NETWORK INNOVATION COMPETITION 2018

Project number: UKPNEN03

OPTIMISE PRIME

Optimising the networks to unlock the transition to electric for commercial vehicles

1. Project Summary

1.1. Project Title	Optimise Prime
1.2. Project Explanation	The project will deliver a comprehensive understanding of the impact that electrification of commercial vehicles will have on distribution networks. It will explore opportunities to minimise this impact, such as optimising network and charging infrastructure, providing network services, testing technical and commercial solutions to save customers £207m by 2030.
1.3. Funding licensee:	London Power Networks Plc[1]
1.4. Project description:	*1.4.1. The Problem(s) it is exploring* For the UK to meet carbon reduction objectives, electric cars and vans must increase from 1.7% of new car sales today to 60% by 2030[2]. The Commercial fleet and Private Hire Vehicle (PHV) sectors are expanding with the growth of mobility-as-a-service and home deliveries. Businesses buy 58%[3] of new vehicles and will be early EV adopters, yet there has been limited study to understand or minimise their network impacts. High mileage and usage patterns will result in higher network demand versus private EVs, creating two problems: 1. Connected customers will face increased costs to reinforce networks impacted by the uptake of commercial EVs, especially those charged at home. 2. High connection costs are a barrier to commercial EV adoption. The resulting prolonged use of diesel vehicles has clear environmental consequences and could damage the electricity industry if it is seen to block EV adoption. *1.4.2. The Method(s) that it will use to solve the Problem(s)* 1) Flexibility services to DNOs from commercial EVs on domestic connections. 2) Planning tools for depot energy modelling, optimisation with profiled network connections. *1.4.3. The Solution(s) it is looking to reach by applying the Method(s)* This industry-led Project will create a detailed understanding of the impact of commercial EVs and the opportunities for flexibility. This will allow licensees to accurately forecast and plan mitigations, including flexibility and profiled connections, minimising costs for the connected and connecting customer. Depot based tools and home charging strategies will allow fleet and PHV operators to electrify more quickly at a reasonable cost, without negatively impacting the distribution network. *1.4.4. The Benefit(s) of the project* The understanding gained will inform all GB DNOs on how best to address challenges arising from electrification of fleets and PHVs.

[1] London Power Networks Plc is the leading funding licensee, however all three funding licensees (London Power Networks Plc, Eastern Power Networks Plc, South Eastern Power Networks Plc) of UK Power Networks will be involved.
[2] Table 5.2; Reducing UK Emissions, Committee for Climate Change https://tinyurl.com/y74w9sbo
[3] DfT Vehicle Licensing Statistics https://tinyurl.com/ycglqhnw

	Deployed across GB the solutions will enable licensees to accommodate predicted loads, facilitating the adoption and rapid rollout of low carbon transport. Optimise Prime may save customers £207m, over 2.7m tCO2eq. of carbon and release 1.9GVA of capacity by 2030.		
1.5. Funding			
1.5.1 NIC Funding Request (£k)	16,399	1.5.2 Network Licensee Compulsory Contribution (£k)	1,845
1.5.3 Network Licensee Extra Contribution (£k)	0	1.5.4 External Funding – excluding from NICs (£k):	16,241
1.5.5. Total Project Costs (£k)	34,691		
1.6. List of Project Partners, External Funders and Project Supporters (and value of contribution)	Project Partners: Hitachi Vantara (lead) £3.7m, Hitachi Europe £0.6m, Hitachi Capital £0.06m, Royal Mail Group £9.9m, Centrica £1.6m, Uber £0.4m, Scottish and Southern Electricity Networks £0.05m, UK Power Networks £1.8m External Funders: Project Supporters: Office for Low Emission Vehicles, Transport for London, Mayor of London, SP Energy Networks		
1.7 Timescale			
1.7.1. Project Start Date	21 January 2019	1.7.2. Project End Date	28 February 2022
1.8. Project Manager Contact Details			
1.8.1. Contact Name & Job Title	Ian Cooper /Innovation Lead Nicole Thompson / Director	*1.8.2. Email & Telephone Number*	Ian.cooper@ukpowernetworks.co.uk 07875 118 104 Nicole.thompson@hitachivantara.com 07880 157 196
1.8.3. Contact Address	UK Power Networks, Newington House, 237 Southwark Bridge Road, London, SE1 6NP Hitachi Vantara, 7th Floor, 1 Appold Street, London, EC2A 2UU		
1.9: Cross Sector Projects (only complete this section if your project is a Cross Sector Project, ie involves both the Gas and Electricity NICs).			
1.9.1. Funding requested the from the [Gas/Electricity] NIC (£k, please state which other competition)	N/A		
1.9.2. Please confirm whether or not this [Gas/Electricity] NIC Project could proceed in the absence of funding being awarded for the other Project.	N/A		
1.10 Technology Readiness Level (TRL)			
1.10.1. TRL at Project Start Date	6	1.10.2. TRL at Project End Date	8

Optimise Prime seeks to understand and minimise the impact the electrification of commercial vehicles will have on distribution networks. It will develop technical and commercial solutions to save customer costs and enable the faster transition to electric for commercial fleets and Private Hire Vehicle (PHV) operators.

2.1 Aims and Objectives

This Project aims to be the first of its kind, paving the way to the development of cost effective strategies to minimise the impact of commercial electric vehicles (EVs) on the distribution network. Commercial EVs are defined as vehicles used for business purposes, including the transport of passengers and goods. Compared to vehicles used for domestic purposes, commercial EVs will have a much greater impact on the electricity network. This arises from the co-location of multiple vehicles at depots, coupled with higher energy requirements resulting from higher daily mileages and payloads which will also increase network impacts when commercial EVs are charged at domestic properties.

The Project involves two DNO groups across four license areas[4]. This will allow us to understand the impact of a wide range of variables, including different network constraints, typical mileage and driving style, traffic characteristics, location (urban, sub-urban, rural) and availability of public “top-up” charging. By studying this diversity, the learnings generated by the Project will be applicable to the whole of GB. The Project will deliver invaluable insights through the use of data-driven forecasting tools designed to allow networks to proactively plan upgrades. In addition, this Project will create a detailed understanding of the amount of flexibility that commercial EVs can provide to the network through smart charging. Finally, a site planning tool will allow organisations to request profiled connections from the DNO. Taken together, these form a set of innovative capabilities that allow for greater network utilisation.

The Project consortium includes two of the largest UK commercial fleets and a major PHV operator. It aims to involve 2,000-3,000 vehicles. By having scale, the industry will be able to robustly test different approaches to reducing the impact of vehicle electrification, in advance of mass adoption throughout the 2020s.

This Project will seek to answer three core questions relating to the electrification of commercial fleets and PHV operators:

Table 1 – Questions that will be addressed

1. How do we quantify and minimise the network impact of commercial EVs?	We will gain a comprehensive and quantified understanding of the demand that commercial EVs will place on the network, and the variation between fleet and vehicle types. We will achieve this through large-scale field trials where we will capture and analyse significant volumes of real data leading to the creation and validation of practical models that can be used to better exploit existing network capacity, optimise investment and enable the electrification of fleets as quickly and cheaply as possible.
2. What is the value proposition for smart	We will gain an understanding of the opportunities that exist to reduce the load on the network through the better use of data, planning tools and smart charging. Additionally, we

[4] London Power Networks, Eastern Power Networks, South Eastern Power Networks and Southern Electric Power Distribution.

solutions for EV fleets and PHV operators?	will consider and trial the business models that are necessary to enable these opportunities. We will achieve this by developing technical and market solutions, and then using them in field trials to gather robust evidence and assess their effectiveness.
3. What infrastructure (network, charging and IT) is needed to enable the EV transition?	We will understand how best to optimise the utilisation of infrastructure to reduce the load on the network. This will be achieved through the collection, analysis and modelling of fleet and PHV journey data.

By answering these questions, the Project will enable network operators to quantify savings which can be achieved through reinforcement deferral and avoidance while facilitating the transition to low carbon transport.

2.1.1 The Problems that need to be solved

The uptake of EVs is expected to cause substantial challenges to the electricity networks. The My Electric Avenue project estimated that 32% of low voltage (LV) feeders in the UK will require intervention once EV adoption reaches 40-70%.[5] This uptake is likely to be initially driven by commercial organisations for the following reasons:

- Commercial organisations are more likely to purchase new vehicles and replace them regularly, typically every five years. As a result, 58% of new vehicles are registered by businesses.[6] Figure 1 shows a projection of the breakdown of new EV sales by purchaser, the majority being bought by commercial fleets.
- New legislation, including financial penalties, designed to drive environmental improvements (carbon and air quality) creates strong economic incentives for businesses to transition to EV.

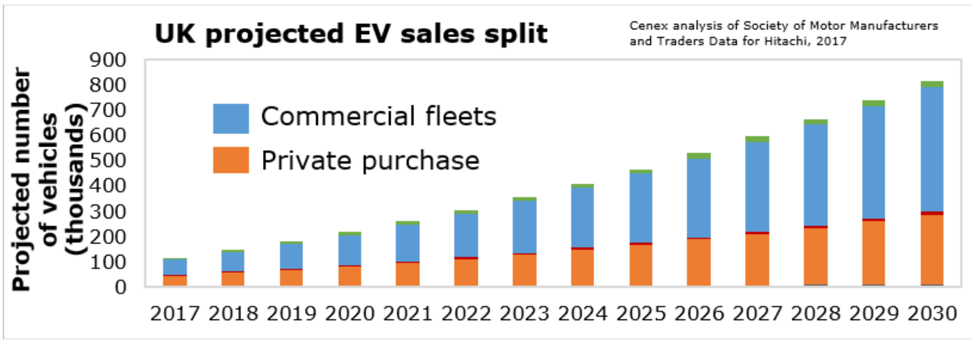

Figure 1 – UK Projected EV sales forecast to 2030[7]

These two factors are exacerbated by changing transport habits, which are resulting in an increased proportion of vehicles used for commercial purposes on the road. This is due to a rise in online delivery services and new Mobility as a Service (MaaS) offerings such as Uber. New EVs suitable for commercial use are projected to come to market en-masse in 2020 at a cost that makes EV adoption viable for businesses, as such it has not been possible to test their effects at scale until this time. Therefore, gaining an understanding of the effects of commercial EVs on the network is essential to ensure that networks will be ready to facilitate the EV rollout expected in the 2020s at the lowest cost.

