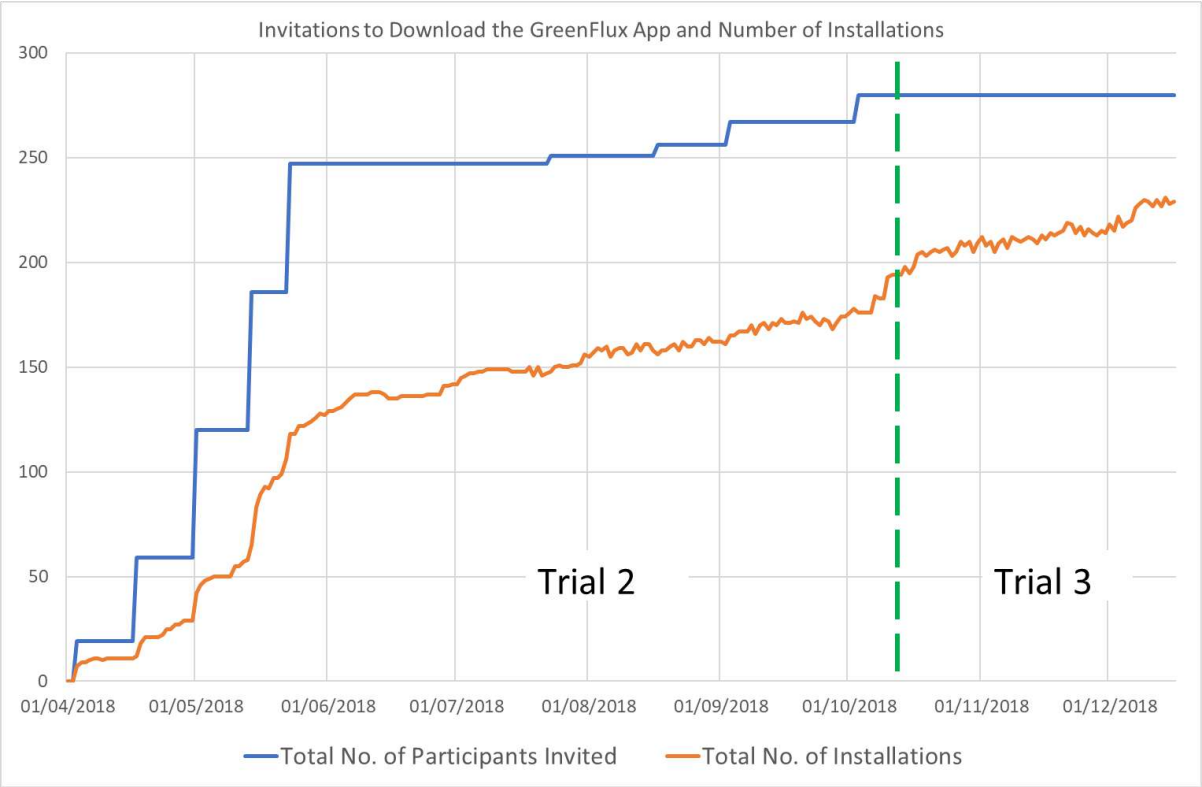
7.3.1 Downloads of the GreenFlux App

The app was initially released in April 2018, at the start of Trial 2. Participants were invited in batches as they were moved from Trial 1 to Trial 2, or when they first went into routine

management. If a participant had already downloaded the app in Trial 2 then it should have automatically update to the Trial 3 version in mid-October. Participants were alerted to the new version and were also able to manually update their app.

The graph below shows the total of installed copies of the app compared to the number of participants invited throughout Trials 2 and 3.

Figure 39: Number of Installations of the GreenFlux App (Trial 2 and Trial 3)



The number of participants who had been invited to download the app is shown in blue – clearly showing each batch of invites at intervals of approximately two weeks at the start of trial 2, with small increases later in the trial as new participants were able to join routine management. The resulting running total of app installations is shown in orange. Increases are shown which align with each batch of invitations, suggesting that most participants either respond quickly to the invitation, or not at all.

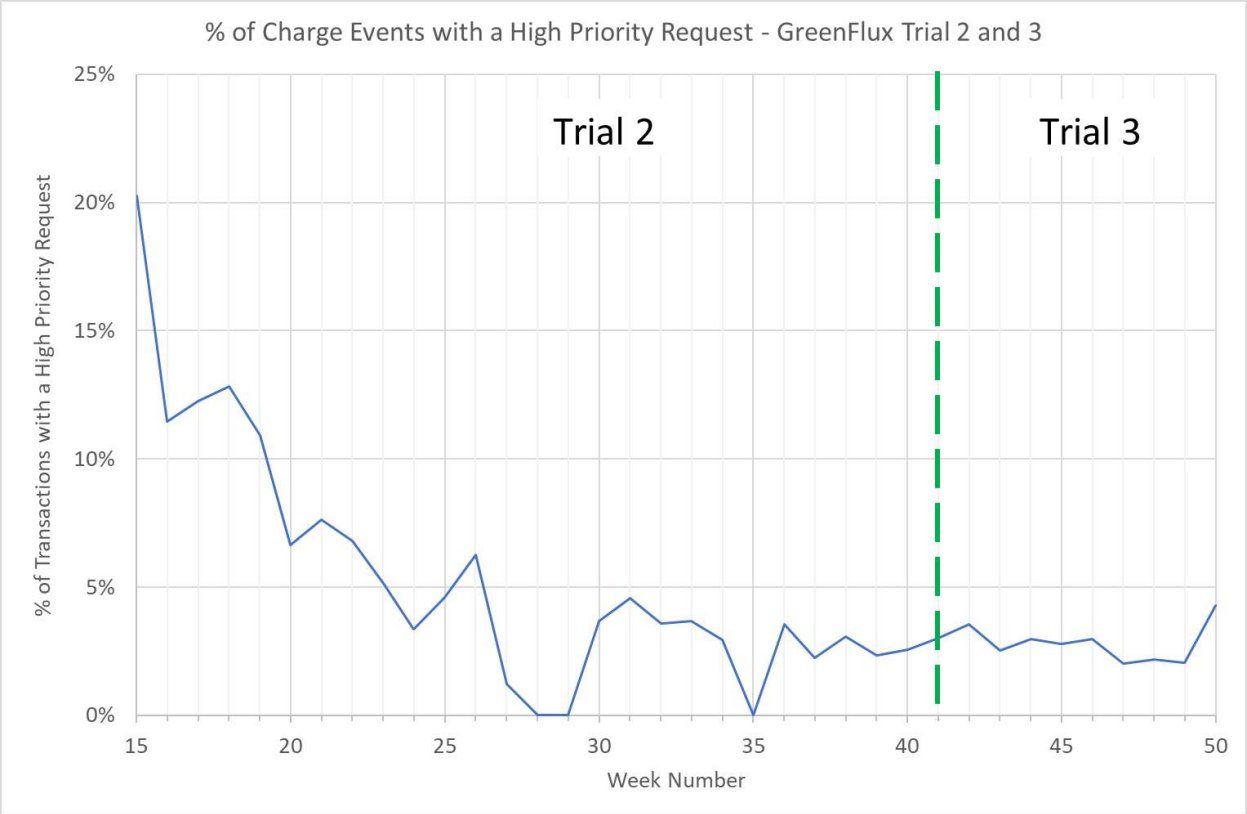
There was a further marked increase around the time of the launch of Trial 3. At the beginning of October there were 176 installations, compared to the 267 participants who had been invited (66%). By the end of Trial 3 this had increased to 229 installations from 280 invites (82%). This may indicate a greater interest in the app due to the additional functionality offered (when compared to Trial 2) and the ability to use the app to earn a financial reward. These figures align reasonably well with those reported by participants, with 81% of Trial 3 survey respondents saying that they had used the app. Some of reasons why participants did not download the app are shown in Figure 28.

7.3.2 High Priority Requests

The first version of the GreenFlux app (released for Trial 2 in April 2018) provided a simple interface which allowed the user to request 'high priority' for the current charge session. In the GreenFlux system available current is allocated to high priority chargers first, before trickling down to 'normal' and 'low' priorities respectively (low priority occurs at the end of a charge cycle, or where a vehicle is on a timer and not yet actively charging). Therefore, if all the participants with active sessions choose to enact the request for high priority, all chargers will have the same priority and will be treated equally.

Transactions which occurred during Trial 2 and Trial 3 have been analysed to show the use of this feature throughout the period when it was available. This is based on a total of 29,404 transactions between the start of Trial 2 and the end of Trial 3, for which participants had been invited to download the app. 1,054 of the 29,404 transactions had an associated high priority request (3.6%). 279 participants were invited to download the GreenFlux app at some point during Trial 2 or 3. 265 of this group used their charger during Trial 2 or 3, and 179 (68%) of these made at least one high priority request during this period.

Figure 40: Use of GreenFlux High Priority Requests by Week Number



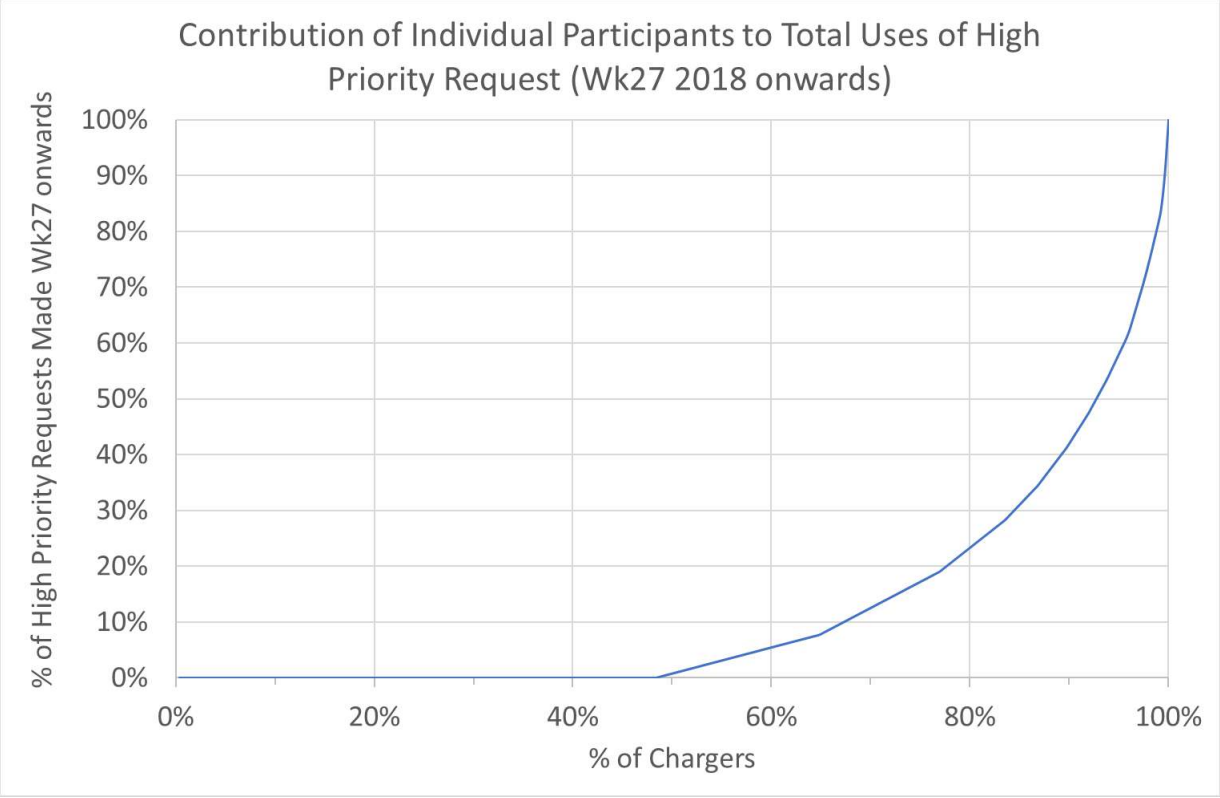
The first week of Trial 2 (week 15) is an anomaly, as this represents a pilot group of participants for Trial 2, who were asked to make multiple requests in order to test the app. In the early weeks of Trial 2 there is a clear period of higher usage of the app, likely to be as a result of participants experimenting with the app when they first received an invitation. The majority of invitations to download the app were issued during April and May (weeks 15 to 22 inclusive). From week 27 onwards (w/c 2nd July 2018) fewer than 5% of transactions had an associated high priority request and this remained stable between the

end of Trial 2 and the start of Trial 3. The use of high priority requests appears to bear little relationship to the level of management actually occurring, as high priority requests continued throughout Trial 3, despite no management taking place (see Figure 34 and Figure 35). This suggests that a very small percentage of participants were requesting high priority "just in case", without looking at whether their current charge session was actually being constrained.

The Trial 2 survey (details provided in the previous quarterly report) showed that the availability of a high priority feature alleviates some of participants' concerns relating to smart charging (47% of participants responded that the app alleviated either "all", "most" or "some" of their concerns regarding smart charging.

The high priority request may be being used by the majority of participants occasionally, or more frequently by a smaller number of participants. The graph below shows the percentage of total participants (based on those who used their charger from Wk27 onwards) compared to the percentage of the total high priority requests.

