Optimise Prime

HITACHI Inspire the Next

Uber

Scottish & Southern Electricity Networks

centrica

Royal Mail

UK Power Networks

Optimise Prime Key Learnings

Summary of interim findings

June 2022

RIIO NIC NETWORK INNOVATION COMPETITION

Introduction to Optimise Prime

The world's largest commercial EV trial

6,000+ Electric Vehicles throughout the UK

Gathering data and trialing charging solutions across 3 use cases

Home based fleets


Depot based fleets


Private Hire Vehicles

Accelerating the transition to EVs for fleets

Faster move to EV resulting in CO_2 reductions and air quality improvements

Minimising network impacts, reducing costs for electricity customers

Cross industry collaboration and co-creation

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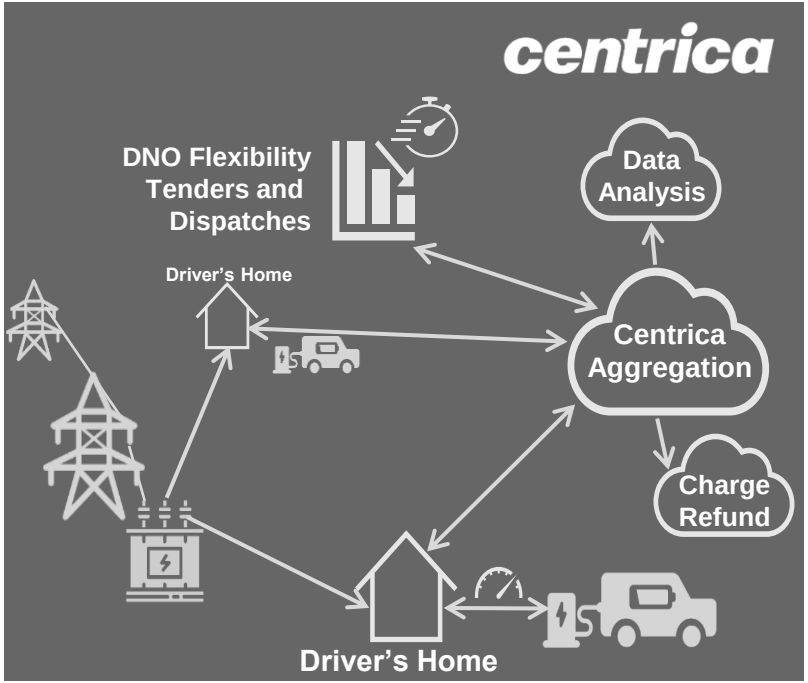
RIIO NIC NETWORK INNOVATION COMPETITION — funded through Ofgem's Network Innovation Competition

WS1: Return-to-Home Charging

The Return-to Home charging trial, conducted with Centrica's British Gas Fleet, involves the study of vehicle charging patterns and the trial of flexibility services



As part of the trial, Centrica have installed charge points at over 700 homes and implemented the systems necessary to control charging and reimburse drivers

Some key learnings:

An at-home ICEV fleet will **not be able to charge fully at home** – some drivers will need to use public charging. This is due to a range of factors, including lack of off street parking and lack of capacity at some all-electric homes

The impact of recent electricity price rises is especially noticeable in fleets that also use **public charging** – impacting the TCO for these vehicles

Higher electricity prices and reduced subsidies have not been offset by EV price declines, due to continued lack of supply in the market for electric LCVs

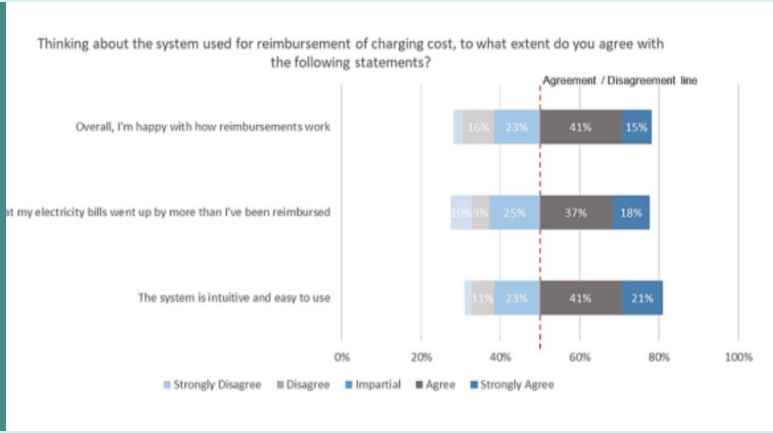
WS1: Return-to-Home Charging

The at home trials have included studying the processes needed to separate and bill business energy use and offer flexibility services