[5] My Electric Avenue Close Down Report https://tinyurl.com/ybctn2pd
[6] DfT Vehicle Licensing Statistics https://tinyurl.com/ycglqhnw
[7] Cenex analysis for Hitachi based on Society of Motor Vehicle Manufacturers and Traders data, 2017

In addition, a higher incidence of clustering, combined with significantly higher mileages, means that substantial network reinforcement may be required to support the decarbonisation of commercial vehicles (as discussed in 2.1.1.1). This could result in potential delays, as DNOs may be slow to reinforce the network to meet unprecedented demand, high costs for depot operators and for customers.

Without an informed approach to commercial vehicle electrification, the network may require substantial reinforcement. As shown in Figure 2 some or all of the costs of these reinforcements will need to be socialised according to current regulations. Additionally, operators of EVs may incur higher costs through their connection agreements in the depot charging use case.

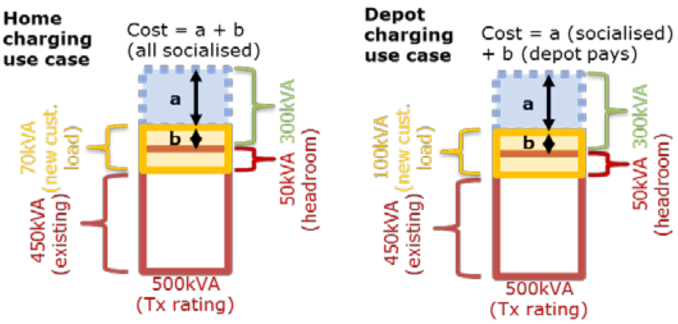

Figure 2 – Cost allocation of EV-related network reinforcement

Even in areas where ultra-low emissions zones are planned, the Project partners state that the total cost of ownership of EVs is higher than that for Euro 6 diesel vehicles at this time. This reduces the adoption rate of EVs for commercial vehicles – incurring additional costs from upgrading connections will slow the rollout further.

2.1.1.1 Issues and Challenges for Networks

Compared to domestic vehicles, commercial EVs present a different set of challenges to the network.

The average mileage of commercial EVs is typically higher than domestic vehicles. Government surveys estimate an average annual light commercial vehicle mileage of 13,000 miles, compared to 7,800 for cars[8]. This represents an energy requirement two thirds higher than for domestic car drivers, before consideration of the higher payloads that commercial vehicles typically operate with and the possibility that van drivers may also own a car, charging both vehicles on the same connection. In terms of network impact, this manifests as higher peak loads and/or decreased flexibility from peak load shifting.

Commercial EVs used by maintenance engineers and PHV drivers are typically garaged and charged at domestic premises. This results in substantially different load profiles than for typical domestic properties due to their shift patterns.

Alternatively, commercial EVs may be co-located in depots, resulting in clustering of charge points. This concentration of deployment results in highly localised peak loads. Furthermore, the potentially rapid rollout of commercial EVs makes proactive infrastructure planning a necessity so that rollout is not inhibited and costs are minimised. As part of this planning process it is essential to consider the value of smart solutions to avoid unnecessary reinforcement.

We have identified two fundamental ways, or use cases, in which fleets and PHVs operate today, each with their own specific challenges for the network:

[8] National Travel Survey: England 2016 https://tinyurl.com/yddz7ed5 and Road Traffic Estimates: GB 2017 https://tinyurl.com/ybr44cqv

Use Case 1: Return to Home Charging
Many commercial organisations, such as British Gas, garage their vehicles at their employees' homes. This requires installation of chargers at employee residences. This creates a challenge for the network since commercial loads are effectively "hidden" inside the domestic load profile, making forecasting and planning more challenging. Where PHV drivers have off-street parking they will also often charge their vehicles at home. Hidden loads, without flexibility, mean that the full costs associated with network reinforcement will be socialised, a resulting in higher costs for network customers.

Another challenge is that the value of commercial EV flexibility and smart charging to the DNO is currently unquantified. The NIA funded project Electric Nation aims to estimate the flexibility that can be unlocked for domestic charging, but the operational constraints and higher mileage resulting from the commercial use of an EV mean that the value proposition for smart charging is different and requires specific investigation.

Use Case 2: Return to Depot and Public Charging
Organisations such as Royal Mail operate depots, where substantial numbers of vehicles are co-located on a single site. Without smart charging, 100 EVs could represent an increase of load of 0.7MW per site, assuming that fast chargers of 7kW are deployed on a one to one ratio of charger to EV. For the entire Royal Mail fleet, this would represent a maximum load of approximately 320MW across the UK – approximately 0.5% of the UK's peak demand for this fleet alone. If depot operators were to implement rapid (50kW) charging the impact on the network could be substantially higher.

Similar to depots, public charging points will increasingly be co-located, for example, in electrified 'filling stations' (as can be seen in announcements of Shell and BP[9] investing in EV charging capabilities). The higher power chargers found at these sites, such as rapid DC, will place substantially higher loads on the network. As with the home charging case, this presents three key challenges to the network:

- A section of the block of reinforcement cost is borne by the depot or charge point operator. However, a portion may be socialised, resulting in higher costs for customers. Additionally, charging can result in high peak loads, which reduce the efficient use of network capacity, further increasing costs.
- The substantial network reinforcement that is likely to be required could result in long waiting times for connections, which will slow the rollout of commercial EVs. Similar to the return to home charging use case, the amount and value of flexibility and smart charging from commercial EVs is currently unquantified.

2.1.1.2 Issues and Challenges for Fleets and PHV Operators

Return to Home Charging
In this use case, EV charging is through the driver's existing domestic retail supply agreement. As such, the cost of energy per kWh to charge the car is typically higher than if it were charged at business premises under a commercial supply agreement.

Additionally, where the fuel cost is reimbursed, the fleet manager is required to sub-meter the charger and the cost is calculated by applying the driver's domestic retail tariff. The driver recovers the cost of charging through the company's expenses system. This places an administrative overhead on the process, resulting in higher costs and potential employee dissatisfaction.

Based on the experience of one of the Partners, these factors result in charging costs of around £0.20 per kWh, which is estimated to be double the cost of charging under a more typical commercial arrangement[10]. When considering the total lifetime cost of a vehicle, these high charging costs makes EV adoption uneconomic compared to diesel.

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[9] Shell buy New Motion https://tinyurl.com/y78lu3th; BP buy ChargeMaster https://tinyurl.com/ya5lvgt3
[10] Based on average large customer cost 10.49p/KWh table 3.41 https://tinyurl.com/y945fsz4

Return to Depot and Public Charging

When EVs return to the depot for charging, the potentially high peak-loads result in substantial connection costs from the DNO, making the rollout of EVs costly for operators. In a recent Future Insights paper[11] Ofgem has highlighted that, without smart infrastructure, companies may find re-locating depots a cheaper option than upgrading connections.

Smart charging and timed connection profiles can minimise connection costs. However, designing an energy system for a depot is a complex and specialised task which fleet and PHV operators are often not in a position to carry out. Optimisation is required to minimise energy costs while considering a range of variables. These include number of EVs, mileage, operational characteristics, other sources of energy demand, opportunities for renewables and storage, value streams from demand response, physical site constraints, connection costs, asset financing and return on investment.

Although the usage demands and profiles are different in the case of public charging, the fundamental challenge is the same.

As fleet and PHV operators do not have the capabilities to determine an optimal connection from the DNO they may over-specify their network connection requirements, resulting in poor electricity network utilisation and unnecessarily high infrastructure costs.

2.1.2 The Methods

To address the challenges described above, we will trial two Methods.

Table 2 – Methods

Method 1 Smart demand response for commercial EVs on domestic connections	Currently the additional peak demand would trigger reactive network reinforcement with the costs being entirely socialised as domestic and non-domestic use is blended together. In Optimise Prime we aim to separate the commercial loads to make them visible, testing demand response approaches with commercial EVs charging at domestic premises to identify and quantify the available charging flexibility.
Method 2 Depot energy optimisation and planning tools for profiled connections	Currently depots request a connection based on worst case estimated peak demand triggering, often triggering network reinforcement. The cost is part paid for by the connecting customer and part socialised across connected customers. In Optimise Prime we aim to design and test smart charging and energy optimisation behind the meter at depots to be able to conform to an agreed profiled connection. We are developing the tools and processes to calculate the optimal connection profile and infrastructure for each site to minimise connection cost and/or capacity used. We will also test demand response approaches to identify and quantify the available charging flexibility from an optimal profile. The project will develop the commercial arrangements to enable the rollout of the Method following the Project.

The above Methods, along with the associated enabling technologies, are described in more detail in Appendix 10.2.