Figure 41: Contribution of Individual Participants to Total Use of High Priority Request (Wk27 2018 onwards)

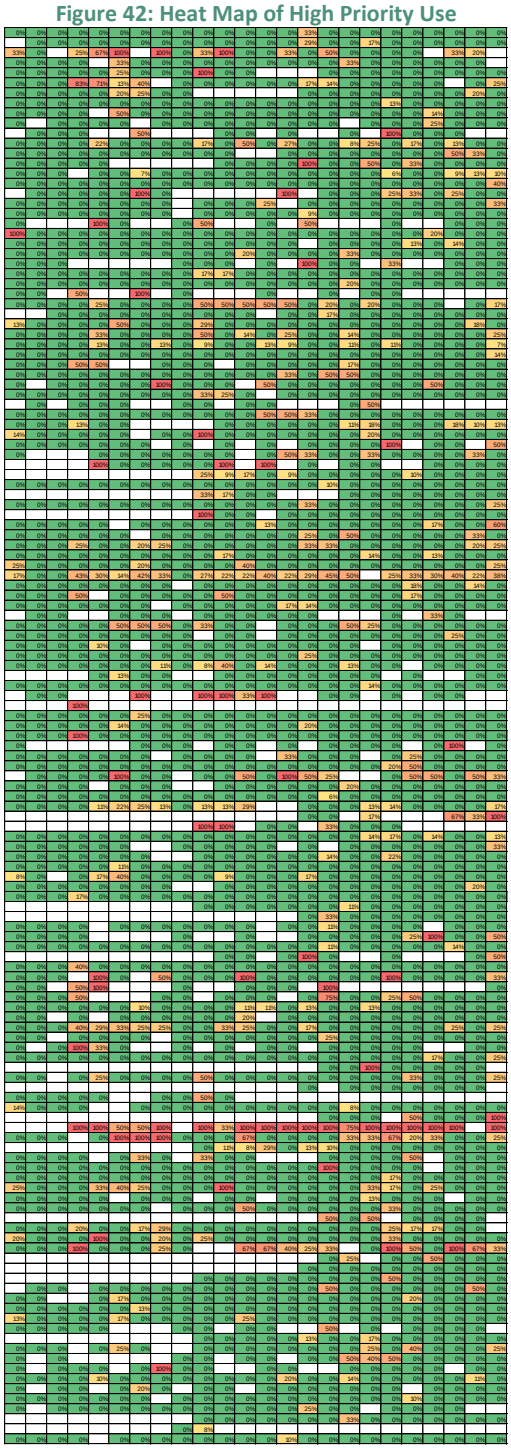


This shows that 50% of the participants made no high priority requests from Wk27 onwards. 20% of participants were responsible for nearly 80% of the requests. In fact, two participants together contributed 15% of the requests.

The pattern of usage by individual participants can be visualised on the heat map on the following page. Each cell contains the % of transactions in each week for which each participant had requested high priority. A colour scale has then been applied, from green

(no/very low proportion of transactions requesting high priority) to red (high proportion). A blank cell corresponds to a week in which the charger was not used. Participants who did not request high priority for any transactions from Week 27 are excluded, leaving a total of 141 participants (rows on the heat map).

Figure 42: Heat Map of High Priority Use



This shows that for the majority of participants their use of the high priority is occasional (i.e. within each row the majority of cells are green, with an occasional yellow or red week). For each of these 141 participants the proportion of weeks in which they have made a high

priority request has been calculated. The distribution of these values is shown in the table below:

Proportion of Weeks with a High Priority Request (Wk27 onwards)	Number of Participants	% of Participants
0.1 to 10%	68	48%
10 to 20%	31	22%
20 to 30%	20	14%
30 to 40%	10	7%
40 to 50%	5	4%
50 to 60%	3	2%
60 to 70%	1	1%
70 to 80%	0	0%
80 to 90%	1	1%
90 to 100%	2	1%
Total	**141**	**100**

Table 6: Use of High Priority Function

This shows even among the group of participants who did make use of the high priority feature from Week 27 onwards this usage is occasional. Only 5% of participants who used the feature did so in more than 50% of the weeks analysed above.

The tendency of participants to use the high priority feature can also be compared based on the participants registered vehicle (i.e. plug-in vehicle type and battery capacity). This is shown in the figures below, using a box and whisker plot showing the lower and upper quartiles (outer edges of the box), median (line within the box) and maximum (excluding outliers). Trial 2 and Trial 3 have been separated. In both cases participants who did not use their charger during the relevant part of the trial have been excluded.

Figure 43: % of Transactions with a High Priority Request - by Plug-In Vehicle Type

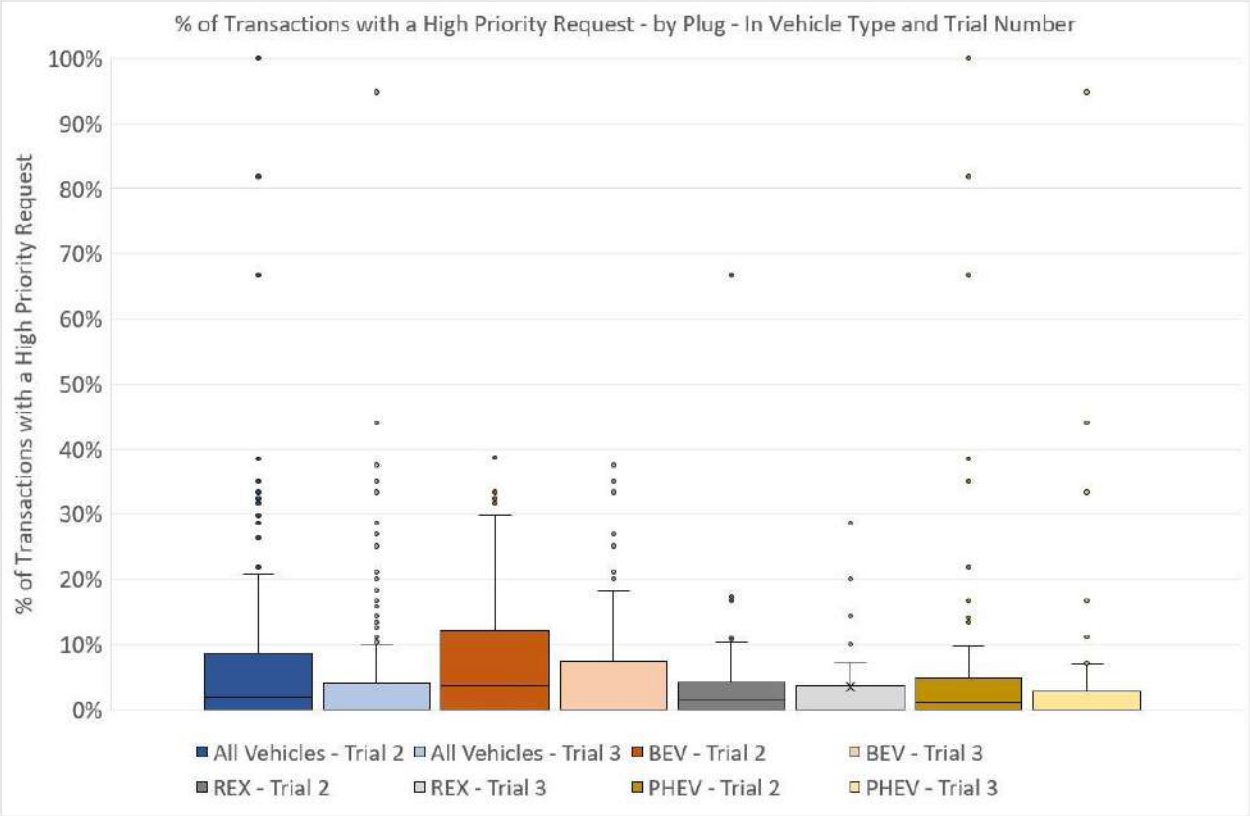
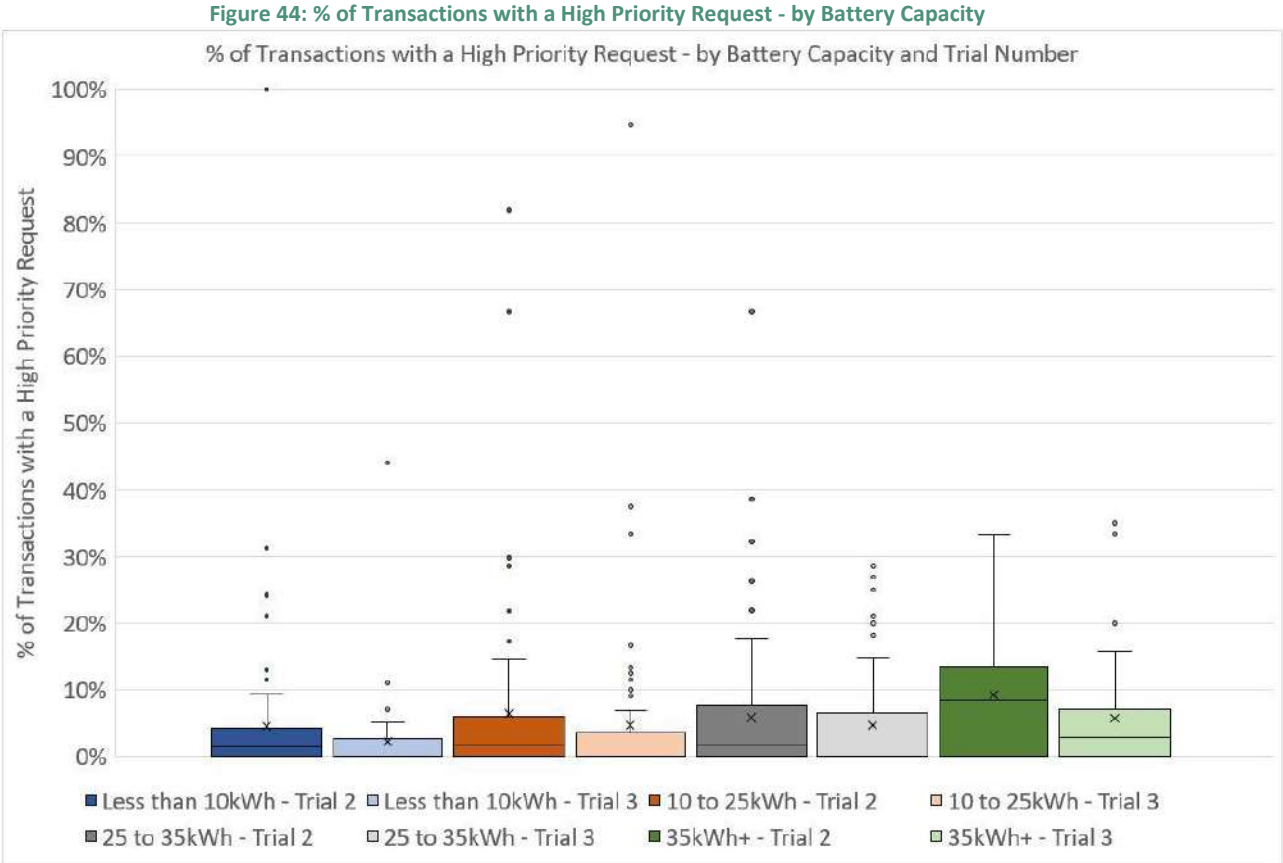


Figure 44: % of Transactions with a High Priority Request - by Battery Capacity



This data is also summarised in the table below, showing the percentage of participants who have never made a high priority request, and the median value in each category.

	Category	% of Participants with no high priority requests	Median % of transactions with a high priority request	Number of Participants in Category who Used the Charger
	All Vehicles	Trial 2 = 40% Trial 3 = 54%	Trial 2 = 1.8% Trial 3 = 0%	Trial 2 = 251 Trial 3 = 242
Plug-in Vehicle Type	BEV	Trial 2 = 36% Trial 3 = 51%	Trial 2 = 3.6% Trial 3= 0%	Trial 2= 113 Trial 3= 114
	REX	Trial 2 = 47% Trial 3 = 51%	Trial 2 = 1.3% Trial 3= 0%	Trial 2 = 38 Trial 3 = 35
	PHEV	Trial 2 = 42% Trial 3 = 58%	Trial 2 = 1.1% Trial 3= 0%	Trial 2 = 100 Trial 3 = 93
Battery Capacity	Less than 10kWh	Trial 2 = 33% Trial 3 = 55%	Trial 2 = 1.4% Trial 3 = 0%	Trial 2 = 75 Trial 3 = 64
	10 to 25kWh	Trial 2 = 40% Trial 3 = 60%	Trial 2 = 1.7% Trial 3 = 0%	Trial 2 = 65 Trial 3 = 63
	25 to 35kWh	Trial 2 = 43% Trial 3 = 56%	Trial 2 = 1.6% Trial 3 = 0%	Trial 2 = 72 Trial 3 = 68
	35kWh and above	Trial 2 = 33% Trial 3 = 40%	Trial 2 = 8.5% Trial 3 = 2.8%	Trial 2 = 43 Trial 3 = 47

Table 7: Summary of Use of High Priority Function, by Trial, PIV Type and Battery Capacity

40% and 54% of participants in Trials 2 and 3 respectively never requested high priority. Some of these participants did not download the app. However, the decline between Trial 2 and 3 across all categories suggests that the use of the feature declined among those who did have the app between Trial 2 and Trial 3.

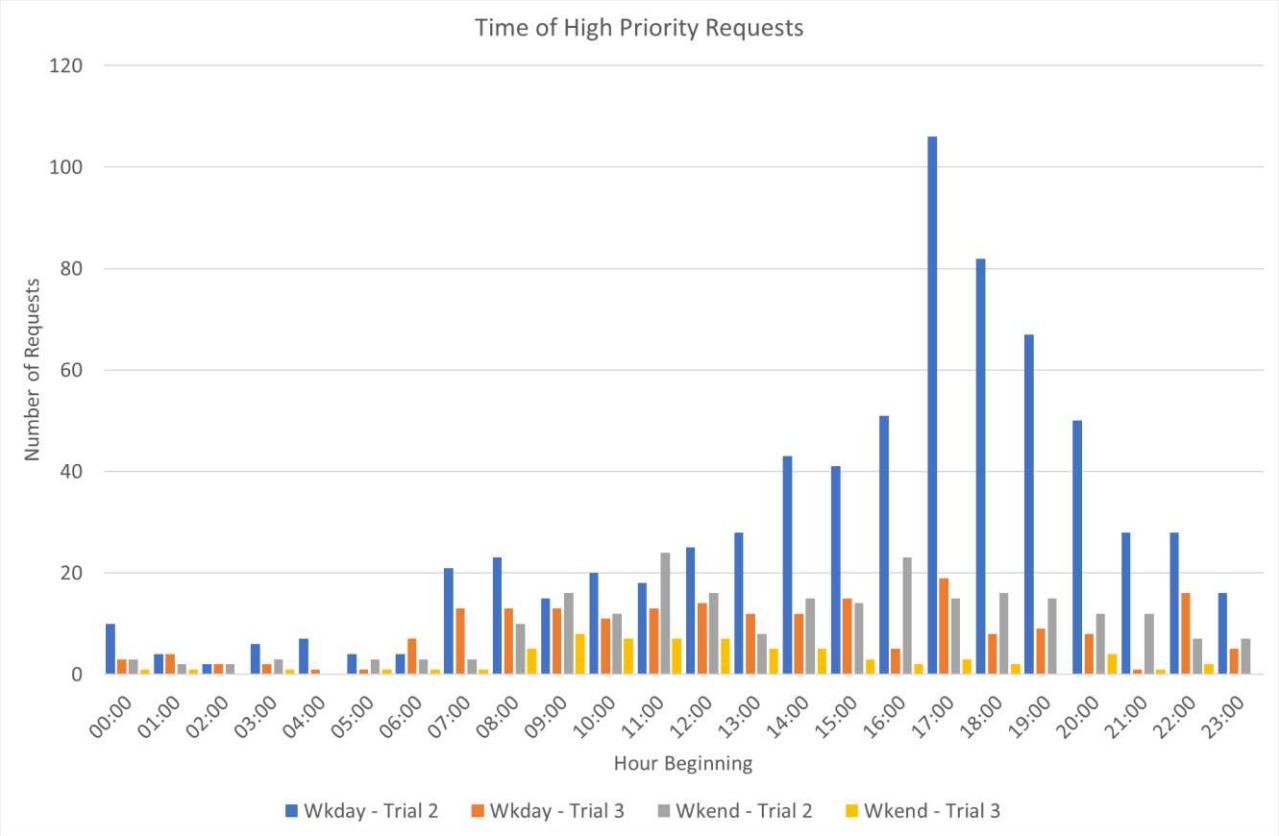
Use of high priority is slightly more common for battery only vehicles than either range extended or plug-in hybrid vehicles. This is understandable as the potential consequences of demand management are more severe for those without an alternative fuel source.