Commercial EV loads at domestic properties – learnings for fleets

Automating the reimbursement of charge-at-home electricity is necessary for larger fleets

There are limitations in what can be achieved through a commercial solution at present, because the driver first has to pay the bill and be separately reimbursed, creating worries for drivers



Communicating the complexities of optimisation and engaging drivers can be difficult

Achieving benefits from **time-of-use tariffs** is challenging, as the fleet cannot control the driver's choice of tariff

Due to regular shift patterns on weekdays, **plug-in rates could be accurately predicted** with an estimated 95% accuracy, potentially making flexibility provision more accurate. Weekends and holidays remain more challenging to predict due to irregular shift patterns

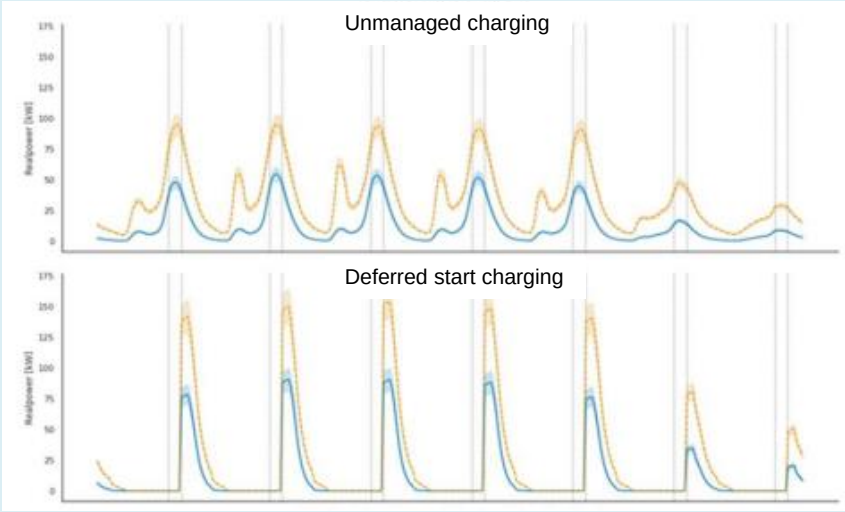
WS1: Return-to-Home Charging

Unmanaged, EV demand would fall at peak load times for the network.
However, simply delaying charging could lead to new, higher, demand peaks.

Commercial EV loads at domestic properties – impact on network load

Unmanaged, the **peak charging demand** from WS1 match peak demand on the distribution network 17:00 - 19:00, coinciding with peak demand on the distribution network.

Smart charging has been modelled to significantly reduce peak demand from return-to-home vehicles. However, the benefits of simply shifting load later are much less than of balancing load over a longer period.