2.1.3 Development and Demonstration being undertaken

The Project will carry out trials to demonstrate each of these methods. Initially the EVs will be monitored for their usage and charging. This will enable the verification of the data flows and early analysis to be carried out. Following this a number of flexibility

[11] Implications of the transition to Electric Vehicles P23 https://tinyurl.com/y8csao7q

services will be requested at different prices. We will look to vary the following parameters to identify the how the responses change, so that as much information is available as possible for the future development of commercial services:

1. **Cost:** At what value (£/kW/h) is it economical for fleets and PHV operators to provide flexibility services? How does the response quantity/quality vary with price?
2. **Magnitude:** What is the aggregated total amount of load (kW) that can provide flexibility services for a given type or number of EVs?
3. **Duration:** How long (hours) can this flexibility service be sustained for?
4. **Responsiveness:** How quickly (days, hours, minutes) can commercial EVs respond to take part in flexibility activities?
5. **Proximity:** How does the response or cost vary with the length of notice given to the fleet or PHV operator?
6. **Make-up:** Is there a variation between availability and utilisation payment values that delivers the lowest service cost?
7. **Predictability:** How predictable is the flexibility from commercial fleets and PHV operators? Can it be relied upon to deliver when requested by the DNO?

The detail of these trials will be determined during the Design and Define Phase of the Project. £990k has been budgeted to provide flexibility payments, based on the scale of the proposed trials. If the trials include fewer EVs or lower service costs, Project underspend in this category will be returned to customers in the normal way for a NIC project.

Uber's PHV EVs will use a mixture of home and depot type charging, spanning both of the methods. Data will also be provided by Uber to show the operation of their fully electric PHV. This will be incorporated into the Project to show the impact of this EV user type on the network.

2.1.4 The Solutions That Will Be Enabled

The Project will aim to quantify the impact EV fleets and Private Hire (PH) EVs have on the electricity network and how it can be reduced using flexibility services and optimising the existing available capacity.

Both Methods and the data from PHV EVs will provide DNOs the learning which allows for a better understanding and forecasting of the loads that commercial EVs place on the network. In addition, the Methods provide a quantified understanding of the overall value and role of flexibility for commercial EVs in planning and maximising network capacity. Charging data and load forecasts will be visible to the DNOs to improve their understanding of network loading and allow for advanced network control using systems such as those being trialled in UK Power Networks' Active Response NIC project.

Method 2 provides a set of tools that can maximise the utilisation of network capacity for depots, reducing costs for both fleet and PHV operators and customers. The site planning tool will allow operators of charging infrastructure to optimise their load profile to minimise connection costs. In doing this, the project will help maximise the use of existing capacity, minimising the need for network reinforcement and reducing costs for customers.

2.2 Technical Description of the Project

The Project will develop a solution architecture as shown in Figure 3. For the avoidance of doubt the following are **not** included in the Project cost as they are funded by the Partners:

- Purchase of EVs;
- Purchase and installation of charging infrastructure and behind the meter energy hardware; and

- Costs to upgrade electrical infrastructure required to enable the Project.

2.2.1 DNO systems

To minimise the cost of Optimise Prime, all DNO system development is being done by UK Power Networks and not duplicated within SSEN. SSEN will provide network data as required and input flexibility services directly to Hitachi's systems via a human interface.

Within UK Power Networks' estate, as far as possible, existing platforms and interfaces (or those already under development) are being used to minimise Project costs. The primary platform will be the new UK Power Networks Active Network Management (ANM) platform being developed as part of a business funded activity. If issues occur in this process resulting in delays to this platform being available in time for this Project, the Distributed Energy Resources Management System (DERMS) platform developed as part of the Power Potential project will be used as an alternative. Behind either platform will be the existing Distribution Management System (DMS) and data historian (PI).

In order to manage the EV movement and demand data a geospatial database and analytics tool will be used. This platform already exists within UK Power Networks' estate but will require modification for this purpose.

A new profiled connection planning tool will be developed. This tool will be designed within the project and is proposed to be based on UK Power Networks' existing network modelling tools, which will require limited modification for this purpose. Estimated costs based on similar work are included in the project budget.

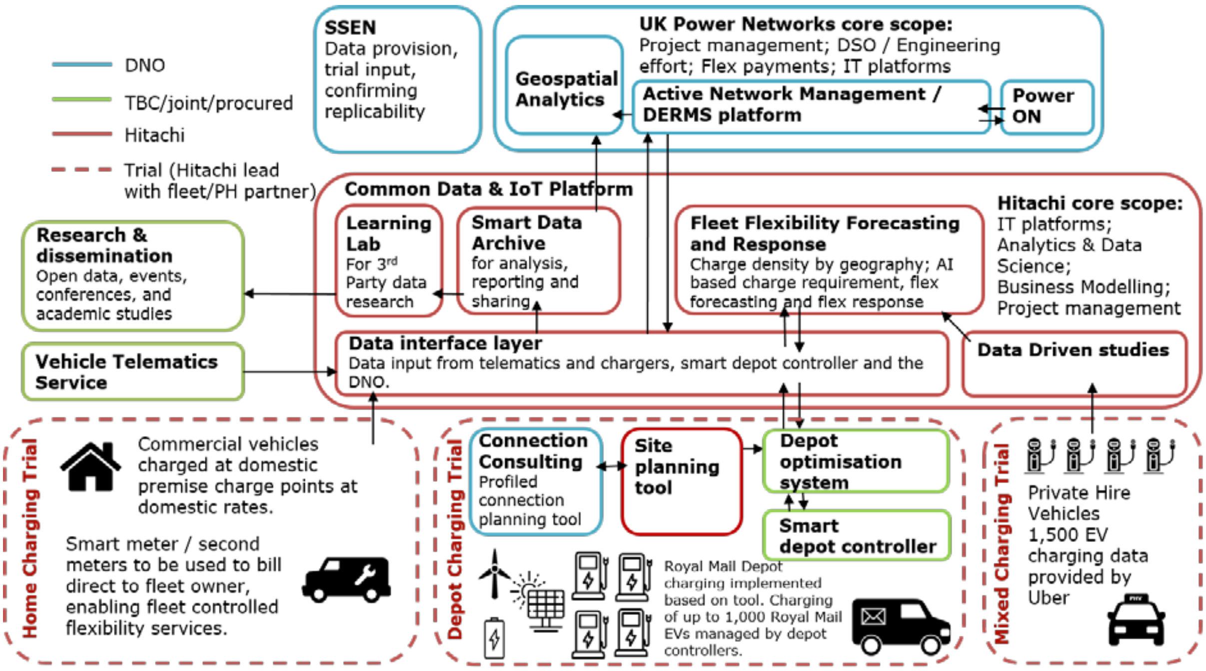

Figure 3 – Solution Architecture

2.2.2 Hitachi systems

There are five core technology components that underpin the delivery of the Project. These will be based on a common Internet of Things (IoT) platform, allowing data to be shared efficiently between the components. Hitachi are contributing approximately 32% of the cost of the IoT platform.

2.2.2.1 Big Data Innovation Lab

The big data innovation lab is a platform which will support the data analysis and forecasting activities in this Project. Data will include vehicle telematics, charge point data and third party data sources such as weather, holidays and vehicle demand schedules.

This platform will provide the following functionalities:

Machine learning based analysis and forecasting

The platform will enable the energy specialists to visualise and explore Project data, creating bespoke machine-learning based forecasting and analysis models. An innovation lab environment will allow different parties to work with the data, enabling a collaborative approach to answering the questions stated above.

Data management and governance

The platform will ingest, cleanse and store the data. Back-up and version control systems will ensure data integrity for all parties and ensure that the data can be effectively utilised for future research beyond the lifetime of the Project, in accordance with data protection procedures set up during the Project.

Authorisation and anonymisation

The platform will provide the capability for access controls to the different data sources to ensure data security. Anonymisation will ensure that issues associated with commercial sensitivities and GDPR are appropriately addressed.

2.2.2.2 Flexibility

The platform will offer the capability to interface between DNO systems and the charge points to test the potential for flexibility. By interfacing either directly, or via a user portal, the system will enable different flexibility tests to be carried out to allow the Project to explore the capability for Demand Side Response (DSR) with commercial EVs.

The system will be able to offer a variety of different flexibility "products" to the EV charge points. Each product can have different magnitudes, duration, response and costs and can be customised per-postcode region.

By measuring the intention to accept a flexibility request, and additionally the actual charge profile, we will gain a detailed understanding of the available flexibility.

2.2.2.3 Site planning tool

The site planning tool will provide a simple interface for depot operators to input their vehicle schedules, mileage, site energy profiles and other constraints related to the depot such as available space, location and existing energy tariffs.

The tool will then calculate an optimal configuration of charging and behind the meter energy assets, designed to minimise charging costs for the site, for a given capex/opex ratio and investment timescale. The tool will output a range of information including:

- Estimated charging costs for the fleet;
- EV charging schedules;
- Behind the meter infrastructure requirements; and
- The load profiles of the site to allow for a profiled connection request to the DNO.

The tool will be web-based and outputs will be designed to enable efficient processing of connection requests by the DNO, integrating with the profiled connection planning tool that will be developed by UK Power Networks. The site planning tool will be part-funded from UK Power Networks' (50%) and Hitachi Europe's (10%) own contributions to the project.

2.2.2.4 Depot optimisation system

The depot optimisation system (software) will control and optimise the multiple charge points and energy assets which are present on the site of a depot through a smart depot controller (hardware).

The system will consider the vehicle demand, energy import tariffs, weather forecasts and other relevant data in order to calculate an optimal charge profile for each EV.

The system will take part in the demand-response experiments in order to allow the Project to understand the potential for demand side response activities at depots. The depot owning Partner will invest in the charging infrastructure, the NIC will 90% fund development and installation of the optimisation system.