High priority requests occur much more frequently by participants with the largest battery sizes. Demand management reduces the average current available to a car across a charging session (e.g. instead of 32A being available for three hours there may be two 15-minute pauses, reducing the average rate to 27A). In most cases the reduced rate is still sufficiently fast to fully recharge the vehicle before it is unplugged. However, this may not be the case during shorter transactions, or where a large amount of energy is required. The second of these scenarios is more likely to occur for participants with vehicles with larger batteries.

The app interface during both Trials 2 and 3 showed participants the current that their vehicle was drawing and the amount available from their charger in real time. Participants may be requesting high priority either in response to demand management being active (i.e.

observing that smart charging is reducing the current available), or in anticipation that management may occur during the charging session. The timing of the requests can provide some insight to this, particularly when compared to the times of day when management is active (see Figure 34 and Figure 35**Error! Reference source not found.**).

Figure 45: Time of High Priority Requests



This shows that considerably more high priority requests were made on weekdays in Trial 2 than in other periods. The timing of these requests also aligns with the times when management was more likely to be active. Fewer requests are received at the weekend, but this may be due to fewer transactions occurring as well as a lower likelihood of demand management, or fewer time pressures on drivers. A significant proportion of participants are requesting high priority for charging sessions which are unlikely to be constrained – as shown by the number of requests received during the daytime.

During Trial 3 participants could select one of three different charging preferences which would alter the time their vehicle charged, potentially allowing them to maximise their reward value. The use of high priority requests for the different charging preferences is shown in the table below.

Charging Preference	Number of Transactions during Trial 3*	Number with a High Priority Request	% of Transactions with High Priority Request
Optimise Time (Default setting -charge at all times, regardless of price)	5301	127	2.4%
Minimise Cost (charge during off-peak time only)	3971	103	2.6%
Optimise Time and Cost (charge during off-peak and the 'taper' period)	623	42	6.7%
Total	**9895**	**272**	**2.7%**

Table 8: Use of High Priority with Different Charging Preferences

* Transactions from participants involved in Trial 3 only, where consumed energy was at least 0.5kWh.

This reinforces the view that participants select high priority without consideration of whether or not management is likely (e.g. when allowing overnight charging via the minimise cost option).

7.3.3 Use of Charging Preferences during Trial 3

Participants could use the GreenFlux app to manage their preference for when their vehicle charged as part of Trial 3, via by selecting one of three options:

- To "minimise charging cost"
  - In which case the system paused charging during peak and taper tariff period (only charging between 22:00 and 16:30)
- Or "optimise time and cost"
  - In which case the system only paused during the peak tariff period but would bring a charger on to charge during taper tariff (charging from 19:00 to 16:30)
- Or "optimise time" (default option, to prevent unexpected changes to charging)

The impact of the ToU tariff can be observed by comparing the time at which charging began across the whole population for charging events during Trial 3, and those outside it. This is shown in the two graphs below.

Figure 46: Start of Charging Time - Weekdays - ToU Reward vs. No Reward

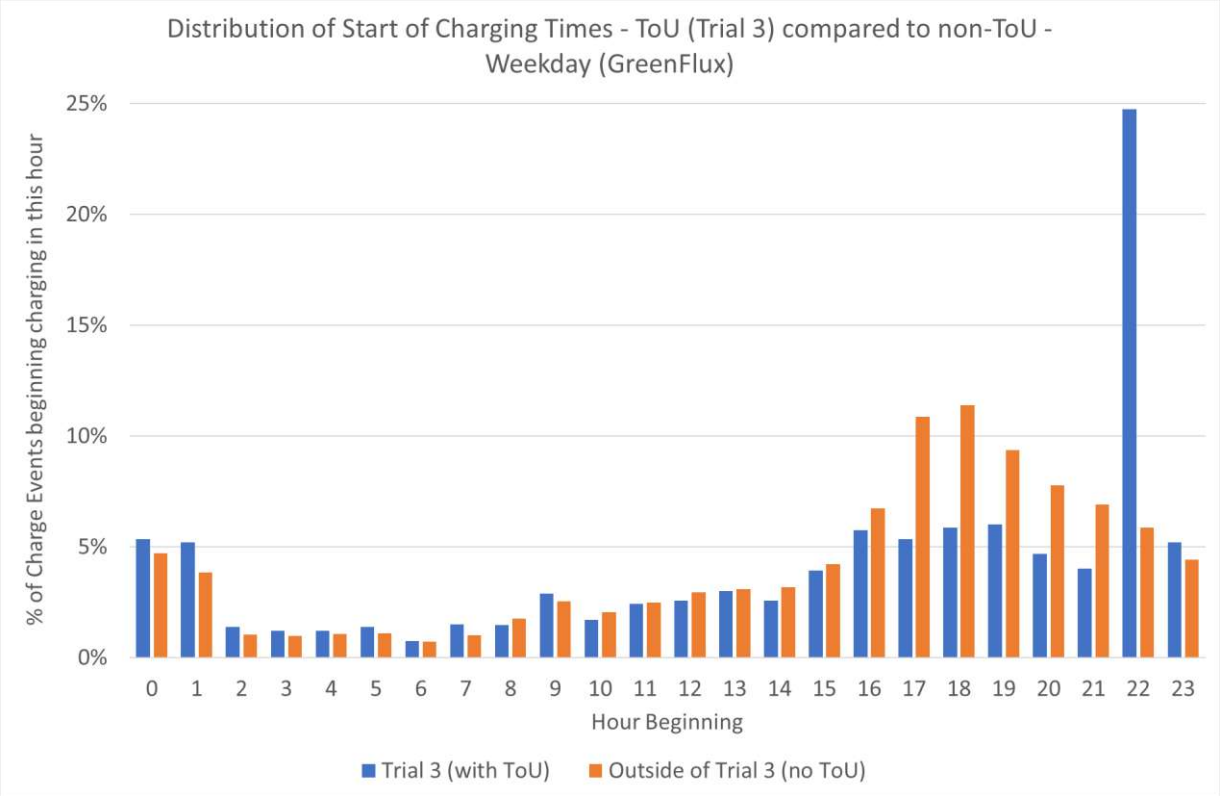
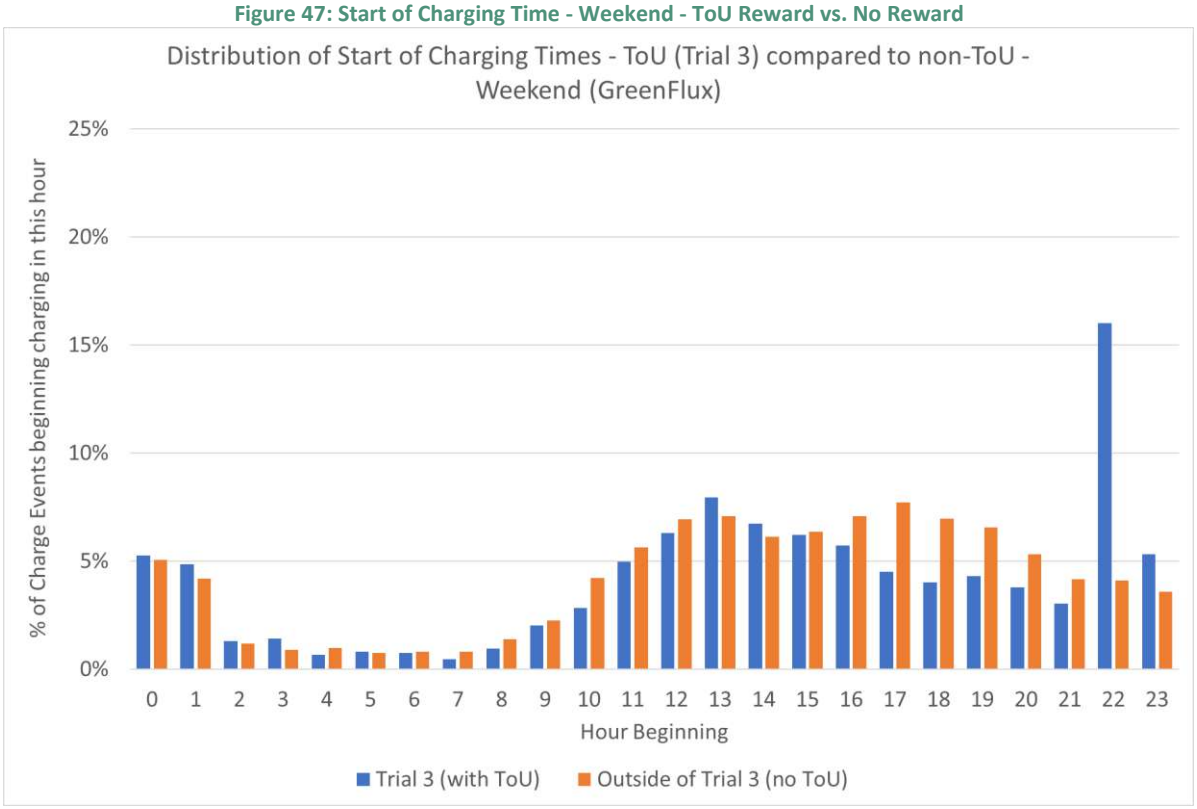


Figure 47: Start of Charging Time - Weekend - ToU Reward vs. No Reward



This shows a clear change in the proportion of charging events which begin in the traditional evening peak for both weekdays and weekends. The displaced transactions have moved to 22:00, when the off-peak rate began.

The GreenFlux app could be used by participants to maximise their reward value by selecting one of the charging preferences described above. GreenFlux has provided data for charging events which occurred during Trial 3, recording which charging preference had been used. Alternatively, participants could choose to increase their reward value using the car's timer function (i.e. leaving the app set to 'optimise time' but setting a timer on the vehicle to delay charging until the off-peak period). The use of a in vehicle timer would have exactly the same effect as using the app in terms of reward earned (or in real life savings on a ToU tariff – the only advantage of the app being that the time of charge control setting is done for the user, so long as they don't change it, whereas on a vehicle timer if changed it has to be changed back.

The data provided by GreenFlux for sessions during Trial 3 covers 9,895 charging events[4]. 274 participants were part of the Trial 3 group, and a charging record exists for 246 of these participants (90%). The remaining participants may have not used their charger during the Trial 3 period, or their charger may have been offline. If any charge events took place on either the 'minimise cost' or 'optimise time and cost' settings then the participant must have interacted with the app, in order to change the preference from the default (optimise time). 149 of the 246 participants with transactions during Trial 3 used these preferences (61%). The remaining 39% of participants may have not downloaded the app at all (see Figure 39). Alternatively, they may have chosen to remain on the default option and potentially maximised their reward value by charging outside the peak (either due to their plug-in time, or by using a timer). These issues will be investigated when the Trial 3 survey result analysis is complete.

The box and whisker diagrams below show distribution of the percentage of participants charge events from the Trial 3 period, where either 'minimise cost' or 'optimise time and cost' were used, by both PIV type, and battery capacity.

[4] Only charging events where greater than 0.5kWh was consumed are included in the analysis.

Figure 48: Use of Minimise Cost or Optimise Time and Cost (non-default options) by PIV Type