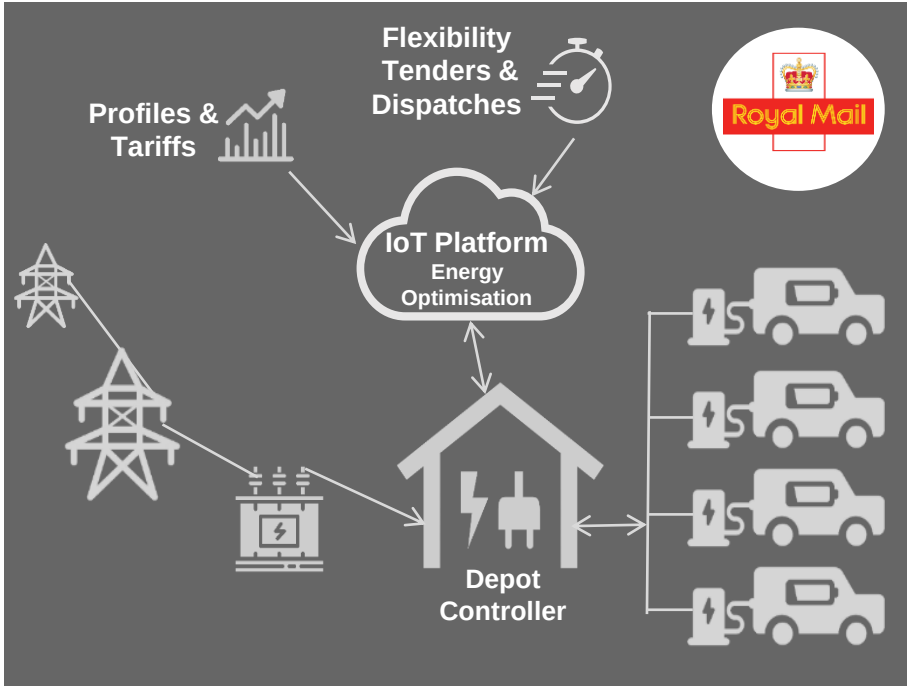


Within the return-to-home trial there is expected to be a **significant seasonal variation** in power demand based on analysis of ICEV data.

The majority of British Gas fleet journeys **should be able to be fulfilled with the current generation of EV Vans**. On-route charging could be used for occasional longer trips.

WS2: Depot Charging

The Depot charging trial, conducted at Royal Mail delivery offices across London, involves the trial of time profiled connections and EV flexibility services



This trial required the installation of control systems on to of new and existing Royal Mail Infrastructure, leading to a number of learnings:

CPs should be designed together with the control system, to simplify the process of **integration**

Different CPs, **settings and firmware** can result in varying results. This needs to be understood or standardised in order to effectively optimise

Reliance on t**hird party data sources** can create risks. Monitoring of data sources is important and periodic changes to data feeds should be expected

There may be a lack of consistent **routines/policies for charging** vehicles at the end of shift, and these will need to be put in place to enable smart charging

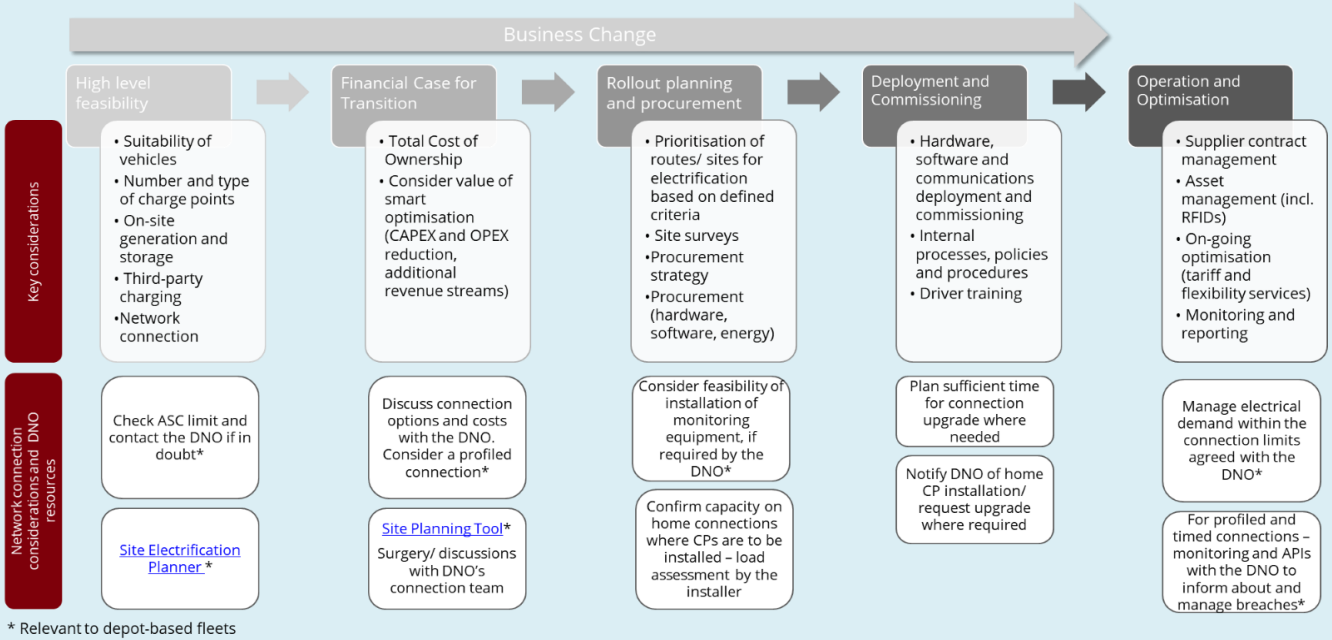
The use of **RFID** tags to identify which vehicle is using which charger within a depot is not always reliable. Tighter vehicle to charger integration is needed for advanced optimisation