2.2.2.5 Telematics and Vehicle Data Integration

The platform will integrate with existing sources or data, such as the journey data held on Uber's platform, and existing telematics services. Where the Partners have insufficient telematics on their EVs to gather the required data, the Project will procure telematics devices and services, integrating the data into the Hitachi platform. £300k of NIC funding has been budgeted for this purpose.

2.3 Design of Trials

The aim of the trials is to gather adequate data and real-life experience to provide a statistically robust understanding of the impacts the different use cases of commercial EV charging place on the network, and additionally ways of minimising such impact (e.g. flexibility, profiled connections). The trials will also investigate a number of ways to help connecting customers, such as fleet and PHV operators, transition to EVs early.

The Project will be split into three trials, reflecting the three partner fleet use cases in Table 3. Trials 1 and 2 will gather data from both EVs and chargers. These trials will provide a detailed understanding of both charge profiles, the role of flexibility for the two use cases of home and depot charging and the value of new profiled connection offers.

Trial 3 will not gather data directly from chargers, but will take vehicle location data and correlate it with known charge locations. This will result in a detailed picture of how EVs charge during the day across the license areas. The Trial 3 EVs will use home charging and public charge points, thereby providing a mixed-use case of user behaviour.

Each trial will focus initially on a fleet or PHV Operator Partner, which will provide the initial EV volume and access to the data and charge points. As the Project progresses, we may recruit additional participants to provide additional EVs and greater behavioural diversity, including fleets managed by Hitachi Capital Vehicle Solutions. In total, we aim to study 2,000-3,000 EVs. We believe that a significant sample size is required to provide a statistically robust picture of charge behaviour that can be used to forecast the impacts of EV growth.

A target of 1,000 EVs per trial will result in a dataset comparable in size to that being developed for the residential sector in Electric Nation, where 700 EVs are being tested. A trial of this scale is made feasible not only by the fact that costs of EVs and infrastructure are being met by the Partners, but also because the Project does not have to recruit individual drivers to the trial as the volumes are expected to primarily be met by the partners' drivers.

Table 3 – Description of the Trials

Trial Number	Name	Partner	Description
1	Home Charging	British Gas Maintenance[12]	A field study of charging behaviour and flexibility with a return to home fleet.
2	Depot Charging	Royal Mail Delivery	A field study of charging behaviour and flexibility with a depot-based fleet. Additionally, testing of profiled connections.
3	Mixed Charging	Uber PHV Operator	A study based on analysis of journey data from electric PHVs.

[12] British Gas are a subsidiary of project partner Centrica.

Trial Design

To ensure that each Trial is successful, there will be a Definition and Design phase which will detail the specifications, test criteria and success criteria for each trial. This will then provide the basis for the technical design phase, before moving to software build, test, and installation in time for the start of the Trials.

In parallel, the appropriate charging infrastructure will be specified and deployed by the Partners to allow for field testing to start in Q3 2020.

During the field testing phase, live data will be captured to build forecasting models. Additionally, in Trials 1 and 2, regular experiments will be carried out to understand the sensitivities associated with different demand response propositions. Different flex offers will be made to the drivers, with variations in magnitude, duration, value and notice period tested. The experiments will be refined as the trials progress based on the results.

The Project will employ commercial and behavioural analysts to build a detailed understanding of the non-technical variables that can affect the ability of fleet and PH EVs to partake in flexibility programmes. This will allow the Project to refine future flexibility offers as part of the experiments.

Finally, as part of the depot optimisation, new behind the meter optimisation solutions will be tested to evaluate how demand can be shifted in order to conform to a profiled connection. This will allow us to understand the potential to reduce costs arising from the deployment of charging infrastructure and more efficient network utilisation.

The outcomes of these Trials will be a detailed and robust understanding of the different methods that can be deployed to alleviate local network constraints resulting in lower costs for customers.

2.4 Changes Since ISP

In the ISP, the loads resulting from public charging were to be investigated through the design and implementation of a Charge Point Operator (CPO) interoperability platform.

This system would have acted as a single interface between the network and public charging operator and additionally would have enabled a common platform for the exchange of data between individual CPOs enabling charge point roaming.

As a result of further investigation, including a round table discussion with UK CPOs, we identified that the costs associated with this solution are substantial and benefits primarily accrue to EV owners rather than to the networks. Therefore, we will no longer carry out this activity and instead will achieve the learnings relating to public charging through a detailed analysis of the Uber driver data, which will offer the same insights to the DNO at a substantially reduced cost.

In addition to the changes above, the following changes since the ISP have increased the scope of the project but will also bring additional benefits:

- The addition of Royal Mail as a Partner, resulting in the revision of the scope of the Return to Depot use case;
- More in-depth quantification of the EV and infrastructure investments that will be funded by the partners (though these investments are not funded by NIC, the additional investment forms part of the project); and
- More detailed clarification of the scope of systems development for the DNO in the project.

This has consequently increased the cost of the project (from £18.45m in the ISP to £34.69m in this proposal). These additional costs are largely met by benefit-in-kind contributions from Partners and by controlling the scope around investigation of public charging, the total request for NIC funding has been maintained at £16.6m.

Section 3: Project business case

Optimise Prime will save GB DNOs and electricity customers £207m by releasing over 1,900 MVA of capacity on the distribution network by 2030. It will provide better forecasting, resulting in more accurate investment plans. It will help GB achieve their carbon emission and air quality targets by delivering over 2.7m tCO2 eq. of carbon savings by 2030. The project will break even by 2025/26.

3.1 Summary of Optimise Prime benefits

UK Power Networks is well aware of the challenges of decarbonising Britain and recognises its role in facilitating the transition of GB to a low carbon future. As such, their innovation portfolio has been developed to address those challenges at all network levels with the common aim to deliver a flexible, reliable, low carbon and low cost electricity network.

Optimise Prime will design, develop and test at scale a number of technical and commercial solutions for unlocking the transition of commercial vehicles to electric. It will build on other innovation projects looking at the electrification of residential vehicles (such as "My Electric Avenue" and "Electric Nation"), those focusing on fleets and PHVs (such as our "Black Cab Green" and "UPS Smart Electric Urban Logistics"), and on network solutions (such as our "Active Response" project). This Project is aimed at adding value to identified gap areas, as discussed in section 4.5.1.

The significant benefits from Optimise Prime will accrue to electricity customers, fleet and PHV operators and the general population across UK Power Networks, SSEN and the other GB electricity networks as key learning and solutions are shared.

There are significant carbon, capacity and financial benefits from Optimise Prime:

- The accelerated adoption of commercial EVs will save over 2.7m tCO_2e across GB by 2030 through the Methods, equal to a full Boeing 747-400 travelling around the world 1,484 times[13].
- The cost savings to the connecting customers is expected to accelerate the electrification of depot based fleets by 36% by 2030.
- By providing home charging solutions and providing learning that removes the operational risk of using commercial EVs, we expect to accelerate the transition to electric for home based fleet vehicles and PHVs by 14% by 2030.
- We estimate that 1,900 MVA less capacity will be used by 2030 due to flexible charging and profiled depot connections deferring or avoiding reinforcement.
- Overall we expect that the Optimise Prime methods will save GB DNOs and electricity customers £207m by 2030.

3.2 Links to business changes within UK Power Networks and GB DNOs

UK Power Networks and SSEN are investing in a number of innovative technologies and market models as they adapt to changes in patterns of electricity supply and demand to reduce costs for customers. Optimise Prime has been designed to complement these existing investments and the outcomes from the project will be designed to add further value to the following solutions:

- Load forecasting model – the datasets generated from the Optimise Prime project will inform DNOs' load forecasts which are then used to inform their investment plans. UK Power Networks has recently carried out a NIA project, Recharge the Future[14], which

[13] Based on Earth circumference at equator and 101g of CO2 produced per passenger per km flown: http://www.carbonindependent.org/sources_aviation.html
[14] http://www.smarternetworks.org/project/nia_ukpn0028

informed their forecasting model, however this did not include commercial EV data as such data were not available at the time.

- Active response[15] – better understanding of the usage patterns of commercial EVs will feed in to the load forecaster that drives real time decisions on network capacity modifications.
- LV Monitoring – UK Power Networks is investing in the deployment of monitoring solutions to increase LV network visibility. Granular load forecasting considering commercial EVs will help highlight areas where network constraints may occur first and so monitoring would bring most benefit.
- Flexibility roadmaps – Additional flexibility products from home and depot charging will be created, adding to the liquidity available in the flexibility market. This will assist DNOs with achieving their flexibility targets.
- Management of plug-in EV uptake on distribution networks[16]: SSEN have been carrying out a project looking at EV load management solutions for managing any network constraints. Optimise Prime will aim to test the market maturity of delivering such solutions, like flexibility services, through third parties managing either the charge points directly or through smart metering, which is one of the SSEN proposed enduring solutions.
- Smart Charging Architecture Roadmap[17] – The project run by UK Power Networks is looking at a spectrum of EV smart charging models and the core architecture elements across all of them. Optimise Prime will validate the recommendations of this project by testing some of the proposed smart charging models and developing some of the 'no regret' architecture elements.

It is worth noting that UK Power Networks will be procuring flexibility services as an alternative to any large load-related reinforcement going forward and will benefit from EV fleet participation in flexibility events, as are other GB DNOs.

3.3 Business case methodology

3.3.1 Cost benefit analysis

The quantified financial, capacity and carbon benefits included above and in the benefits tables and figures below and in Appendix 10.1 have been calculated using our Optimise Prime business case cost benefits analysis model. This is explained in detail in Appendix 10.3 with tables detailing all the assumptions used.