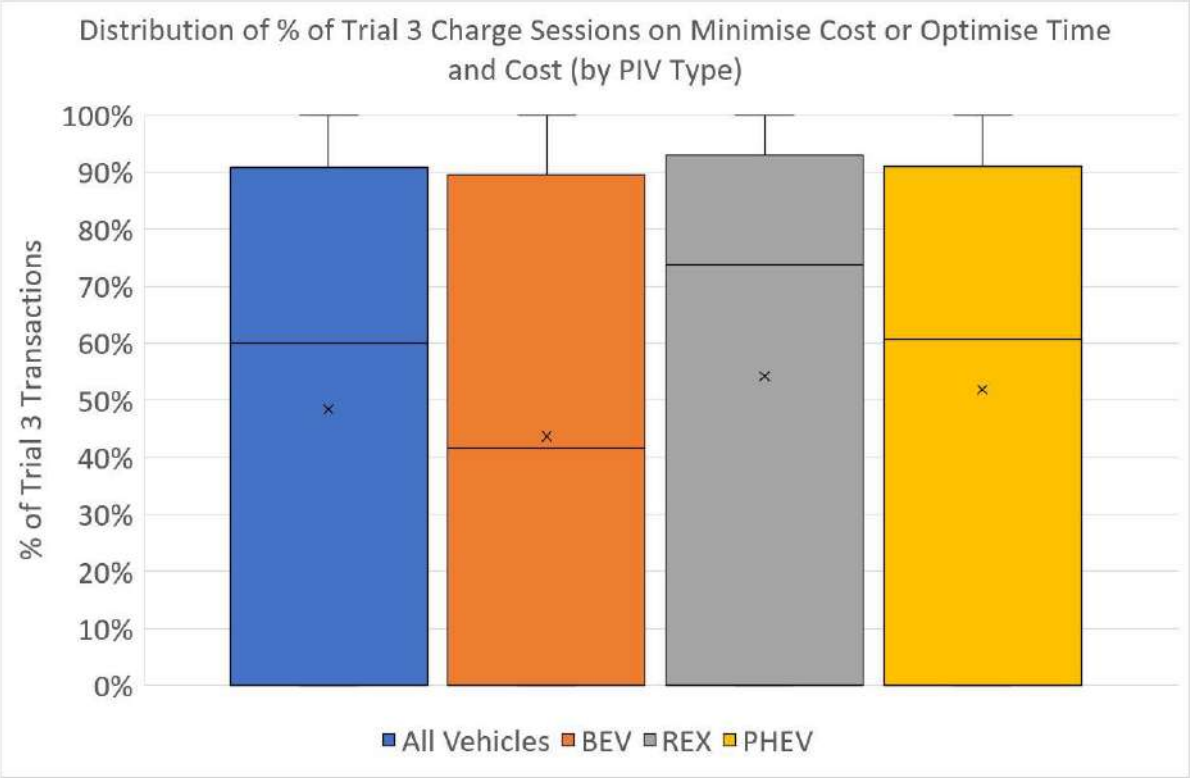
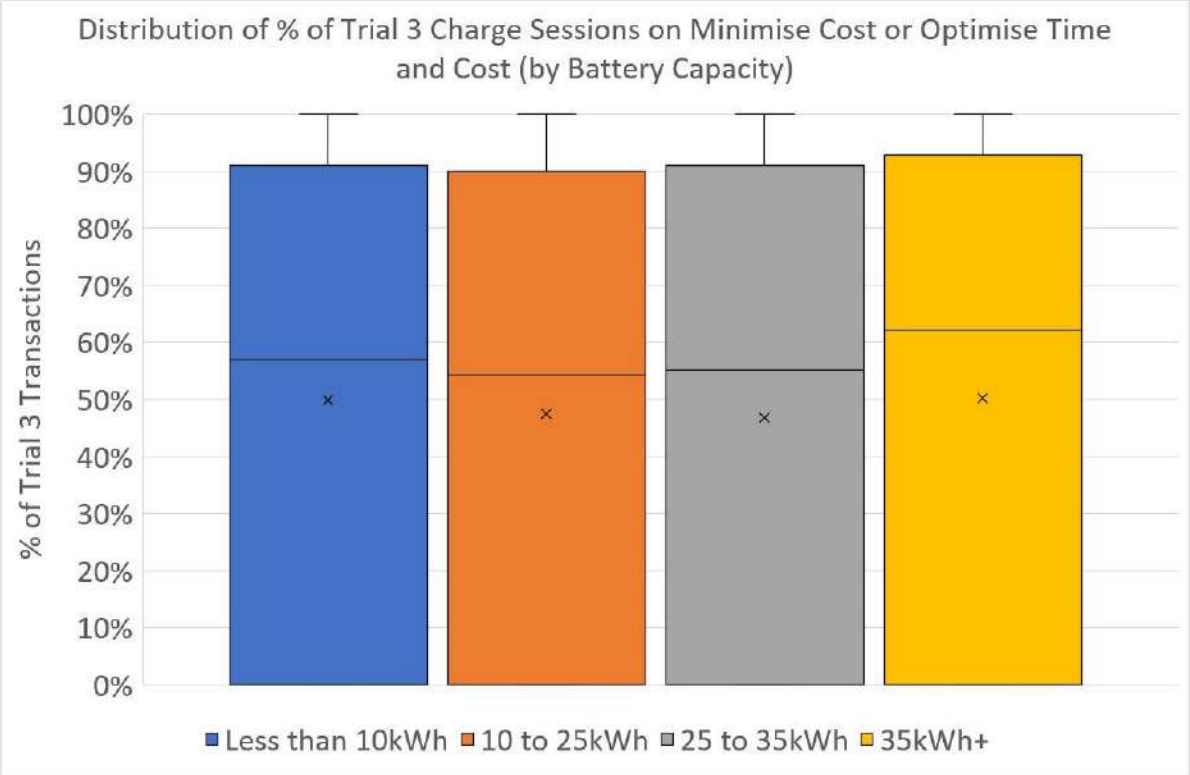


Figure 49: Use of Minimise Cost or Optimise Time and Cost (non-default options) by Battery Capacity



Both plots show considerable variation in the level of use of different charging preferences by participants, both by PIV type and battery capacity – as the interquartile range (the size of the central box) is large. The median values in each case are summarised in the table below.

	Category	Median % of Trial 3 Charge Events using either Minimise Cost or Optimise Time and Cost
	All Vehicles	60%
Plug-in Vehicle Type	BEV	42%
	REX	74%
	PHEV	61%
Battery Capacity	Less than 10kWh	57%
	10 to 25kWh	54%
	25 to 35kWh	55%
	35kWh and above	62%

Table 9: Median Values for % of Trial 3 Charge Events using either Minimise Cost or Optimise Time and Cost

Use of "non-default" charging preferences (minimise cost or optimise time and cost) may have varied through the course of Trial 3. This has been visualised below using a heat map, showing a row for each participant (only including those who used a 'non-default' charging preference in at least one week between Weeks 43 (w/c 22nd October) and 50 (w/c 10th December)). The two plots shown below each represent one half of the participants.

% of Charge Events on Non Default Option - by Week Number

43	44	45	46	47	48	49	50
100%	100%	100%		100%	100%		100%
100%	100%	100%	100%	100%	100%	100%	100%
		100%				100%	50%
0%	0%	100%	100%	100%	100%	100%	100%
50%	100%	75%	50%	67%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
75%	82%	100%	71%	100%	100%	64%	9%
100%	100%						
0%	0%	100%	100%	100%	100%		100%
67%	100%	100%	100%	100%	100%	100%	100%
0%	0%	100%	100%	100%	100%	100%	100%
0%	0%	33%	0%	100%		100%	
100%	100%	0%	0%	0%	0%	0%	0%
100%	100%	100%	100%		100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	33%	83%	100%	100%	100%	100%	100%
0%	0%	0%	75%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
0%	0%	0%	100%	100%	100%	100%	100%
0%	0%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	33%	71%	100%
0%	0%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	67%	100%	100%
0%	0%	0%	0%	18%	0%	0%	14%
100%	100%	100%	100%	100%		100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
0%	0%	100%	100%	100%	100%	100%	
100%	100%	100%	50%	75%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
0%		100%	100%	100%			100%
100%	100%		100%		100%	100%	
100%	100%	100%	100%	100%	100%	100%	100%
100%		100%	100%	100%	100%	100%	100%
0%	0%	0%	0%	57%	100%	100%	100%
100%	83%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	14%	0%	0%	0%
100%	100%	100%	100%	100%	75%	100%	100%
0%	0%	0%	50%	100%	100%	100%	100%
100%	100%			100%	100%	100%	100%
		100%			100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
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0%		33%			100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%		100%	100%
0%	0%	20%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	86%	63%	100%	100%	100%	100%	100%
0%	0%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
50%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	100%	89%
100%	100%	100%		100%	100%	100%	50%
100%	100%			100%	100%	100%	100%
0%	0%	100%	100%	100%	100%	100%	100%
0%	0%	100%	100%	100%	100%	100%	100%

% of Charge Events on Non Default Option - by Week Number

43	44	45	46	47	48	49	50
100%	100%	100%	100%	100%	100%	80%	80%
0%	0%	86%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%		100%	100%	100%	100%	100%	100%
0%		100%	100%	100%	100%	100%	100%
		100%		100%	100%		
0%	0%	100%		100%	100%	100%	100%
100%		100%	100%	100%		100%	
100%	100%	100%		100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
		100%		100%	100%		
100%	100%	100%	100%	100%	100%	100%	100%
	0%		0%	0%	0%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
0%		100%	100%	100%	100%	100%	0%
		100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	88%	57%	100%	100%	100%	100%	86%
100%	100%	100%					
100%	75%	100%	100%	100%	100%	100%	100%
							100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
	0%	100%					
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
0%	0%	0%	40%	40%	100%	100%	100%
100%		100%	100%	100%	100%		
100%	100%	100%	100%	100%	100%	100%	100%
100%		100%	100%		100%	100%	100%
100%	100%	100%	100%		100%	100%	
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
0%	0%	33%	83%	100%	100%	100%	100%
		100%	100%	100%	100%	100%	80%
100%	100%	100%	100%	100%	100%	100%	100%
100%		100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	73%	100%
78%	100%	100%	100%	100%	73%	90%	89%
		22%	100%	100%	100%	100%	100%
0%	33%	100%	100%	100%	100%	100%	100%
67%	100%	100%	100%	100%	100%	100%	100%
67%	100%	100%	100%	100%	100%	100%	100%
0%	0%	100%	100%		100%	100%	100%
		100%		100%	100%	100%	100%
0%	0%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
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	100%	100%	100%	100%	100%	100%	100%
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100%	100%	100%	100%	100%	100%	100%	100%
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100%	100%	100%		100%		100%	
0%	100%	100%	100%	100%	100%	100%	100%
0%	0%	100%		100%	100%		100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	75%	0%	0%	100%	25%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	
	83%				67%	100%	100%
100%	100%		100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%
100%	100%		100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%		
0%	25%	100%	100%	100%	100%	100%	100%
	0%	100%	100%	100%	100%	100%	100%
100%	100%	100%	67%	50%	100%	100%	50%

This appears to indicate that for the majority of participants once they have changed their preference (either to a non-default option, or back to the default) they keep the same preference, as rows generally remain the same colour across multiple weeks. The app

settings are retained for all subsequent transactions once set, until and if changed. A smaller number of participants have switched preferences from week to week (e.g. the bottom row of the right-hand plot). This also appears to indicate that the majority of participants either use a non-default option for all their transactions or not at all (as participants who didn't ever use minimise cost or optimise time and cost are excluded from the above plot).

Using the app and charging preferences was one way in which participants could respond to the reward structure and seek to maximise their reward. However, the analysis above does not show where participants changed their charging behaviour without using the app – either by using a timer or changing the plug-in time. For each charging event where meter values are available (i.e. those that occurred whilst the charger was online) the time at which charging started can be determined. This may be some time after the car was plugged in, either due to the use of a timer set by the participant on their car, or by using a charging preference in the app. Each transaction has been evaluated to show whether charging began in the weekday evening peak (Monday to Friday 16:00 to 19:59). The percentage of a participants charging events which met this criterion has been evaluated before the introduction of the ToU reward (i.e. outside of Trial 3) and after this (during Trial 3). If participants responded to the ToU tariff then a lower proportion of their charge events would begin in the weekday evening peak during Trial 3 (i.e. they would fall into the left-hand column in the table below), when compared to the rest of the trial. The breakdown of participants is shown in the table below (excluding participants with fewer than five charge events during Trial 3).

	Category	Trial 3 vs. Outside of Trial 3		
		Lower % of Transactions Beginning in the Weekday Evening Peak	**Equal %** of Transactions Beginning in the Weekday Evening Peak	**Higher %** of Transactions Beginning in the Weekday Evening Peak
	All Participants	76% (178)	2% (4)	23% (53)
Plug-in Vehicle Type	BEV	68% (74)	4% (4)	28% (31)
	REX	80% (28)	0% (0)	20% (7)
	PHEV	89% (76)	0% (0)	11% (15)
Battery Capacity	Less than 10kWh	85% (53)	0% (0)	15% (9)
	10 to 25kWh	73% (46)	0% (0)	27% (17)
	25 to 35kWh	74% (49)	2% (1)	24% (16)
	35kWh and above	68% (30)	7% (3)	25% (11)

Table 10: Change in Proportion of Charge Events Beginning in the Weekday Evening Peak (Trial 3 compared to rest of the project), by PIV Type and Battery Capacity

This shows that the majority of participants in all categories moved their demand away from the weekday evening peak during Trial 3. It also appears to indicate that participants

with smaller battery sizes were more likely to shift their demand away from the evening peak within Trial 3 when compared to those with the largest batteries, potentially because these participants are aware that their vehicle does not take long to charge, and they have an alternative fuel source if they need to make an unexpected journey before charging begins later in the evening.

The table above only shows the direction of the change which participants made (lower or higher proportion of their charging starting in the weekday evening peak). The extent of the change made can be seen on the graphs below, for different types of plug-in vehicle and different battery capacities.

Figure 50: % Change of Charge Events Beginning in the Weekday Evening Peak - Outside Trial 3 (without ToU reward) vs. Inside Trial 3 (by Battery Capacity)