Actual vehicle movements from depot fleets may **vary significantly** from expected shift patterns

WS2: Depot Charging

One of the outputs was a fleet electrification guide and operating model – providing fleet managers with guidance on the steps needed to electrify, and some of the potential risks that need to be managed

The project's Site Planning Tool can also aid fleets in planning connection requirements for depot based sites



Analysis of Royal Mail's TCO highlighted the main drivers of ICEV and EV cost differences:

EV prices are the key determinant of whether EVs make economic sense for a fleet, but there are many other factors influencing total cost, including connection costs for depots

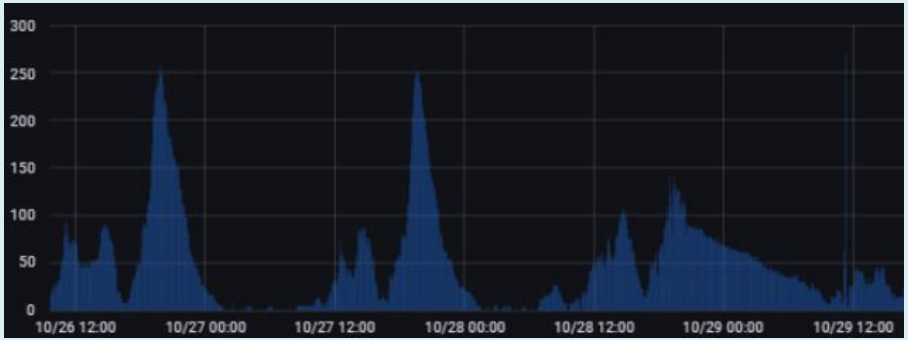
The **OPEX savings** for depot-based EVs even without smart charging can offset a 28% higher CAPEX price of EVs vs ICEVs at present, based on the Royal Mail use case

WS2: Depot Charging

Key learnings on Smart Charging & Flexibility for networks

Based on modelled predictions of charging demand, **smart charging** should deliver reduction of peak demand for the network, energy and connection costs at depots.

Flexibility trials proved an ability to **control charging in response to a flexibility request** from the DNO.



Comparison of unmanaged (left) and managed (right) EV charging load at a Royal Mail depot

It's not always possible to install **point of connection monitoring** within the network and installing on customer premises can be complex

Profiled Connections trials

Initial trials of profiled connections have had mixed results, especially at smaller sites, leading to the conclusion

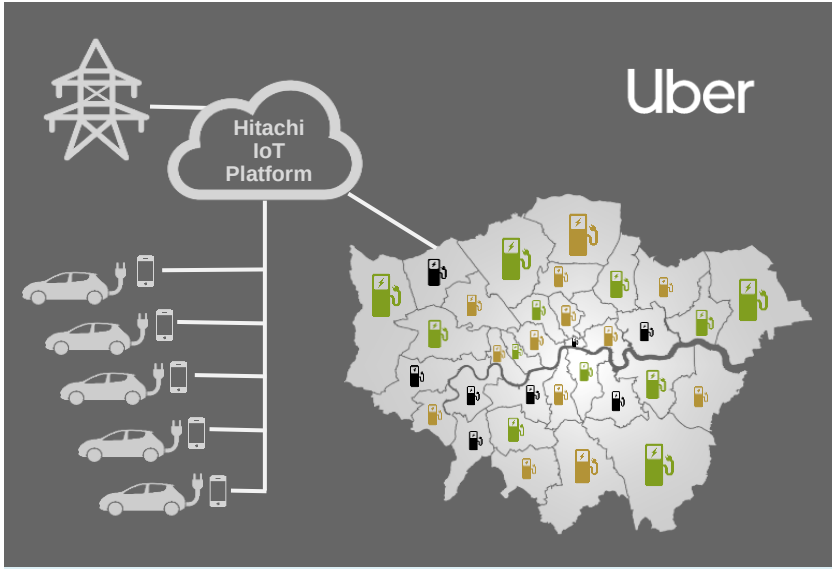
Adequate EV load, in proportion to background load, is needed for a successful profiled connection. **Controllable EV load needs to be greater than the variation in building load**