In summary, the vehicle and depot addresses provided by the partners were mapped to the UK Power Networks' network. Based on the electrification roadmaps of our partners, the additional load expected from each EV and depot was added to the relevant substations over the required electrification period. This was then compared against the real network capacity in those areas and used, combined with the UK Power Networks current network load forecast through to 2050, to identify where additional reinforcement would be required. We then used this as a basis to scale up across all fleets based on the number of light commercial vans on the road in GB[18] and a peak load scale factor (peak load factor = GB peak load/UK Power Networks peak load).

We compared the electrification roadmap of fleets and their adoption of flexibility in the Base case scenario to the accelerated uptake through the Methods. This acceleration is shown in Figure 4 and Figure 5.

[15] http://www.smarternetworks.org/project/ukpnen02a
[16] http://www.smarternetworks.org/project/nia_ssepd_0026
[17] http://www.smarternetworks.org/project/nia_ukpn0034
[18] https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

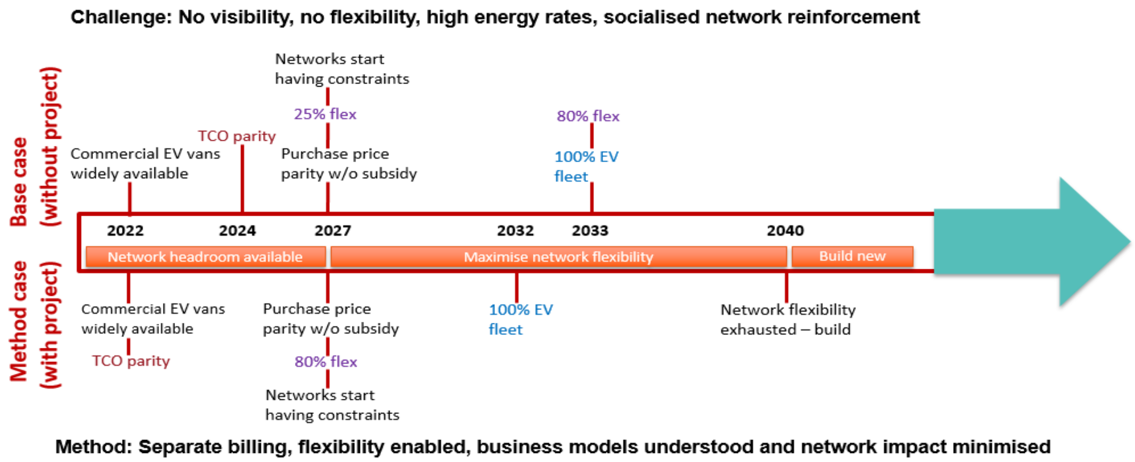

Figure 4 – Timeline for Use Case 1 – home charging commercial fleets.

In the home charging case, Optimise Prime will:

- Help achieve the total cost of ownership (TCO) parity two years earlier by allowing fleet operators charging at home to use cheaper commercial rates;
- Triple the percentage of home based commercial fleets offering flexibility services to the DNO by removing operational risks and proving the business case for flexibility; and
- Allow 14% more commercial vehicles to be electrified by 2030.

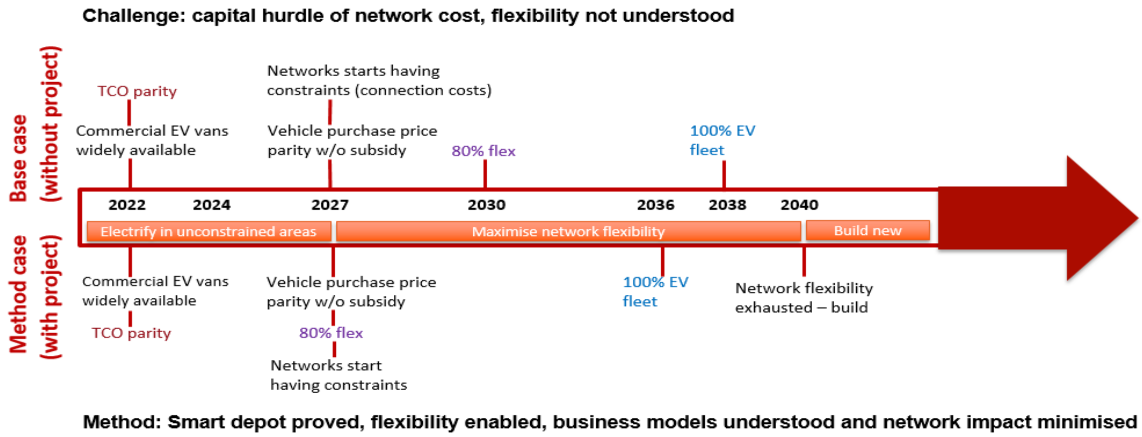

Figure 5 – Timeline for Use Case 2 – depot charging commercial fleets.

The base case for home charging fleets assumes smart charging capabilities for all charge points[19].

In the depot charging case, Optimise Prime will:

- Reduce the capital investment required for network connections and allow 36% more depot based commercial vehicles to be electrified by 2030; and
- Accelerate the uptake of flexibility by three years with more EVs offering flexibility services to the DNO earlier.

The base case for depot charging fleets assumes that timed connections are being looked at as an alternative to traditional reinforcement, as well as an element of behind the meter capacity optimisation.

3.3.2 Load growth and network impact

UK Power Networks' latest load growth model forecasts load growth on secondary and primary substations within our licensee area. The model takes EV inputs from the NIA

[19] Based on the introduction of the Automated and Electric Vehicles Bill: https://tinyurl.com/ycofjuhu

project “Recharge the Future”. The additional load from commercial fleets were assessed based on the uptake and assumptions described above.

3.3.2.1 Site selection for modelling

In order to assess the load impact of fleet EVs on the network, a sample of individual EV charging locations and depot locations were taken from the partners and mapped to the networks. It is important to note that the accuracy of the network impact, and therefore the benefits from deferred reinforcement, relies on both the load growth and the existing site capacity. The sample sites selected for the modelling were characterised into three major categories and their implications on the business case are listed in Table 4.

Table 4 – Sample site characteristics and their indications on the business model.

Site characteristic in the Base case	Business case indications	
	Domestic charging Method	**Depot charging Method**
No upgrade required from 2022 to 2050	The Methods will have little impact on these sites as there is enough existing capacity for all future growth or there is no growth and/or new depot connections.	
Three or more upgrades required from 2022 to 2050	The Method will have some impact on these sites as reinforcement could be deferred but not beyond 2050 as the fleet load is a small percentage of the overall load.	The Method will have major impact on these sites as new connections are likely to trigger reinforcement. Flexibility provided by these depots can also help manage peak load in the future.
One or two upgrades required from 2022 to 2050	The Method will have major impact on these sites as the fleet load represent a large percentage of the overall load and peak reduction could completely avoid reinforcement in some cases.	

There are extreme and moderate cases in the mix and the sample sites can therefore be deemed representative based on available information. The benefits derived from the assessment on the selected sample sites are extrapolated to all of UK Power Networks’ sites.

3.3.2.2 Reinforcement trigger point

Network reinforcement is triggered when the peak demand exceeds either the site firm capacity or total equipment (typically limited by the transformer) rating. The amount of new capacity is based on standard transformer sizes used by UK Power Networks.

The Methods will enable lower connection capacities and peak demand reduction through flexibility. This will release capacity and result in lower reinforcement costs. Flexibility services will only be offered or procured when the networks are constrained.

3.3.2.3 Flexibility assumptions

One of the benefits of the Methods in Optimise Prime is the increased opportunity for the EVs to provide demand response or flexibility services to the network. Based on information from partners, fleet vehicles operate up to 12 hours a day. The current mileage, and effectively the battery size taking into account a 85.7% charging efficiency[20], allows for more than five hours of flexibility. This is a typical flexibility duration based on the UK Power Networks’ recent flexibility tenders. The detailed methodology and underlying assumptions for this assessment are described in detail in Appendix 10.3.

It is these different behaviours, verified by our fleet partners, which drive the benefits shown in the modelling results below.

[20] https://ieeexplore.ieee.org/document/7046253/

3.4 Optimise Prime financial benefits

The graph below shows the forecasted financial benefits of Optimise Prime:

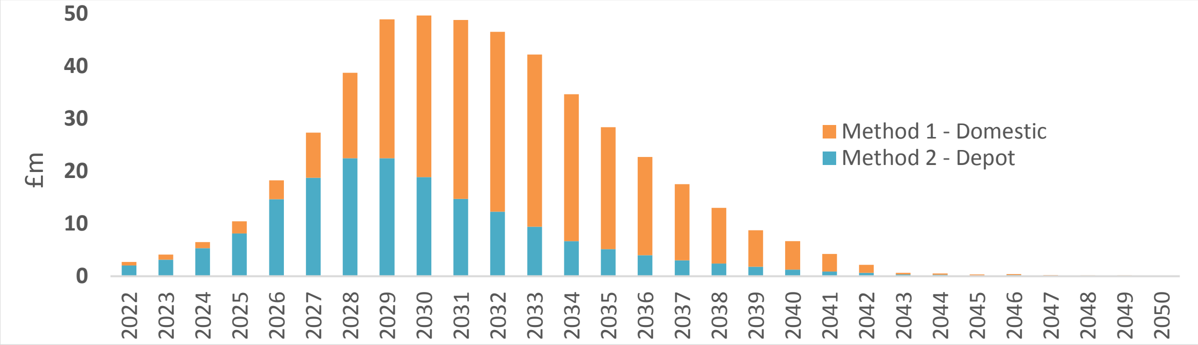

Figure 6 - Forecasted financial benefits across GB (£485m by 2050)

The graph demonstrates that there are significant financial benefits of rolling out the Optimise Prime methods across GB up to 2050. Table 12 shows the financial benefits and the cumulative installations for each method for 2030, 2040 and 2050.