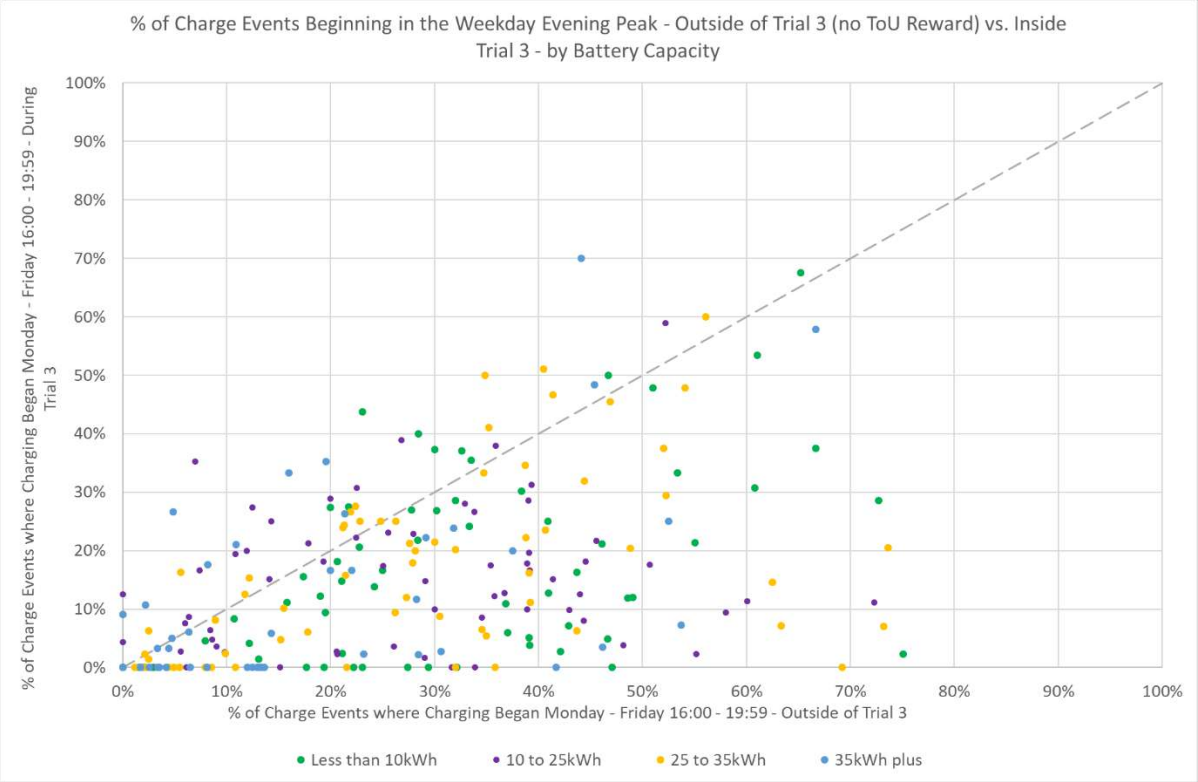
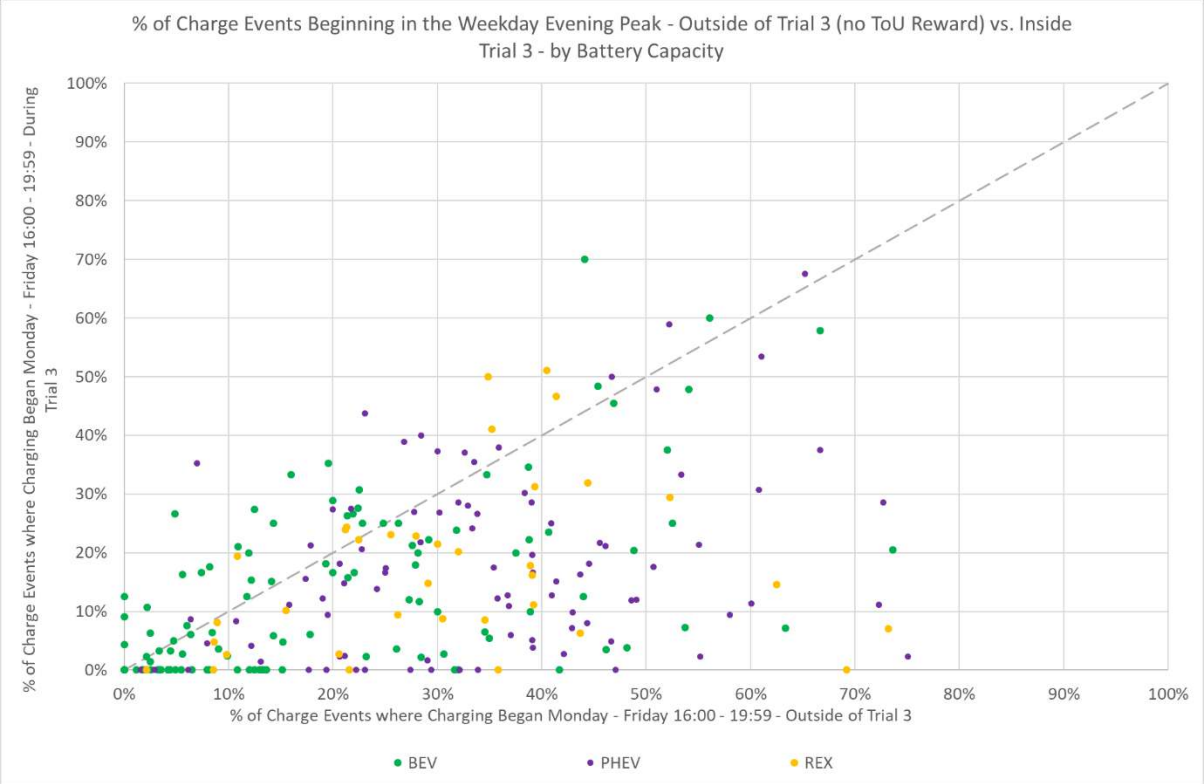


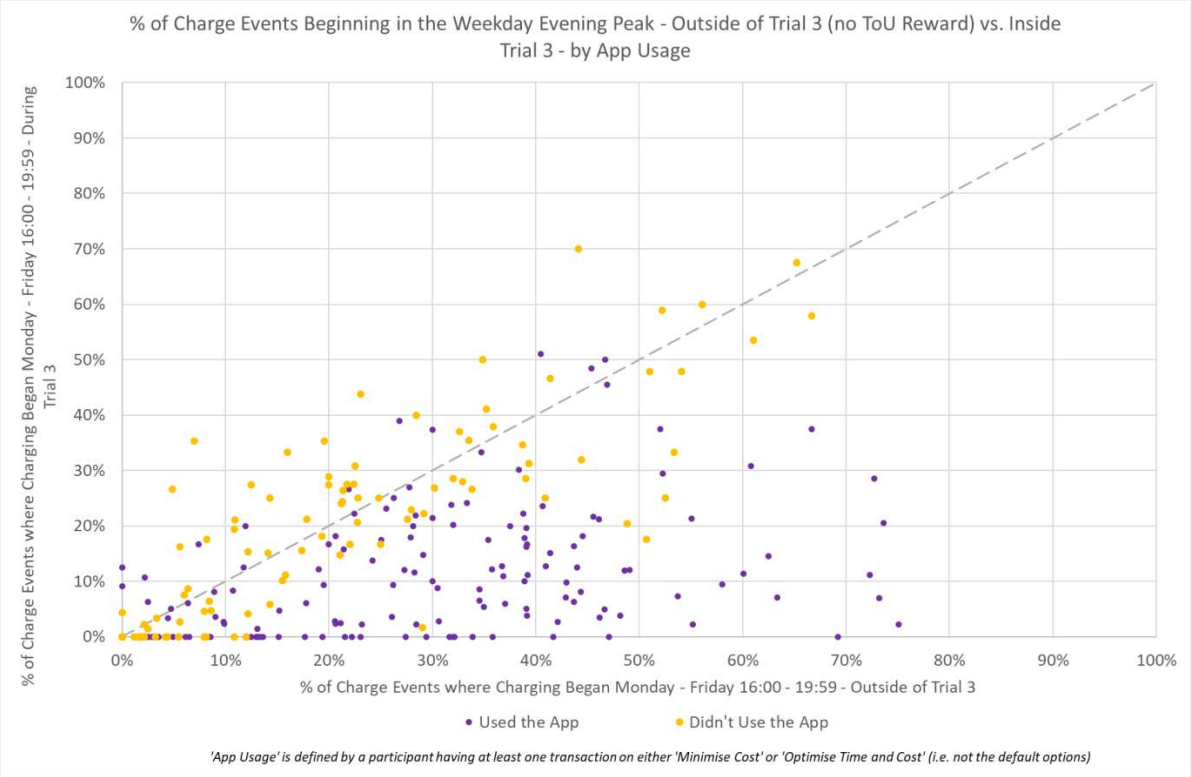
Figure 51: % Change of Charge Events Beginning in the Weekday Evening Peak - Outside Trial 3 (without ToU reward) vs. Inside Trial 3 (by PIV Type)



In both these graphs, any marker below the dashed line represents a participant who had a lower proportion of their charge events beginning in the weekday evening peak during Trial 3 (when they received a ToU based reward) compared to the rest of the trial. Participants making the largest changes are on the bottom right hand side of the plot (i.e. large % of charge events in the evening peak outside of Trial 3, then a low % during Trial 3). Seven participants have moved from starting over 50% of their charging events in the evening peak to less than 10% when receiving ToU based rewards. All seven of these participants made substantial use of the 'minimise cost' charging profile.

A similar comparison can be made between participants who used the app to change their charging preference (i.e. they have used either the 'minimise cost' or 'optimise time and cost' options at least once) and those who did not (all their Trial 3 charging was on the default option).

Figure 52: % Change of Charge Events Beginning in the Weekday Evening Peak - Outside Trial 3 (without ToU reward) vs. Inside Trial 3 (by App Usage)



This is summarised in the table below.

Category	Trial 3 vs. Outside of Trial 3		
	Lower % of Transactions Beginning in the Weekday Evening Peak	**Equal %** of Transactions Beginning in the Weekday Evening Peak	**Higher %** of Transactions Beginning in the Weekday Evening Peak
All Participants	76% (178)	2% (4)	23% (53)
Participants who used the app	90% (126)	0% (0)	10% (14)
Participant who did not use the app	55% (52)	4% (4)	41% (39)

Table 11: Change in Proportion of Charge Events Beginning in the Weekday Evening Peak (Trial 3 compared to rest of the project), by Use of the App

This shows that the largest changes in charging behaviour were achieved by those participants who used the app, but even amongst those who did not use the app, the majority of participants started a lower proportion of their charge events during the evening peak. The app made changing charging behaviour away from charging during the evening peak easy for participants, which may have supported participants in making the largest changes. However, it is not possible to say whether these participants would have achieved similar levels of change if they had been exposed to the same reward, but without the support of the app (i.e. whether participants who used the app would have set timers

instead, if the app hadn't been available to them). If possible, this will be explored with participants in the focus groups.

Further analysis of app usage and linking to this to participants responses to the customer research surveys will be contained in the final project report.

8 Decommissioning

Elements of the 'smart charging' functionality of the Electric Nation required decommissioning as the demand management trial has now finished. In most cases, where reliable communications can be established with the charger, this can be completed remotely. If this was not possible, participants were contacted to ask them to re-establish communications and if this was not successful then arrangements are being made for the Tech Factory to carry out a site visit.

The current status of decommissioning activities is shown below for GreenFlux and CrowdCharge:

Current Position	Total Number of Chargers
Removed from smart charging remotely (i.e. decommissioning complete)	94.5% (326)
Removed from smart charging via site visit (i.e. decommissioning complete)	1.4% (5)
Online, awaiting action by GreenFlux	0.6% (2)
Escalated to the Tech Factory for a site visit	2.9% (10)
No response from participant (charger offline)	0.6% (2)
Total	**100% (345)**

Table 12: Decommissioning Status - GreenFlux

Most chargers have been decommissioned successfully remotely, avoiding the need for site visits. Only a very small number of chargers remain in smart charging but offline, with no response from the participant.

Current Position	Total Number of Chargers
Decommissioned remotely (i.e. decommissioning complete)	62.7% (205)
Decommissioned via site visit (i.e. decommissioning complete)	8.9% (29)
Escalated to the Tech Factory for a site visit	5.1% (17)
Participant agreed to reset equipment – awaiting action	0.3% (1)
Participant on holiday – awaiting action	0.3% (1)
No response from participant (charger offline)	3.4% (11)
Remaining commissioned in order to take part in further testing (outside of Electric Nation, where the participant has consented to this)	19.3% (63)
Total	**100% (327)**

Table 13: Decommissioning Status - CrowdCharge

The majority of decommissioning (where it is required) has taken place, although requiring a greater number of site visits than in the GreenFlux group. A number of participants have consented to remaining connected to CrowdCharge so that they could be used in future demand management activities, beyond the scope of Electric Nation.

9 Next Steps

9.1 Customer Research

The project final survey was distributed to all participants on 7th January 2019. Participants will have until 10th February to complete the survey. This survey investigates participants' involvement in the trial and whether their attitude to demand management has altered after their trial experience. It will also ask broader questions about EV ownership. If the participant has completed the Recruitment survey, they will be eligible for a £25 Amazon voucher as an incentive. The small number of participants who have not yet completed the Recruitment survey have also been sent a link to this and reminded that to be eligible for the £25 voucher they need to complete the Recruitment survey. Analysis of these survey results will be included in the final trial report.

Final analysis of all the trial surveys will be included in end of project reports. This analysis will include the statistical quantification of the impact of demand management on individual participants to allow a ranking of their experience.

9.2 Smart Charging Trials/Data Analysis

As reported above, the smart charging trials are now complete. Decommissioning work will continue (led by Drive Electric) until the remaining chargers are decommissioned.

The focus of the EA Technology team for the remainder of the project is on the processing of the data generated by the project and analysis of these results. At the time of writing two separate databases have been established – one for GreenFlux and one for CrowdCharge. The outputs are similar in each case, but the calculation methods differ substantially due to differences in the data provided and control algorithms used. The activity for these databases in the coming months is as follows:

- CrowdCharge: implement all the required calculated fields and verify the database output against calculation specifications. This will then allow analysis of charging behaviour for participants across the trial, analysis of group demand and the amount of demand management necessary. Analysis of app usage data will be explored further with CrowdCharge.
- GreenFlux: refine calculation methods for detecting management of individual transactions and verify the database outputs. Analysis is already underway of the total group demand and amount of demand management at a group level. The experience of individual participants will be analysed further in the coming months.

Appendix 1 – Recruitment Survey

Electric Nation Recruitment Questionnaire

December 2016

568 Electric Nation	ONLINE SCRIPT DRAFT 14/12/16	Susie Smyth, Michael Brainch, Lucy Upshall, Helen Rackstraw

INTRODUCTION TO THE RESEARCH AND ADHERENCE TO MRS CODE OF CONDUCT

CATI ONLY: Hello, may I speak to **NAME FROM SAMPLE** please?

C1. I am calling from Impact Research about the Electric Nation project that you recently agreed to take part in. We recently sent you a survey link by email, can I check whether you received that email?
Yes
No – **CONFIRM EMAIL ADDRESS WITH RESPONDENT MATCHES SAMPLE**

C2. We would be really grateful if you would be able to complete this survey as soon as possible, I can take you through the questions now on the phone, or if you prefer you can complete it online? The survey should take no longer than 10 minutes.
Phone - **CONTINUE**
Online – **CHECK IF NEED LINK RE-SENDING, THANK AND CLOSE.**

Thank you for agreeing to participate in this important project about the future of electric vehicles. This is the first of a number of surveys you will be asked to take part in during the trial and should take no more than 10 minutes to complete, depending on the answers you give us. The purpose of this survey is to check the information we hold about you and gather some background about your household before you start the trials. This information will be used in combination with that from the other trial participants to understand how perceptions might vary by different groups.

This is a genuine market research study and no sales call will result from our contact with you. The interview will be carried out in strict accordance with the Market Research Society's Code of Conduct. Your identity and any information you provide to us will be kept confidential and will not be used for any purposes other than this research. Your details

were provided to us by DriveElectric and only Impact Research and DriveElectric will have access to your personal contact information so that we can keep in touch with you throughout the trials.

SAMPLE CONFIRMATION

We already have some details about you that were passed to us by DriveElectric that we would like to check all are correct before we continue.