Other findings include:

- **Determining an accurate profile** is key to being able to adhere to the profile – there are limitations to what can be achieved when modelling from ICEV data
- Profiled connections may need to **be refined** as more data becomes available or as customers change their electrification plans
- **Contractual, operational and technical** measures may be needed to operate profiled connections, but could make the product less attractive to customers

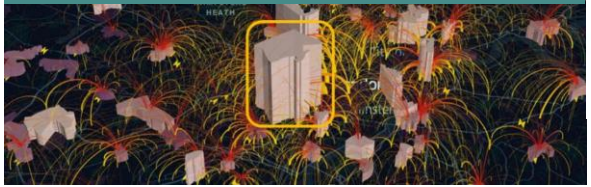
WS3: Mixed Charging

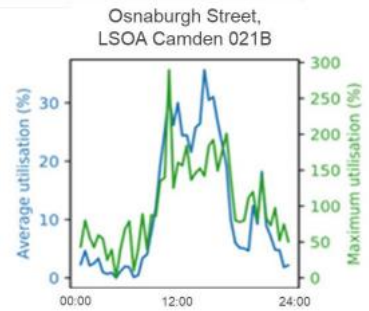
The Mixed Charging trial is a study based on trip data from Uber EVs operating in London – analysing current and future charging demand



Charging demand at locations is derived from studying where Uber drivers have breaks in their schedules, whether they're likely to need to charge and where charge points are located

Based on modelling the optimal CP for each charge event, **the most popular CPs in London have demand beyond their capacity**, so drivers may need to queue or travel further to charge.





Areas in/around Westminster and the City of London especially lack sufficient rapid chargers

The TCO for Electric PHVs is generally positive, however there are barriers that may impact some groups of drivers:

The development of the **second-hand market** for EVs will be crucial in the transition of all drivers to electric PHVs

The **Congestion Charging** exemption for EVs plays a crucial role in the breakeven point between the ICE and EV TCO for Uber, and significantly impacts other fleets operating in London

WS3: Mixed Charging

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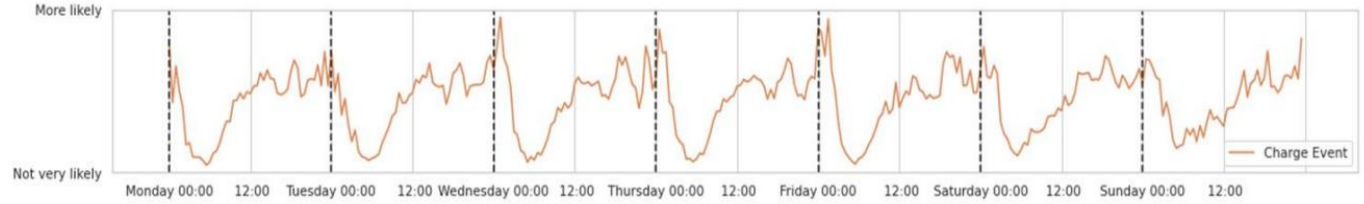
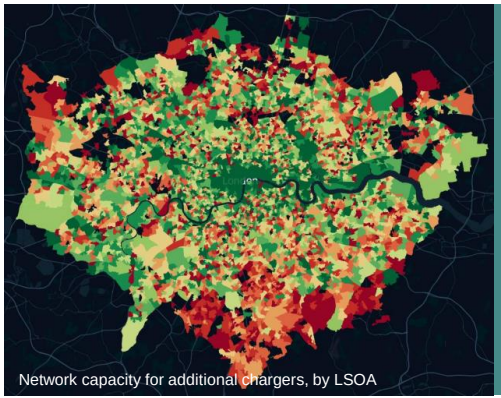
Learnings from network operators are focused on the timing and location of demand from PHVs