Method 1 is predicted to have a significantly greater financial benefit than Method 2. This is because reinforcement triggered by domestic load growth (i.e. home charging) is socialised and paid for by all connected electricity customers. Therefore the benefits also accrue to them. Method 2 (depots) are non-domestic connections, where the cost of reinforcement is apportioned between the connecting depot and all connected electricity customers, as a result the socialised benefits are less than Method 1. However, the lower connection cost improves the economics of adopting EVs, allowing an earlier switch to zero carbon vehicles resulting in significant carbon benefits.

3.5 Optimise Prime capacity benefits

The release of network capacity, by reducing peak demand caused by commercial EVs, is a core benefit of Optimise Prime. This capacity will enable the connection of more load to the distribution network before reinforcement needs to take place.

Method 1 (domestic) is the primary source of capacity benefits. Through the IoT platform it will be possible to alter the charging patterns of commercial EVs to reduce peak demand by time-shifting the EV charging or reducing its rate.

Method 2 (depot) will also create capacity benefits. Depot customers will plan and optimise their infrastructure to meet their charging demands and limit peak loads. Based on this, they can then also request a profiled connection from the DNO with more capacity at off-peak times. The DNO will be able to optimise the utilisation of available capacity and grant more connection requests before reinforcement is triggered. The released capacity becomes negative as there are more vehicles providing flexibility because they are on traditional (often significantly more expensive) firm connections.

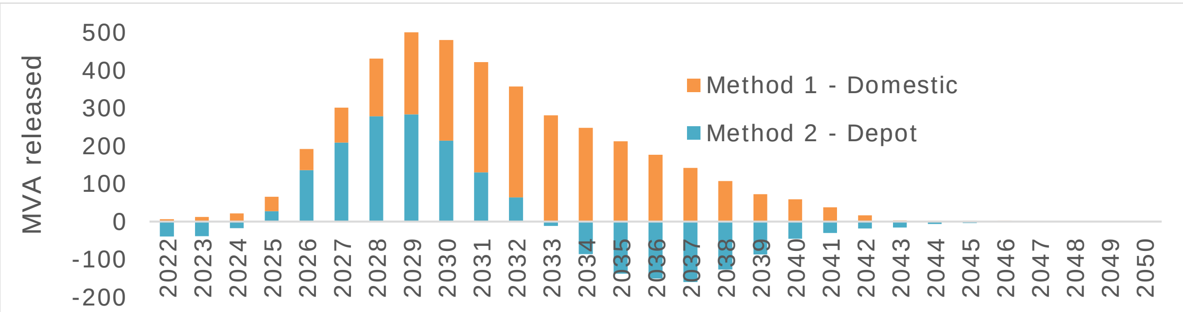

Figure 7 – Combined Capacity Benefits of Methods across GB, MVA (3,188MVA total)

The capacity released shown in Figure 7 is low at the start, as the network has available capacity. This increases through the 2020s as less capacity is available and flexibility enabled by the method allows more fleets and PHV operators to adopt EVs. After 2031, we predict that additional capacity benefits will begin to decline as the bulk of commercial vehicles will have transitioned to electric and the addition of new commercial EVs slows. By this time we predict that the use of smart charging will be considered business as usual, as such it is included in our base case as well as our method case.

3.6 Optimise Prime carbon benefits

The transport sector accounts for 27% of the UK's total greenhouse gas emissions[21], with 37.7 million vehicles on the road in the UK today, of which 10% are vans[22]. The carbon benefits are principally from enabling the earlier electrification of commercial vehicles, resulting in significant reductions in emissions of CO_2 and other pollutants.

This project makes it possible for fleet and PHV operators to electrify their commercial vehicles earlier and in doing so reduce the number of diesel vehicles on the road by reducing the total cost of ownership (TCO) of EVs. This is by reducing the need for expensive reinforcement at depots, making EV charging for home based fleets less expensive and providing demand response services as an additional revenue stream.

As can be seen in Figure 8, significant carbon benefits are expected as a result of the Project, cumulatively totalling 2,727,439 tCO_2 equivalent across GB by 2030. As a comparison, the entire TfL bus fleet in London emits 650,000 tCO_2 each year[23].

In addition to the carbon benefits there are also likely to be reductions in other pollutants, such as NOx and particulates.

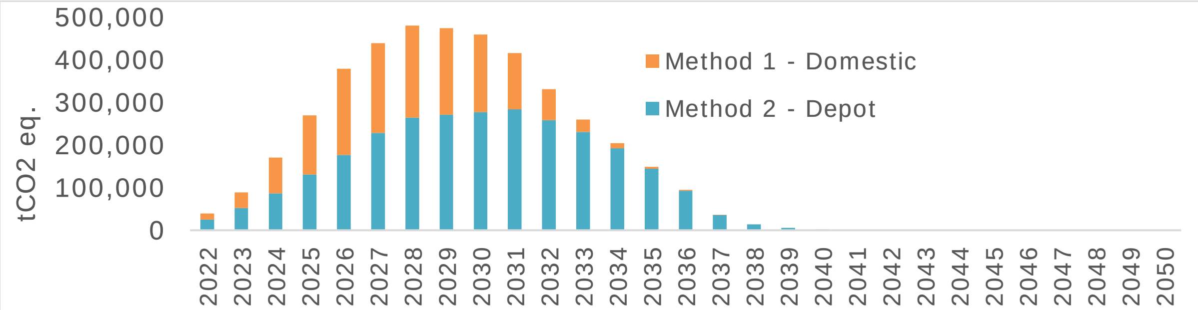

Figure 8 - Carbon benefits across GB tCO2 eq. (4,225,811 tCO2 equivalent by 2050)

Unlike in the financial and capacity benefits, it can be seen that the majority of Carbon benefits are as a result of Method 2 (depot). This is due to the potential for reinforcement costs being a more significant barrier for depot electrification, and the method reducing costs for the depot operator, improving the EV TCO, rather than for the electricity network customer through socialised reinforcement costs.

Environmental benefits will accrue from the avoidance or deferral of carbon intensive reinforcement activities, such as laying new cables in the ground, transport of machinery and parts to and from site etc. Having assessed the typical magnitude of these benefits in previous projects, we do not expect them to have a meaningful impact on the project carbon benefits, as such we have not quantified them or included them in the numbers provided here. These benefits will principally occur in Method 2, where requirements for larger connections serving depots will be reduced.

[21] DfT CO2 by Transport Mode https://tinyurl.com/y7m9efgw
[22] DfT Vehicle Licensing Statistics: https://tinyurl.com/ycglqhnw
[23] Cutting Carbon from the London Bus Fleet presentation by Finn Coyle, Environmental Manager (Transport Emissions) for TfL: https://tinyurl.com/y7whshug

Section 4: Benefits, timeliness, and partners

As a scaled, data-driven commercial EV trial, this innovation Project will deliver a £207m reduction in the network cost of EV transition and unlock a 2.7m tCO2 eq. reduction of carbon emissions by 2030. The Project brings together two DNO groups, and Partners that in total manage over 100,000 vehicles in the UK.

4.1 Summary of benefits

This Project is designed to deliver benefits to a range of stakeholders, specifically:

- **GB DNOs** will gain a greater understanding of the impact of commercial EVs, allowing for better forecasting of demand. The Project will allow the DNOs to utilise available demand flexibility in charging of EV fleets.
- **Customers** will benefit from lower network costs as existing infrastructure is used more efficiently, reducing the need for reinforcement, through the use of smart charging and the provision of profiled connection agreements.
- **Commercial fleets and PHV operators**, such as our Project Partners will gain the necessary understanding to operate EVs and plan an optimal EV infrastructure roll-out, given potential distribution network constraints. This will reduce the total cost of ownership for EVs, allowing an earlier transition from petrol and diesel.
- **The public** will benefit from the significant environmental improvements of a faster transition to electric power, reducing CO_2 emissions and air pollution.
- **Hitachi** will gain detailed understanding that will enable it to offer charging solutions and services to commercial fleets after the project.

4.2 Accelerating the development of a low carbon energy sector and delivering environmental benefits

The environmental benefits of this Project will principally come from the acceleration of the roll-out of commercial EVs, by testing methods to minimise the impact of commercial EVs on the network thereby removing barriers to adoption.

4.2.1 Supporting UK climate and air quality policy

Road transport currently contributes around 27% of UK domestic CO_2 emissions[24]. To tackle this, the Climate Change Act and air quality policies are driving the electrification of road transport. The Carbon Plan highlights the electrification of transport as a critical activity if the UK is to meet its 2050 climate change targets of an 80% reduction in greenhouse gas emissions compared with 1990 levels. While UK CO_2 emissions fell by 38% between 1990 and 2017, transport sector emissions fell by only 0.7%[25].

The use of EVs brings significant environmental benefits, including reductions in emissions of carbon, nitrogen dioxide, particulate matter and noise pollution. Air pollution from cars and vans has a significant societal impact and is responsible for up to 10,000 premature deaths per year in the UK and £5.9bn in annual healthcare costs. The annual healthcare cost attributed to a diesel van equates to £593, compared to £35 for an equivalent battery electric van.[26]

4.2.2 Importance of commercial vehicles

Commercial fleet vehicles and PHVs are a growing proportion of the vehicles on the roads, especially in urban areas, where air pollution is often the worst. This is caused by an increase in home deliveries and use of mobility services as an alternative to personal car ownership. While the transport sector, and the economy as a whole, has

[24] DfT CO2 by Transport Mode https://tinyurl.com/y7m9efgw
[25] UK Emissions Statistics https://tinyurl.com/yb5ujfap
[26] Health cost of air pollution from cars & vans https://tinyurl.com/y9t7wtkl

decarbonised since 1990, the light van, postal/delivery and taxi sectors have increased their CO_2 emissions by 20%, 28% and 30% respectively between 1990 and 2015.[27]

Commercial vehicles also undertake longer journeys[28] and use more polluting diesel engines[29] than domestic cars. As a result, these vehicles disproportionately contribute to pollution in cities and are the focus of the trials and business models in this Project.