S ASK ALL
A1 Can we check your full name is **INSERT FROM SAMPLE** .....
Correct
Wrong – **INSERT NAME HERE**

S ASK ALL

A2 And is this your home address where your charging point is installed? **INSERT FROM SAMPLE** .....
Correct
Wrong – **INSERT CORRECT ADDRESS HERE**

Is your postcode?
INSERT FROM SAMPLE .....
Correct
Wrong – **INSERT CORRECT POST CODE HERE**

QHIDDNO
AUTOCODE DNO FROM POSTCODE LIST:

1) WPD (East Midlands)
2) WPD (South West)
3) WPD (Wales)
4) WPD (West Midlands)
5) Electricity North West
6) Guernsey Electricity
7) Jersey Electricity
8) Manx Electricity Authority
9) Northern Ireland Electricity
10) Northern Powergrid
11) Scottish Hydro
12) Southern Electric
13) SP Distribution
14) SP Manweb
15) UKPN

S ASK ALL

A3 Is this the best telephone number on which we can contact you on for the duration of the trials?

Correct
Wrong – **INSERT CORRECT NUMBER HERE**

S ASK ALL

A5 And is this your preferred email address?
Correct
Wrong – **INSERT CORRECT EMAIL ADDRESS HERE**

A6 And can I confirm your vehicle is…
FROM SAMPLE:
FULL EV OR HYBRID
CAR MAKE AND MODEL

(ALLOW EDITING FOR ANY FIELDS THAT ARE WRONG)

S ASK ALL

A7 Does your household have regular access to any other vehicles apart from the electric/hybrid vehicle registered for this trial?

Yes **(SPECIFY MAKE AND MODEL)**
No

S ASK IF YES AT A7

A8 How many other vehicles does your household have regular access to?

1
2
3+

S ASK ALL

A9 Which of these best describes how you personally use the electric/hybrid vehicle registered for this trial?

I am the main driver
I drive the car regularly but am not the main driver
I rarely or never drive the vehicle **CONFIRM WITH RESPONDENT, CLOSE, AND CONTACT IMPACT AS ALL DRIVERS SHOULD BE REGULAR DRIVERS OF THE VEHICLE.**

M ASK ALL

A10 Apart from you, who else is likely to drive the electric/hybrid vehicle registered for this trial?

Please select all that apply.

My partner
Another household member
Someone who does not live in the household
Only me EXCLUSIVE

Thank you for confirming that information. We will now ask you some questions about your household.

DEMOGRAPHICS AND HOUSEHOLD INFORMATION

S ASK ALL,

B1 Please record your gender below.

1) Male
2) Female

S ASK ALL

ADD VALIDATION RULE NO YOUNGER THAN 16 AND UP TO 99 YEARS OLD

B2 Please record your age below.

……. Years old

AUTOMATICALLY CODE INTO THE FOLLOWING AGE BREAKS (HIDDEN VARAIBLE]

IF CODE 1 CLOSE

QHIDAGE Please record **age** below

1) Under 18
2) 18-25
3) 26-35
4) 36-45
5) 46-55
6) 56-64
7) 65+

S ASK ALL

B3 Which of the following best describes ***your*** employment?

1) Self employed
2) Employed over 30 hours a week
3) Employed part time, 15-30 hours a week
4) Employed part time, less than 15 hours a week
5) Full time Student
6) Unemployed- seeking work
7) Unemployed- other
8) Looking after the home/children full time
9) Retired
10) Unable to work due to sickness or disability
11) Other (please specify)

S **ASK IF CODE 1, 2, 3, 4 AT B3**

IF CODE 5, 6, 7, 8 SKIP TO B5

B4 Is your work…

1. Mainly daytime work
2. Mainly evening work, from 7pm to 11pm
3. Mainly night work, 11pm to 5am
4. Shifts that change from day to day or week to week

B5 How many people (including children) are there in your household altogether (that is currently living at home with you)?

Please include yourself in the total.

ENTER NUMBER 1-20

IF 2 OR MORE AT B5 ASK B6

B6 How many children live permanently in your household?

ENTER NUMBER 0-20

S ASK ALL

B7 Which ONE of the following categories best describes the employment status of the ***Chief Income Earner*** (CIE) in your household?

1) Semi or unskilled manual *worker (e.g. Caretaker, Park keeper, non-HGV driver, shop assistant etc.)*
2) Skilled manual worker *(e.g. Bricklayer, Carpenter, Plumber, Painter, Bus/ Ambulance Driver, HGV driver, pub/bar worker etc.)*
3) Supervisory or clerical/ junior managerial/ professional/ administrative *(e.g. Office worker, Student Doctor, Foreman with 25+ employees, salesperson, etc.)*
4) Intermediate managerial/ professional/ administrative *(e.g. Newly qualified (under 3 years) doctor, Solicitor, Board director of small organisation, middle manager in large organisation, principle officer in civil service/local government etc.)*
5) Higher managerial/ professional/ administrative *(e.g. Doctor, Solicitor, Board Director in a large organisation 200+ employees, top level civil servant/public service employee etc.)*
6) Student
7) Casual worker – not in permanent employment
8) Housewife/ Homemaker
9) Retired and living on state pension
10) Retired and not living on state pension
11) Unemployed or not working due to long-term sickness
12) Full-time carer of other household member

S ASK IF CODE 10 AT B7

B8 Which ONE of the following categories best describes the employment status of the Chief Income Earner ***before*** they retired?

SHOW THE SAME LIST AS B7, EXCLUDING CODES 9 AND 10

AUTOMATICALLY CODES OF QUESTIONS B7 AND B8 INTO SOCIAL ECONOMIC GRADE AS FOLLOWS:

CODE 1	**D**
CODE 2	**C2**
CODE 3 OR 6	**C1**

CODE 4 **B**
CODE 5 **A**
CODE 7 OR 8 OR 9 OR 10 OR 11 OR 12 **E**

S GRID ASK ALL
B9 Which of these best represents your **total** household income before tax and other deductions, either per month or per year.

This information will only be used to check that we have surveyed a mixture of different customers.

ONLY ALLOW ONE ANSWER IN ONE COLUMN

	PER MONTH	PER YEAR
1	Up to £539	Up to £6,499
2	£540 - £789	£6,500 - £9,499
3	£790 - £1289	£9,500 - £15,499
4	£1290 - £2079	£15,500 - £24,999
5	£2080 - £3329	£25,000 - £39,999
6	£3330 - £4999	£40,000 - £59,999
7	£5000 - £7499	£60,000 - £89,999
8	£7500 and over	£90,000 and over
98	Don't know	Don't know
99	Prefer not to say	Prefer not to say

S ASK ALL
B10 Which of the following do you have in your main charging address?

Mains electricity only
Mains electricity and mains gas
Mains electricity and another fuel source such as oil

S ASK ALL
B11 Do have solar panels (photovoltaics) at your home address?
Yes
No
Not sure

S GRID ASK ALL
B12 On average, how much is your combined spend, on gas **and** electricity?

ONLY ALLOW ONE ANSWER IN ONE COLUMN

	PER MONTH	PER YEAR
1	Less than £35 per month	Less than £400 per year
2	£35 - £49	£400 - £599
3	£50 - £65	£600 - £799
4	£66 - £85	£800 - £999
5	£86-£100	£1,000 - £1,199
6	£101 - £115	£1,200 - £1,399
7	£116 - £130	£1,400 - £1,599
8	£131-£149	£1,600 - £1,799
9	Over £150 per month	£1,800 or more per year
98	Don't know	Don't know
99	Prefer not to say	Prefer not to say

QHIDFUELPOV:
1 FUEL POOR – IF MORE THAN 10% OF INCOME SPENT ON FUEL BASED ON RESPONSE AT B9 AND B12
2 NON-FUEL POOR – IF LESS THAN 10% OF INCOME SPENT ON FUEL BASED ON RESPONSE AT B9 AND B12

C1 Finally, have you experienced any technical difficulties while taking the survey?

1. No
2. Yes (Please specify)

Thank you for the information you have provided today. We will be in touch again once you have had your vehicle and been charging it for a few weeks to understand a little more about how you use and charge you vehicle.

If you have any questions in the meantime about the survey you have just done, or future surveys, please contact Impact Research on 01932 226 793 and ask for a member of the Electric Nation team. Our full contact details and those of the Electric Nation project partners such as DriveElectric were provided to you in your welcome pack. Please do not hesitate to get in touch if you have any questions.

Thank you.

Appendix 2 – Baseline Survey

Electric Nation Recruitment Questionnaire

February 2017

568 Electric Nation	ONLINE SCRIPT FV 22/02/17	Susie Smyth, Michael Brainch, Lucy Upshall, Helen Rackstraw

INTRODUCTION TO THE RESEARCH AND ADHERENCE TO MRS CODE OF CONDUCT

CATI ONLY: Hello, may I speak to **NAME FROM SAMPLE** please?
C1. I am calling from Impact Research about the Electric Nation project that you recently agreed to take part in. We recently sent you a survey link by email, can I check whether you received that email?
Yes
No – **CONFIRM EMAIL ADDRESS WITH RESPONDENT MATCHES SAMPLE**

CATI ONLY: C2. We would be really grateful if you would be able to complete this survey as soon as possible, I can take you through the questions now on the phone, or if you prefer you can complete it online? The survey should take no longer than 5 minutes.
Phone - **CONTINUE**
Online – **CHECK IF NEED LINK RE-SENDING, THANK AND CLOSE.**

ASK ALL
Thank you for agreeing to participate in this important project about the future of electric vehicles. This is the second survey that you will be asked to take part in during the trial and should take no more than 5 minutes to complete, depending on the answers you give us. The purpose of this survey is to gauge how you are currently charging your electric vehicle. This information will be used in combination with that from the other trial participants to understand how behaviour might vary by different groups.

This is a genuine market research study and no sales call will result from our contact with you. The interview will be carried out in strict accordance with the Market Research Society's Code of Conduct. Your identity and any information you provide to us will be kept confidential and will not be used for any purposes other than this research. Your details were provided to us by DriveElectric and only Impact Research and DriveElectric will have

access to your personal contact information so that we can keep in touch with you throughout the trials.

USE

We have some details about you we would like to check are correct before we continue.

M ASK ALL

A1 Firstly, what do you use your electric vehicle for? Please select all that apply.

1) Social
2) Business
3) Commuting

S ASK ALL

A2 Does your household have regular access to any other vehicles apart from the electric/hybrid vehicle registered for this trial?

1) Yes
2) No

S ASK IF A2=YES

A2a How many other vehicles does your household have regular access to apart from the electric/hybrid vehicle registered for this trial?

1) ……. **(SPECIFY MAKE AND MODEL FOR EACH)**

M ASK IF A2 = YES PLEASE SHOW ON SAME PAGE AS A2

A3 Is your other vehicle(s)… Please select all that apply.

1) Electric
2) Range extended electric
3) Plug in Hybrid
4) Hybrid
5) Petrol
6) Diesel
7) Other (please specify)

Thank you for confirming this information. We will now ask you some questions about your electric vehicle.

CHARGING BEHAVIOUR

M ASK ALL, ROTATE ALL

B1 To what extent do you agree or disagree with the following statement, where 1 is strongly disagree and 5 is strongly agree.

1) My charging behaviour varies considerably from day to day
2) My charging behaviour has a regular routine
3) Whenever I have access to a charger, I plug in, regardless of the level of charge of the vehicle
4) I will only plug in to charge when the battery is too low to complete my current/next journey

M **ASK ALL, MULTICODE**

B2 Where do you charge your electric vehicle? Please select all that apply.

3) Home
4) Service station (motorway) / Petrol station
5) On street charge point
6) Work
7) Supermarket/Shopping centre car parks
8) Other Car parks (please specify)
9) Friend/relative's house
10) Other (please specify)
11) Don't know

S **ASK ALL, SINGLE CODE**

B3 And, where do you charge your electric vehicle most often?

INSERT ALL SELECTED AT B2

S **ASK ALL, SINGLE CODE BY ROW**

B4 How often do you charge your electric vehicle in the following locations?

	1)	2)	3)	4)	5)	6)	7)	8)
Location	More than once a day	Once a day	5 -6 times a week	3-4 times a week	Once – twice a week	Once a fortnight	Less than once a fortnight	I don't have charging routine / Don't know
INSERT ALL SELECTED AT B2								

M **ASK ALL, MULTICODE**

B5 When do you typically charge your electric vehicle at the following locations? Please select all that apply to each location.

	1)	2)	3)	4)	5)
Location	Morning	Afternoon	Evening	Overnight	I don't have a standardised charging routine
INSERT ALL SELECTED AT B2					

S ASK ALL

B6 Thinking about when you charge your electric vehicle in the following locations, how long do you charge your electric vehicle for on each occasion?

	1)	2)
Location	**PROGRAMMER: NUMERIC BOX** _____ hours	I don't have a charging routine / Don't know
INSERT ALL SELECTED AT B2		

S ASK ALL

B7A How do you tend to judge when to charge your electric vehicle?

1) Number of miles left
2) Percentage of battery left
3) Other (please specify)

S ASK IF B7A = 1

B7B At what point would you feel like you need to charge the battery of your electric vehicle?

1) 10 miles or below
2) 20 miles or below
3) 50 miles or below
4) 100 miles or below
5) 150 miles or below
6) More than 150 miles

7) Other (please specify)

S ASK IF B7A = 2

B7C At what point would you feel like you need to charge the battery of your electric vehicle?

1) Below 75% charge
2) Below 50% charge
3) Below 25% charge
4) Other (please specify)

S ASK ALL

B8 On a scale of 1 – 10, where 1 is completely unacceptable and 10 is completely acceptable, how **acceptable** are your current charging arrangements?

1) 1 – Completely unacceptable
2) 2
3) 3
4) 4
5) 5
6) 6
7) 7
8) 8
9) 9
10) 10 – Completely acceptable
11) Don't know (Please specify why)

S ASK ALL

B9 On a scale of 1 – 10, where 10 is very satisfied and 1 is very dissatisfied, how **satisfied** are you with your current charging arrangements?

1) 1 - Very dissatisfied
2) 2
3) 3
4) 4
5) 5
6) 6
7) 7
8) 8
9) 9
10) 10 – Very satisfied
11) Don't know

S ASK ALL

B10 Which statement best describes your attitude to changing your charging behaviour

1) I am very willing to continue with this current charging arrangement indefinitely
2) I am willing to continue with this current charging arrangement for a limited time only
3) I would prefer alternative charging arrangements
4) I cannot continue with these current charging arrangements

OE ASK IF CODES 2 – 4 SELECTED AT B10
B11 Why do you say that?

S ASK ALL
B12 How do you feel about having your charging arrangements managed as part of the trial?