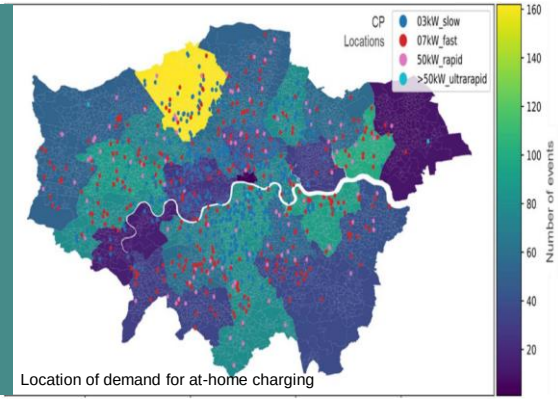
The data from Uber trips has allowed the trials to model charging events and demand throughout Greater London. Charge demand from PHVs is likely to **peak in the evening** as some drivers return home and others need to top up.



There is a **clear pattern within and across days in trip and on-shift charging demand**. Impact of weather on trip patterns appears to be limited.

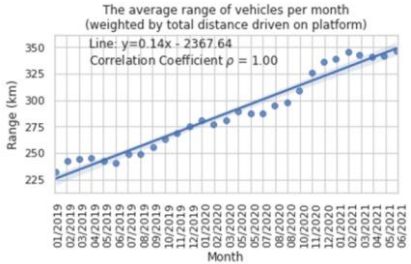

Network capacity for additional chargers, by LSOA

Current **distribution network capacity varies across London**. There is likely to be capacity for sufficient growth in infrastructure in Central London. There may be more constraint in outer areas where drivers live.



Location of demand for at-home charging

Average **EV range** continues to grow, potentially reducing frequency of charging but increasing power need



RIIO NIC NETWORK INNOVATION COMPETITION

Behavioural findings

Over 2,500 surveys responses were received from drivers and fleet managers in order to gauge their acceptance of EVs and highlight non-financial concerns and barriers to adoption.
Key findings included:

Drivers feel **more positively about the EV** technology once they have tried it

Financial and operational barriers to EV adoption exist for PHV drivers; however, positive attitudes suggest a willingness to adopt once concerns are addressed

Charging facilities play a key role in giving drivers the confidence that they can fulfil their daily work tasks

Reliable public charging infrastructure is critical for the adoption of EVs among PHV drivers

There were **overwhelmingly positive attitudes towards EV performance**
EVs are preferred by drivers, who see the benefits for the environment, making the business case for transition even stronger –

PHV charging behaviour in London remains difficult to predict because EV charging locations and timings are based on opportunity rather than habit

- Between the two survey rounds EV drivers showed a growing concern with **access to charging**, whereas for non-EV drivers over the same time interval this concern has decreased
- Drivers who are **not happy** with their EV generally have broad concerns over a range of technical, organisational, economic, and environmental aspects
- Cross-fleet analysis of the behavioural results has shown **consistency of views** across the different fleets

Next steps

Optimise Prime’s trials will draw to a close in June 2022, after which focus will switch to analysing the data, and drawing final conclusions.

Deliverable D6, in Autumn 2022, will release **project datasets**
These should help DNOs and other organisation planning for the EV transition by providing more data on real-world usage patterns of commercial EVs

Deliverable D7, in Winter 2022/3, will be the **project’s final report**
This report will provide our conclusions regarding the project’s two methods for controlling home and depot charging. We will also report what we’ve learned from the trial and business modelling activities in order to help both fleets and DNOs electrify optimally

The Optimise Prime team will also be presenting the results of the project at industry events and promoting our findings throughout the rest of the year.

All Optimise Prime reports and presentations can be found at www.optimise-prime.com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