Delays to electrification of this segment would have a significant impact. For every 100,000 vans that transfer from diesel to electric, we estimate that there could be annual emission savings of 345,000 tonnes of CO_2 on a tank-to-wheel basis, 270,000 tonnes of CO_2 on a well-to-wheel basis (factoring in carbon cost of electricity generation, transmission and distribution), and 1,490 tonnes of NOx emissions.[30]

4.2.3 Impact of network constraints

The electricity network is perceived as a major barrier in achieving the decarbonisation of road vehicles. In its response to the government consultation on the Modern Transport Bill, Transport for London (TfL) commented, "In London, the vast majority of public spending on EV infrastructure is being spent on grid reinforcement, which is not sustainable in the long-term and a burden on local authorities."[31]

The alternative to adopting EVs is often procuring Euro 6 diesel vehicles. Although these comply with currently proposed clean air zones, they are still significantly more polluting than battery electric alternatives. A decision to purchase a diesel van over electric will often mean that electrification is delayed by the useful lifetime of the vehicle, with the majority of vehicles remaining on the road for over 10 years. Commercial consumers may also face high costs to expand connection capacity at their sites. This increases the cost of EV adoption, sometimes to a level where fleet electrification is seen as unfeasible. It may trigger the company to send their EVs home with staff to charge, thereby socialising the cost of reinforcement.

DNOs must ensure that they play a leading role in facilitating connection of chargers to the distribution network cost effectively. Failure to do this may slow the transition to low carbon EVs due to the cost of providing infrastructure. The Project will work with users and operators of charging infrastructure to optimise their utilisation of existing connection capacity, and additionally help DNOs plan future infrastructure requirements to support EV charging. It will achieve this by working with DNOs and customers to understand actual requirements for EV charging, matching this to network capacity through profiled connections and smart charging.

Finally, reinforcement of electricity networks has a direct environmental impact, through use of materials and plant equipment. By reducing the requirement for reinforcement through better utilisation of existing infrastructure, the Project will make an additional contribution to decarbonisation.

4.3 Provides value for money to electricity distribution/transmission customers

The Project will generate learning and develop tools that could deliver £59m in financial benefits rolled out across UK Power Networks' licence areas by 2030; £207m rolled out across GB. A GB-wide rollout would provide over 12 times return on the £16.6m Project cost in benefits to customers by 2030.

[27] UK CO2 emissions by transport mode https://tinyurl.com/y7m9efgw
[28] 18,900 average miles for company cars & 13,000 for light commercial vehicles vs 7,500 for private cars. National Travel Survey https://tinyurl.com/yddz7ed5 Road traffic estimates https://tinyurl.com/ybr44cqv
[29] 96% Light Goods Vehicles run on diesel https://tinyurl.com/ycglqhnw
[30] Cenex analysis for Hitachi based on Defra emissions factors, 2018
[31] Automated & Electric Vehicle Bill https://tinyurl.com/yb4y4ov8

4.3.1 Potential direct impact on the network

The Project aims to enable fleet and PHV operators to minimise their network impact by optimising first, then requesting additional infrastructure. The data from the Project will inform the network planning decision making process, enabling selection of the most cost effective way of mitigating constraints through the consideration of the use of flexibility. Understanding the flexibility available from fleets of EVs is new learning, building on the existing knowledge of domestic EV impacts and flexibility markets developed in other NIA and NIC projects.

Method 1 will be testing demand response approaches with home based commercial EV fleet vehicles. The aim is to identify and quantify the charging flexibility available from commercial EVs charging at home and test the efficacy of using demand side response for resolving network constraints.

Method 2 will be developing and demonstrating optimal network connection profiles for depot based commercial EVs and using the remaining capability for demand response or charging flexibility from this fleet user segment. As a result of Method 2, both the requested connection capacity from fleet operators and their electrical demand will be different in a controllable way[32].

As such, both Methods will have a direct impact on distribution networks, increasing the available capacity through more efficient allocation of capacity to new connections and maximising the utilisation of existing network assets through flexibility activities, when more economic than network upgrades.

4.3.2 Project costs

To ensure this Project is delivered at a competitive cost, resource requirements have been calculated using a bottom-up approach. This is based on a detailed work breakdown structure and the Project plan, with inputs from Hitachi, UK Power Networks, and the Partners. The values have been reviewed by multiple levels of relevant internal stakeholders, including innovation project managers, up through key directors as part of UK Power Networks' innovation governance process, as well as through Hitachi's internal governance processes.

Our costs estimates are based on:

- Inputs from UK Power Networks' experts for labour and resource requirements, including procurement, technical, legal and dissemination activities, based on extensive experience of past NIC, and LCNF projects;
- Inputs from Hitachi, for the design and implementation of the IoT platform and software tools, analysis of project data and overall project management based on the company's experience of delivering IT systems and services; and
- Inputs from Partners based on their forecast cost of integrating the technical solution into their vehicles and facilities and managing trial participant engagement.

We will use a competitive procurement process to select suitably-qualified suppliers for those elements of the Project where several potential suppliers are available. This includes external research and analysis activity, as well as any required hardware and services. Where possible we will award this work in stages of fixed price and scope. This will allow us to avoid scope creep and cost overruns.

[32] Both the Electricity NIC and Network Innovation Allowance (NIA) Governance Documents define Direct Impact as a Method having a measurable, controllable change in the operation of the electricity systems. The NIA Governance adds: "Where the Method involves measures that aim to reduce or shift the electrical demand of commercial or domestic Customers, it is deemed to be controllable". (https://www.ofgem.gov.uk/system/files/docs/2017/07/final_elec_nia_gov_doc_v3_0.pdf)

We believe that trialling multiple Methods for solving network constraints represents good value for money to customers, providing efficiency benefits in innovation overheads and creating solutions that work for a range of different commercial fleets and PHVs. There are a number of common elements to enabling the methods which, to deliver as separate projects, would significantly increase the total cost.

In order to minimise the project costs we have looked to re-use platforms and solutions where available rather than develop new systems from scratch. This includes the Active Network Management (ANM) platform within UK Power Networks and Hitachi's Pentaho analytics platform. We have also taken the decision to carry out IT system integration with UK Power Networks systems, and not SSEN systems. Trials on their network will be manually enabled using a human interface to the Hitachi IoT platform.

4.3.3 Summary Cost tables

The Project costs for each workstream as a percentage of the total is summarised below (for further details of the workstreams, see Section 6):

Table 5 – Project cost breakdown by Workstream

Workstream	Name	Percentage (%)
WS1	Trial 1 – Home Charging	10.9
WS2	Trial 2 – Depot Charging	28.2
WS3	Trial 3 – Mixed Charging	6.1
WS4	IoT Platform, Network Forecasting & Flexibility Analysis	27.4
WS5	Business Model	5.0
WS6	Reports and Documentation	1.6
WS7	Project Management and Sharing Learning	20.8

Note that WS4, IoT Platform, Network Forecasting & Flexibility Analysis includes the implementation of the core IoT and analytics platform utilised by the trials in WS1, 2 and 3. WS7 includes governance/management resources that will benefit all workstreams.

Costs by category are shown in the below table, broken down by category. Note that labour time of the non-Licensee Project Partners, other than that categorised as IT, is shown as 'Consultants'. As such the labour costs appear lower and consultant costs higher than would be typical for a DNO led project.

Table 6 – Project cost breakdown by Category

Cost Category	Cost (£k)	Percentage (%)
Labour	1,006	6.1
Equipment	1,200	7.2
Consultants	9,356	56.3
IT Suppliers & Integration	4,477	27
Travel & Subsistence	13	0.1
Other	553	3.3
Total	**16,605**	**100.0**

Staffing costs for each stage, indicating the number of staff expected to be used (FTEs by stage), days required, cost per day and the total staff cost are shown in Table 7:

Table 7 – Staffing cost breakdown by Partner and Workstream

Project Participant	Workstream	Total (£k)	FTEs	Person Days	Cost (£) / Person Day
UK Power Networks	1	4.3	[redacted]	[redacted]	[redacted]
	2	36.5	[redacted]	[redacted]	[redacted]
	3	14.8	[redacted]	[redacted]	[redacted]
	4	217.8	[redacted]	[redacted]	[redacted]
	5	0.0	[redacted]	[redacted]	[redacted]
	6	32.5	[redacted]	[redacted]	[redacted]
	7	286.9	[redacted]	[redacted]	[redacted]
SSEN	1	2.2	[redacted]	[redacted]	[redacted]
	2	19.6	[redacted]	[redacted]	[redacted]
	6	6.1	[redacted]	[redacted]	[redacted]
	7	385.2	[redacted]	[redacted]	[redacted]
Hitachi Vantara	1	619.4	[redacted]	[redacted]	[redacted]
	2	619.4	[redacted]	[redacted]	[redacted]
	3	619.4	[redacted]	[redacted]	[redacted]
	4	619.4	[redacted]	[redacted]	[redacted]
	6	172.8	[redacted]	[redacted]	[redacted]
	7	2,308.1	[redacted]	[redacted]	[redacted]
Hitachi Europe	1	532.2	[redacted]	[redacted]	[redacted]
	2	731.8	[redacted]	[redacted]	[redacted]
	3	326.6	[redacted]	[redacted]	[redacted]
	4	411.3	[redacted]	[redacted]	[redacted]
	5	822.5	[redacted]	[redacted]	[redacted]
	7	438.5	[redacted]	[redacted]	[redacted]
Hitachi Capital	1	0.0	[redacted]	[redacted]	[redacted]
Centrica	1	179.5	[redacted]	[redacted]	[redacted]
Royal Mail	2	900.0	[redacted]	[redacted]	[redacted]
Uber	3	54.7	[redacted]	[redacted]	[redacted]
Total		**10,361.5**	**22.9**	**17,625**	**588**

4.4 Project Partners and contributions

The Project was proposed to UK Power Networks by Hitachi through a competitive innovation process. Following this, Hitachi and UK Power Networks have worked to recruit a number of companies to join the consortium, primarily organisations operating a large fleet of vehicles or working with a large number of drivers that have made pioneering moves in deploying commercial EVs. The Partners chosen are SSEN, Royal Mail & Centrica (including their subsidiary British Gas) – operators of two of the three largest UK commercial vehicle fleets and major PHV operator Uber. Further details of the Partners can be found in Appendix 10.7.