1) Not at all concerned
2) Slightly concerned
3) Quite concerned
4) Very concerned
5) Not sure

OE ASK ALL
B13 Why do you say that?

INSTALLATION QUESTIONS (DE)

Thinking back to when you had your charge point installed….

G ASK ALL
I1 Overall can you tell us what you thought of your experience with DriveElectric in terms of… **ROWS**
a) Contact with DriveElectric
b) Information provided to you about the project
c) Administration of your application for the charger

COLUMNS
1) Very poor
2) Poor
3) Neither poor nor good
4) Good
5) Very good

S ASK ALL
I2 How was your experience of the install itself?

1) Very poor
2) Poor
3) Neither poor nor good
4) Good
5) Very good

S ASK ALL

I3 Did the installer explain how safety would be managed as part of the installation?

1) Yes
2) No
3) Can't remember

OE ASK ALL

I4 Is there anything you feel you need more information on regarding the project?

OPEN ENDED

Thank you for providing that information. I would just like to confirm your contact information is up to date.

CONTACT INFORMATION

S ASK ALL

C1 Can I confirm that this is still the best number to contact you on?

1) Yes
2) No

S ASK IF C1 = 2

C2 Please provide the best number to contact you on in the future?

_____

C3 Finally, have you experienced any technical difficulties while taking the survey?

1. No
2. Yes (Please specify)

Thank you for the information you have provided today. We will be in touch again once the first trial is underway and you have had few weeks to charge your vehicle.

If you have any questions in the meantime about the survey you have just done, or future surveys, please contact Impact Research on 01932 226 793 and ask for a member of the Electric Nation team. Our full contact details and those of the Electric Nation project partners such as DriveElectric were provided to you in your welcome pack. Please do not hesitate to get in touch if you have any questions.

Thank you.

Appendix 3 – Trial 2 survey app questions – CrowdCharge cohort

Electric Nation Trial 2 Questionnaire

July 2018

568 Electric Nation	ONLINE SCRIPT FV 05/07/17	Helen Rackstraw, Evelin Roberts, Nicole McNab

INTRODUCTION TO THE RESEARCH AND ADHERENCE TO MRS CODE OF CONDUCT

CATI ONLY: Hello, may I speak to **NAME FROM SAMPLE** please?
C1. I am calling from Impact Research about the Electric Nation project. We recently sent you a survey link by email, can I check whether you received that email?
Yes
No – **CONFIRM EMAIL ADDRESS WITH RESPONDENT MATCHES SAMPLE**

CATI ONLY: C2. We would be really grateful if you would be able to complete this survey as soon as possible, I can take you through the questions now on the phone, or if you prefer you can complete it online? The survey should take no longer than 5 minutes.
Phone - **CONTINUE**
Online – **CHECK IF NEED LINK RE-SENDING, THANK AND CLOSE.**

ASK ALL
Thank you for agreeing to participate in this important project about the future of electric vehicles. This is the fourth survey that you will be asked to take part in during the trial and should take no more than 5 minutes to complete, depending on the answers you give us. The purpose of this survey is to gauge how you are currently charging your electric vehicle. This information will be used in combination with that from the other trial participants to understand how behaviour might vary by different groups.

This is a genuine market research study and no sales call will result from our contact with you. The interview will be carried out in strict accordance with the Market Research Society's Code of Conduct. Your identity and any information you provide to us will be kept confidential and will not be used for any purposes other than this research. Your details were provided to us by DriveElectric and only Impact Research and DriveElectric will have access to your personal contact information so that we can keep in touch with you throughout the trials.

USE

Firstly we would like to ask you a couple of classification questions. You may have answered these in the past, however, we would like to understand if anything has changed since you were last interviewed.

M ASK ALL

A1 Firstly, what do you use your electric vehicle for? Please select all that apply.

4) Social
5) Business
6) Commuting

S ASK ALL

A2 Does your household have regular access to any other vehicles apart from the electric/hybrid vehicle registered for this trial?

3) Yes
4) No

S ASK IF A2=YES

A2a How many other vehicles does your household have regular access to apart from the electric/hybrid vehicle registered for this trial?

2) ……. **(SPECIFY MAKE AND MODEL FOR EACH)**

M ASK IF A2 = YES PLEASE SHOW ON SAME PAGE AS A2

A3 Is your other vehicle(s)… Please select all that apply.

8) Electric
9) Range extended electric
10) Plug in Hybrid
11) Hybrid
12) Petrol
13) Diesel
14) Other (please specify)

S ASK IF A3=1, 2, 3, OR 4

A4 Since we last spoke (INTERVIEWER: this could be the baseline survey OR another trial survey) do any other plug-in vehicles, not previously registered on the trial, now have access to your home charge point?

1) Yes
2) No

S ASK IF A4= 1

A5 How frequently does this vehicle use your home charge point?

1. More than once a day
2. Once a day

3. 5-6 times a week
4. 3-4 times a week
5. Once - twice a week
6. Once a fortnight
7. Less than once a fortnight

Thank you for confirming this information. We will now ask you some questions about your electric vehicle.

CHARGING BEHAVIOUR

M **ASK ALL, ROTATE ALL**

B1 To what extent do you agree or disagree with the following statement, where 1 is strongly disagree and 5 is strongly agree.

5) My charging behaviour varies considerably from day to day
6) My charging behaviour has a regular routine
7) Whenever I have access to a charger, I plug in, regardless of the level of charge of the vehicle
8) I will only plug in to charge when the battery is too low to complete my current/next journey

S **ASK ALL**

B1b Have your charging arrangements changed recently? *By this we mean since you last completed a survey.*

1) Yes
2) No
3) Don't know

MC **ASK IF CODE 1 SELECTED AT B1B**

B1c How have your charging arrangements changed? Which of the following apply to you?

1) I tend to charge my vehicle more or less frequently than I did before
2) I tend to charge my vehicle at different times of the day
3) I have changed how long I tend to charge my vehicle for
4) Other [PLEASE SPECIFY]

SC **ASK IF CODE 1 SELECTED AT B1C**

B1d How has the frequency with which you charge changed?

1) I charge my vehicle much more
2) I charge my vehicle slightly more
3) I charge my vehicle less
4) I charge my vehicle much less

MC **ASK IF CODE 1 SELECTED AT B1B,**

B1e Why has your charging arrangements changed? **(INTERVIEWER SELECT RELEVANT CODE)**

1) Change in lifestyle
2) Changes in household status e.g. presence of children
3) Change in job/ hours
4) Change in job location
5) Smart charging
6) Other reason (please specify)

M **ASK ALL, MULTICODE**

B2 Where do you charge your electric vehicle? Please select all that apply.

12) Home
13) Service station (motorway) / Petrol station
14) On street charge point
15) Work
16) Supermarket/Shopping centre car parks
17) Other Car parks (please specify)
18) Friend/relative's house
19) Other (please specify)
20) Don't know

S **ASK ALL, SINGLE CODE**

B3 And, where do you charge your electric vehicle most often?

INSERT ALL SELECTED AT B2

S **ASK ALL, SINGLE CODE BY ROW**

B4 How often do you charge your electric vehicle in the following locations?

	1)	2)	3)	4)	5)	6)	7)	8)
Location	More than once a day	Once a day	5 -6 times a week	3-4 times a week	Once – twice a week	Once a fortnight	Less than once a fortnight	I don't have charging routine / Don't know
INSERT ALL SELECTED AT B2								

M **ASK ALL, MULTICODE**

B5 When do you typically charge your electric vehicle at the following locations? Please select all that apply to each location.

	1)	2)	3)	4)	5)
Location	Morning	Afternoon	Evening	Overnight	I don't have a standardised charging routine
INSERT ALL SELECTED AT B2					

S **ASK ALL**

B6 Thinking about when you charge your electric vehicle in the following locations, how long do you charge your electric vehicle for on each occasion?

	1)	2)
Location	**PROGRAMMER: NUMERIC BOX** _____ hours	I don't have a charging routine / Don't know
INSERT ALL SELECTED AT B2		

S **ASK ALL**

B7A How do you tend to judge when to charge your electric vehicle?

4) Number of miles left
5) Percentage of battery left
6) Other (please specify)

S **ASK IF B7A = 1**

B7B At what point would you feel like you need to charge the battery of your electric vehicle?

8) 10 miles or below
9) 20 miles or below
10) 50 miles or below

11) 100 miles or below
12) 150 miles or below
13) More than 150 miles
14) Other (please specify)

S ASK IF B7A = 2

B7C At what point would you feel like you need to charge the battery of your electric vehicle?

5) Below 75% charge
6) Below 50% charge
7) Below 25% charge
8) Other (please specify)

S ASK ALL

B8 On a scale of 1 – 10, where 1 is completely unacceptable and 10 is completely acceptable, how **acceptable** are your current charging arrangements?

12) 1 – Completely unacceptable
13) 2
14) 3
15) 4
16) 5
17) 6
18) 7
19) 8
20) 9
21) 10 – Completely acceptable
22) Don't know (Please specify why)

S ASK ALL

B9 On a scale of 1 – 10, where 10 is very satisfied and 1 is very dissatisfied, how **satisfied** are you with your current charging arrangements?

12) 1 - Very dissatisfied
13) 2
14) 3
15) 4
16) 5
17) 6
18) 7
19) 8
20) 9
21) 10 – Very satisfied
22) Don't know

S ASK ALL

B10 Which statement best describes your attitude to changing your charging behaviour

5) I am very willing to continue with this current charging arrangement indefinitely

6) I am willing to continue with this current charging arrangement for a limited time only
7) I would prefer alternative charging arrangements
8) I cannot continue with these current charging arrangements

OE ASK IF CODES 2 – 4 SELECTED AT B10
B11 Why do you say that?

S ASK ALL
B12 How do you feel about having your charging arrangements managed as part of the trial?

6) Not at all concerned
7) Slightly concerned
8) Quite concerned
9) Very concerned
10) Not sure

OE ASK ALL
B13 Why do you say that?

App Usage

S ASK ALL
B14 Are you aware that you can access an app to interact with your smart charging system?

1) Yes
2) No
3) Not sure

S ASK IF CODE 1 AT B14
B15 Have you used the app?

1) Yes
2) No

OE ASK IF CODE 2 SELECTED AT B15
B16 Why have you not used the app?

S ASK IF CODE 1 AT B14 AND ASK GREENFLUX ONLY
B17a Are you aware that you can use the app to request high priority charging?
1) Yes, and I have used it
2) Yes, but I have not used it
3) No

4) Not sure

OE ASK IF CODE 1 AT B17a

B17b What were your reasons for requesting high priority charging?

MS ASK IF CODE 1 AT B14 AND ASK CROWDCHARGE ONLY

B18a Which of the following functions, that are available on the app, are you aware of?
Please select all that apply

1) Ability to enter your journeys into a planner as: daily grind/commute, weekly/regulars or occasionals
2) Ability to view a breakdown of your entered journeys by day, week and month and cost of these journey/electricity used
3) Ability to view your charge point usage broken down by month/day of energy used (kWh)/cost (£)
4) Ability to enter the state of charge (% of battery) of your vehicle. CrowdCharge use this information to help ensure you receive enough charge to complete your next journey
5) None of the above

M ASK IF NOT CODE 5 AT B18A AND CODE 1 AT B15 – ONLY SHOWING OPTIONS SELECTED AT B18A

B18b Which of the following have you used on the app?
Please select all that apply

1) Ability to enter your journeys into a planner as: daily grind/commute, weekly/regulars or occasionals
2) Ability to view a breakdown of your entered journeys by day, week and month and cost of these journey/electricity used
3) Ability to view your charge point usage broken down by month/day of energy used (kWh)/cost (£)
4) Ability to enter the state of charge (% of battery) of your vehicle. CrowdCharge use this information to help ensure you receive enough charge to complete your next journey
5) None of the above

OE ASK IF CODE 1 AT B15 AND CROWDCHARGE ONLY

B19 Can you explain why you use the app?

OE ASK IF CODE 1 AT B14

B20 Are there any other functions that you expected to see on the app?

S ASK ALL

B21 How likely are you to use the app going forward?

1) Very likely
2) Slightly likely

3) Neither likely nor unlikely
4) Slightly unlikely
5) Very unlikely

S **ASK IF CODE 1 AT B14**

B22 To what extent does the app alleviate your concerns about managed charging?

1) I had **no** concerns regardless of the app
2) I had concerns and the app alleviates **some** of them
3) I had concerns and the app alleviates **most** of them
4) I had concerns and the app alleviates **all** of them
5) Not sure

S **ASK IF CODE 1 AT B15**

B23 How easy do you find using the app?

1) Very Easy
2) Easy
3) Neither easy or hard
4) Hard
5) Very hard

OE **ASK ALL**

B24 Is there anything else that you would like to share about your experience of being part of the Electric Nation project so far that hasn't already been covered in this interview?

CONTACT INFORMATION

S **ASK ALL**

C1 Can I confirm that this is still the best number to contact you on?

3) Yes
4) No

S **ASK IF C1 = 2**

C2 Please provide the best number to contact you on in the future?

_____

C3 Finally, have you experienced any technical difficulties while taking the survey?

1. No
2. Yes (Please specify)

Thank you for the information you have provided today. If you have any questions about the survey you have just done, or future surveys, please contact Impact Research on 01932 226 793 and ask for a member of the Electric Nation team. Our full contact details and those of the Electric Nation project partners such as DriveElectric were provided to you in your welcome pack. Please do not hesitate to get in touch if you have any questions.

Thank you.

Appendix 4 – Trial 3 survey app questions – Greenflux cohort

Electric Nation Trial 3 Questionnaire

November 2018

568 Electric Nation	ONLINE SCRIPT 13/11/18	Helen Rackstraw, Evelin Roberts, Nicole McNab

INTRODUCTION TO THE RESEARCH AND ADHERENCE TO MRS CODE OF CONDUCT

CATI ONLY: Hello, may I speak to **NAME FROM SAMPLE** please?
C1. I am calling from Impact Research about the Electric Nation project. We recently sent you a survey link by email, can I check whether you received that email?
Yes
No – **CONFIRM EMAIL ADDRESS WITH RESPONDENT MATCHES SAMPLE**

CATI ONLY: C2. We would be really grateful if you would be able to complete this survey as soon as possible, I can take you through the questions now on the phone, or if you prefer you can complete it online? The survey should take no longer than 5 minutes.
Phone - **CONTINUE**
Online – **CHECK IF NEED LINK RE-SENDING, THANK AND CLOSE.**

ASK ALL
Thank you for agreeing to participate in this important project about the future of electric vehicles. This is the fourth survey that you will be asked to take part in during the trial and should take no more than 5 minutes to complete, depending on the answers you give us. The purpose of this survey is to gauge how you are currently charging your electric vehicle. This information will be used in combination with that from the other trial participants to understand how behaviour might vary by different groups.

This is a genuine market research study and no sales call will result from our contact with you. The interview will be carried out in strict accordance with the Market Research Society's Code of Conduct. Your identity and any information you provide to us will be kept confidential and will not be used for any purposes other than this research. Your details were provided to us by DriveElectric and only Impact Research and DriveElectric will have access to your personal contact information so that we can keep in touch with you throughout the trials.

USE

Firstly we would like to ask you a couple of classification questions. You may have answered these in the past, however, we would like to understand if anything has changed since you were last interviewed.

M ASK ALL

A1 Firstly, what do you use your electric vehicle for? Please select all that apply.

7) Social
8) Business
9) Commuting

S ASK ALL

A2 Does your household have regular access to any other vehicles apart from the electric/hybrid vehicle registered for this trial?

5) Yes
6) No

M ASK IF A2=YES

A2a How many other vehicles does your household have regular access to apart from the electric/hybrid vehicle registered for this trial?

3) ……. **(SPECIFY MAKE AND MODEL FOR EACH)**

S ASK IF A2 = YES SHOW ALONGSIDE INPUTTED ANSWER FROM A2a

A3 Is your other vehicle(s)… Please select all that apply.

15) Electric
16) Range extended electric
17) Plug in Hybrid
18) Hybrid
19) Petrol
20) Diesel
21) Other (please specify)

REPEAT FOR EACH ADDITIONAL CAR

S ASK IF A3=1, 2, 3, OR 4

A4 Since we last spoke (INTERVIEWER: this could be the baseline survey OR another trial survey) do any other plug-in vehicles, not previously registered on the trial, now have access to your home charge point?

3) Yes
4) No

S ASK IF A4= 1

A5 How frequently does this vehicle use your home charge point?

8. More than once a day
9. Once a day
10. 5-6 times a week
11. 3-4 times a week
12. Once - twice a week
13. Once a fortnight
14. Less than once a fortnight

Thank you for confirming this information. We will now ask you some questions about your electric vehicle.

CHARGING BEHAVIOUR

M **ASK ALL, ROTATE ALL**

B1 To what extent do you agree or disagree with the following statement, where 1 is strongly disagree and 5 is strongly agree.

9) My charging behaviour varies considerably from day to day
10) My charging behaviour has a regular routine
11) Whenever I have access to a charger, I plug in, regardless of the level of charge of the vehicle
12) I will only plug in to charge when the battery is too low to complete my current/next journey

S **ASK ALL**

B1b Have your charging arrangements changed recently? *By this we mean since you last completed a survey.*

4) Yes
5) No
6) Don't know

MC **ASK IF CODE 1 SELECTED AT B1B**

B1c How have your charging arrangements changed? Which of the following apply to you?

1) I tend to charge my vehicle more or less frequently than I did before
2) I tend to charge my vehicle at different times of the day
3) I have changed how long I tend to charge my vehicle for
4) Other [PLEASE SPECIFY]

SC **ASK IF CODE 1 SELECTED AT B1C**

B1d How has the frequency with which you charge changed?

1) I charge my vehicle much more
2) I charge my vehicle slightly more
3) I charge my vehicle less
4) I charge my vehicle much less

MC **ASK IF CODE 1 SELECTED AT B1B,**

B1e Why has your charging arrangements changed? **(INTERVIEWER SELECT RELEVANT CODE)**

7) Change in lifestyle
8) Changes in household status e.g. presence of children
9) Change in job/ hours
10) Change in job location
11) Smart charging
12) Other reason (please specify)

M **ASK ALL, MULTICODE**

B2 Where do you charge your electric vehicle? Please select all that apply.

21) Home
22) Service station (motorway) / Petrol station
23) On street charge point
24) Work
25) Supermarket/Shopping centre car parks
26) Other Car parks (please specify)
27) Friend/relative's house
28) Other (please specify)
29) Don't know

S **ASK ALL, SINGLE CODE**

B3 And, where do you charge your electric vehicle most often?

INSERT ALL SELECTED AT B2

S **ASK ALL, SINGLE CODE BY ROW**

B4 How often do you charge your electric vehicle in the following locations?

	1)	2)	3)	4)	5)	6)	7)	8)
Location	More than once a day	Once a day	5 -6 times a week	3-4 times a week	Once – twice a week	Once a fortnight	Less than once a fortnight	I don't have charging routine / Don't know
INSERT ALL SELECTED AT B2								

M **ASK ALL, MULTICODE**

B5 When do you typically charge your electric vehicle at the following locations? Please select all that apply to each location.

	1)	2)	3)	4)	5)
Location	Morning	Afternoon	Evening	Overnight	I don't have a standardised charging routine
INSERT ALL SELECTED AT B2					

S **ASK ALL**

B6 Thinking about when you charge your electric vehicle in the following locations, how long do you charge your electric vehicle for on each occasion?

	1)	2)
Location	**PROGRAMMER: NUMERIC BOX** _____ hours	I don't have a charging routine / Don't know
INSERT ALL SELECTED AT B2		

S **ASK ALL**

B7A How do you tend to judge when to charge your electric vehicle?

7) Number of miles left
8) Percentage of battery left
9) Other (please specify)

S **ASK IF B7A = 1**

B7B At what point would you feel like you need to charge the battery of your electric vehicle?

15) 10 miles or below
16) 20 miles or below
17) 50 miles or below

18) 100 miles or below
19) 150 miles or below
20) More than 150 miles
21) Other (please specify)

S ASK IF B7A = 2

B7C At what point would you feel like you need to charge the battery of your electric vehicle?

9) Below 75% charge
10) Below 50% charge
11) Below 25% charge
12) Other (please specify)

S ASK ALL

B8 On a scale of 1 – 10, where 1 is completely unacceptable and 10 is completely acceptable, how **acceptable** are your current charging arrangements?

23) 1 – Completely unacceptable
24) 2
25) 3
26) 4
27) 5
28) 6
29) 7
30) 8
31) 9
32) 10 – Completely acceptable
33) Don't know (Please specify why)

S ASK ALL

B9 On a scale of 1 – 10, where 10 is very satisfied and 1 is very dissatisfied, how **satisfied** are you with your current charging arrangements?

23) 1 - Very dissatisfied
24) 2
25) 3
26) 4
27) 5
28) 6
29) 7
30) 8
31) 9
32) 10 – Very satisfied
33) Don't know

S ASK ALL

B10 Which statement best describes your attitude to changing your charging behaviour

9) I am very willing to continue with this current charging arrangement indefinitely

10) I am willing to continue with this current charging arrangement for a limited time only
11) I would prefer alternative charging arrangements
12) I cannot continue with these current charging arrangements

OE ASK IF CODES 2 – 4 SELECTED AT B10
B11 Why do you say that?

S ASK ALL
B12 How do you feel about having your charging arrangements managed as part of the trial?

11) Not at all concerned
12) Slightly concerned
13) Quite concerned
14) Very concerned
15) Not sure

OE ASK ALL
B13 Why do you say that?

App Usage

S ASK ALL
B14 Are you aware that you can access an app to interact with your smart charging system?

4) Yes
5) No
6) Not sure

S ASK ALL
B14a Are you aware that the app has been recently updated? (i.e. within the last 2 months)

1) Yes
2) No

M ASK IF CODE 1 AT B14
B15 Have you used the app?
Please select all that apply

1) Yes - to change my charging preference
2) Yes - to request high priority

3) Yes - to view my current charging session
4) Yes - to review my reward or previous charging sessions
5) No

OE **ASK IF CODE 5 SELECTED AT B15**

B16 Why have you not used the app?

OE **ASK IF CODE 5 SELECTED AT B15**

B16A Did you know that by not accessing the app, you are on the default 'optimise time' profile (i.e. charging at any time of the day regardless of the price) which means you are not able to accrue additional time of use charging rewards?

1) Yes
2) No
3) Not sure

M **ASK IF CODE 1 3 or 4 SELECTED AT B15**

B25 Which charging preference have you used so far?
Please select all that apply

1) Minimise Cost – restricting the charging to between 10pm and 4.30pm
2) Optimise Time & Cost – avoiding charge at peak times but charging can occur between 7pm and 10pm
3) Optimise Time – charging all times of the day regardless of the price. This is the default setting so if you have not changed it you will be on this preference
4) I did not change it
5) Don't know

OE **ASK IF CODE 1,2,3 B25 – REPEAT FOR EACH PROFILE**

B26A Have you experience any problems with the **[PIPE IN SELECTED AT B25]** profile?

1) Yes (please tell us what problems you have had)
2) No

OE **ASK IF CODE 4 AT B25**

B26B Have you experience any problems using the app?

1) Yes (please tell us what problems you have had)
2) No

S **ASK IF CODE 1,2,3 SELECTED AT B25**

B27 Have you changed charging preference (e.g. from 'minimise cost' to 'optimise time'?

1) Yes – once
2) Yes – 2-3 times
3) Yes – more than 3 times
4) No

5) Don't Know

M **ASK IF CODE 1,2,3 SELECTED AT B27**

B27A Why did you change tariff profiles?
Please select all that apply

1) Wanted to increase the reward amount
2) Due to concerns over not having enough charge
3) Felt the rewards were not high enough to charge outside peak times
4) Wanted to try out other profiles to see how they worked
5) Car didn't charge when I needed it
6) I had a longer/different journey to take and therefore needed charging soon
7) Other (please specify)

S **ASK IF CODE 1 or 3 SELECTED AT B15**

B28 How easy to understand is the charging preference reward structure?

6) Very Easy
7) Easy
8) Neither easy nor hard
9) Hard
10) Very hard

M **ASK IF CODE 1 3 or 4 SELECTED AT B15**

B31 Which of the following features have you used on the app?

1) Ability to review previous charging history – energy usage
2) Ability to review when you were plugged in and unplugged
3) Reward balance
4) Recent transactions
5) None of the above **(exclusive answer)**

G **ASK THOSE THAT SELECT AT LEAST ONE OPTION AT B31 – ONLY SHOWN OPTIONS SELECTED ABOVE**

B31a How useful do you find the feature(s) you have used?

	Not at all useful	Not very useful	Somewhat useful	Quite useful	Very useful
INSERT ALL SELECTED AT B31					

OE **ASK THOSE THAT SELECT AT LEAST ONE OPTION AT B31**

B31b How can the feature(s) be improved?

Please make clear which feature you are referring to – e.g. when viewing the reward balance, I would like to see…

OE **ASK IF CODE 1 or 3 SELECTED AT B15**

B29 Are there any other functions that you expected to see on the app?

S **ASK IF CODE 1 or 3 SELECTED AT B15**

B30 To what extent do you think the charging preference (i.e. where you can be rewarded for charging outside of peak hours) will encourage EV drivers to charge their cars outside of peak times?

1) It will have very little impact on when people charge their cars
2) It will have a small impact on when people charge their cars
3) It will encourage many people to charge at different times
4) It will encourage most people to charge at different times
5) This will be the only solution that will encourage people to charge their cars outside of peak times
6) Don't know

S **ASK ALL**

B21 If there was a similar scheme/app available to you in the future, how likely would you be to use it?

6) Very likely
7) Slightly likely
8) Neither likely nor unlikely
9) Slightly unlikely
10) Very unlikely

OE **ASK ALL**

B24 Is there anything else that you would like to share about your experience of being part of the Electric Nation project so far that hasn't already been covered in this interview?

CONTACT INFORMATION

S **ASK ALL**

C1 Can I confirm that this is still the best number to contact you on?

5) Yes
6) No

S **ASK IF C1 = 2**

C2 Please provide the best number to contact you on in the future?

_____

C3 Finally, have you experienced any technical difficulties while taking the survey?

1. No
2. Yes (Please specify)

Thank you for the information you have provided today. If you have any questions about the survey you have just done, or future surveys, please contact Impact Research on 01932 226 793 and ask for a member of the Electric Nation team. Our full contact details and those of the Electric Nation project partners such as DriveElectric were provided to you in your welcome pack. Please do not hesitate to get in touch if you have any questions.

Thank you.

Appendix 5 – Recruitment Survey Invitation

Dear

You are receiving this survey invitation based upon you signing up to the **Electric Nation** research project. Your details were given to us by our project partner **Drive Electric**.

This initial survey will collect some background information about yourself and your electric vehicle, which will be used throughout the duration of the project. All details collected will be kept confidential and only be used for the purpose of this research as outlined in the welcome back. The information you provide for us is important to help us understand how different electric vehicle users' experiences might vary.

To take part in the survey, please read the following and click on the relevant link below:

<SURVEY LINK>

This survey should take approximately 10 minutes to complete. Please aim to complete the survey within the next seven days, after which time we may be in contact with you to remind you to complete the survey as soon as you can.

As part of this research you will be asked to complete up to seven further surveys throughout the next two years as previously explained.

If you have any queries about the Electric Nation surveys we send you please contact us at Impact Research on 01932 226 793 or electricnation@impactmr.com. If you have any other questions about the research then please refer to your welcome pack for relevant contact details. We look forward to receiving your feedback.

Kind regards,

Impact Utilities

Appendix 6 – Baseline Survey Invitation

Email subject: Electric Nation Survey 2

Dear

Thank you for completing the first survey as part of the **Electric Nation** research. **Now you have had your charger for a few weeks** we would like to ask you about your experience so far.

This survey is to understand your initial charging habits before the demand management trial begins. All details collected will be kept confidential and will only be used for the purpose of this research, as outlined in the Welcome Pack. The information you provide for us is important to help us understand how different electric vehicle users' experiences might vary.

To take part in the survey, please read the following and click on the relevant link below:

<SURVEY LINK>

This survey should take approximately 5 minutes to complete. Please aim to complete the survey within the next seven days, after which time we may contact you to remind you to complete the survey as soon as you can.

As part of the Electric Nation project you will be asked to complete up to six further surveys throughout the next two years, as previously explained.

If you have any queries about the Electric Nation surveys we send you, please contact us at Impact Research on 01932 226 793 or electricnation@impactmr.com. If you have any other questions about the Electric nation project then please refer to your Welcome Pack for relevant contact details. We look forward to receiving your feedback.

Kind regards,

Impact Utilities