As a result of their involvement in the Project, the Partners have agreed to bring forward their investment in EVs – Centrica increasing the planned rollout in the British Gas fleet over the period by 150% and Royal Mail by 233% – a significant investment by both partners.

4.4.1 Partner roles

Hitachi will lead the Project. It will design, build and operate the IoT platform. It will also provide significant resources to deliver the workstreams. Hitachi Capital's Vehicle Solutions division will provide fleet sector experience.

Royal Mail is a fleet Partner. It will invest in EVs and infrastructure and provide access to its EVs and depots for the purpose of the Project.

Centrica is both a fleet and a technology partner. Its home-based British Gas fleet will participate in the Project; while Centrica will provide charging solutions for the home-based fleets as well as demand response services from subsidiary REstore – more information regarding this can be found in Appendix 10.2.

Uber is the PHV operator Partner. It will provide access to data from its growing fleet of EVs that can be utilised by the Project to quantify the impact of the PHV sector.

UK Power Networks will support Hitachi in the management and governance of the Project, providing engineering and connections related resources.

SSEN is a Partner. Inclusion of the Southern Electric Power Distribution area allows the Project to cover a wider area, including all of Greater London. Working with a second DNO group will help to ensure that the methods and solutions developed are applicable throughout GB. SSEN also brings strong experience of EV-focused projects, including the 3rd party led My Electric Avenue.

4.4.2 Partner contributions and benefits

The Partners will bring contributions to the Project that reduce the cost to electricity customers. Hitachi will lead the Project, providing governance and project management expertise. They will also provide of a significant amount of smart energy technology knowledge, technical and commercial knowledge to the Project. They will gain insights into the challenges of the energy and commercial vehicle sectors in adopting EV technologies.

The Project will require a significant deployment of both EVs and associated charging infrastructure. As a result of the importance of this project, fleet Partners have agreed to bring forward their investment plans for EV and in doing so, this infrastructure will not need to be funded by the Project. The fleet and PHV operator Partners will take risks as early adopters of EV technology on a large scale.

They will gain insights into more efficient means of electrifying their vehicles and depots through smart charging, demand response and simpler bill settlement processes, reducing the total cost of ownership and ensuring that they comply with legislation. Fleet and PHV operator partners are also committed to managing the impact of their businesses on the environment and will lower their emissions more quickly by participating in the Project. As the learnings from this Project will be available to the market as a whole, the fleet and PHV operator Partners are only likely to gain an advantage in the short term.

Network Licensee Partners will benefit from learnings which will allow them to better forecast EV demand on their networks, plan future capacity interventions more accurately and develop new connection products that contribute to the faster roll-out of EVs. Savings accruing to the licensees will likely occur in the RIIO-ED2 price control period – learnings from this Project will guide the development of their business plans.

Partner contributions to the project will principally be 'in kind', constituting provision of services and data to the Project, reduction in costs charged to the Project versus commercial rates, and investment in infrastructure and EVs as a result of the Project. UK Power Networks and Hitachi Europe will part-fund (50% and 10% respectively) the development of the site planning tool from their contributions to the project. The breakdown of costs and contributions to the Project from the Partners is shown in Table 8:

Table 8 – Project Costs and Contributions

Project Partner	Total Costs (£k)	Contribution (£k)	Contribution (%)	Outstanding Funding Required (£k)
UK Power Networks	3,575	1,845	52	1,730
Hitachi Vantara	11,516	3,689	32	7,827
Hitachi Europe	6,105	611	10	5,494
Hitachi Capital	58	58	100	0
SSEN	467	47	10	420
Centrica	1,765	1,585	90	179
Royal Mail	10,780	9,880	92	900
Uber	425	371[33]	87	55
Total	**34,691**	**18,086**	**52**	**16,605**

4.4.3 External funding

The consortium has considered external funding sources and will continue to monitor this as schemes become available throughout the life of the Project, such as the currently planned Innovate UK V2G trials, to identify opportunities to add value to the Project. Partners may make use of funding schemes such as the Workplace/Home Charging Schemes and the proposed Charging Infrastructure Investment Fund when procuring equipment.

4.5 Embedding innovation within the Project

This Project is innovative in three respects:

- It is the first Project to specifically address the network challenges of commercial EVs
- It employs an advanced IoT platform and machine learning to manage and analyse a large volume of data from EVs and chargers to aid optimal decision making
- It will allow 'self-service' determination of load profiles by Connecting customers, optimising both site and network capacity
- It takes a holistic approach, looking at technology, behaviour, and business models to find solutions that work for all stakeholders.

4.5.1 Gaps in EV impact understanding

Although there has been significant interest and research on the impact of EVs in recent years, there are still a number of major gaps in understanding, many which we intend to address with this Project.

As Figure 9 shows, the bulk of major EV charging studies have focused on private EVs charged at home. Large trials have taken place in the residential sector, such as the Low Carbon Networks Fund (LCNF) project, My Electric Avenue (100+ EVs), and the NIA-supported project Electric Nation (700 residential EVs). My Electric Avenue studied a non-domestic EV cluster, and concluded that the domestic solution trialled by the project was impractical for workplace users due to differing load patterns.[34] Neither project has studied the difference in flexibility from private versus commercial EVs charged on domestic connections, which is the focus of the Project's home charging use case.

[33] Uber's costs and contribution is based on their minimum commitment of data to the project and may increase based on data availability – see Appendix 10.7.1

[34] Electric Avenue Close Down Report https://tinyurl.com/ybctn2pd

Commercially focused trials completed (or funded) to date have generally not been approached from an electricity network perspective, but have been focused on demonstrating a location or technology specific solution. Where we have identified projects with scopes that overlap with Optimise Prime we will continue to monitor the projects to utilise learnings, avoid duplication and minimise costs.

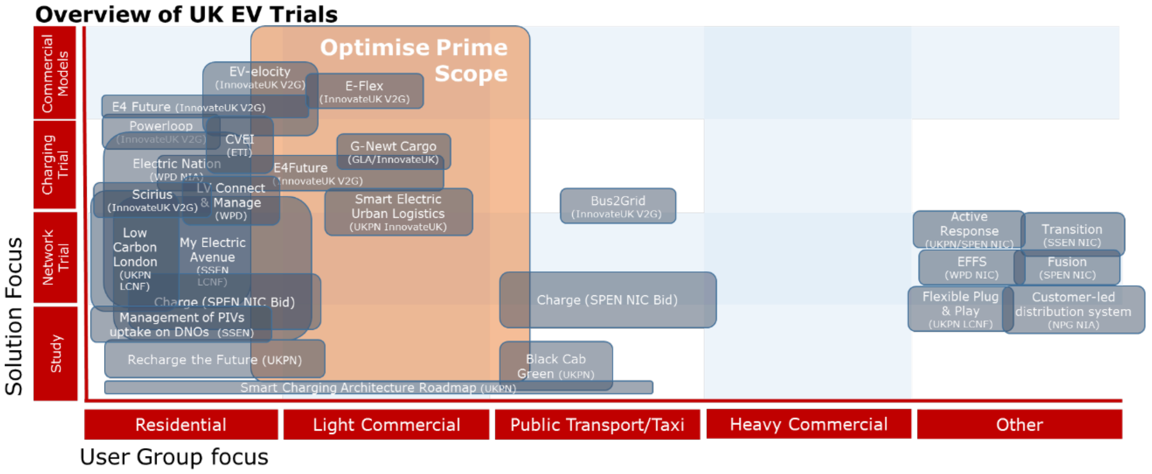

Figure 9 – Overview of UK EV Trials

The Innovate UK funded G-Newt Cargo and Smart Electric Urban Logistics trials both focus on using smart charging to manage EV charging within an existing site constraint. This Project will take this further through the monitoring of charging and optimisation of smart charging use over multiple locations. As described above this forms part of the base case in our cost benefit analysis. We will also trial the ability of the EV fleets and PHV EVs to respond to DSR signals and to participate in a trial of profiled connections, enabling better utilisation of existing network capacity.

Consideration of the commercial model surrounding EV charging has been extremely limited to date. Commercial models are being developed as part of some of the recently started Vehicle-to-Grid trials. However, this is limited to the benefits that can be gained from the use of a single technology. This Project will consider the use of a range of technologies, including smart charging and behind-the-meter generation/storage to find optimal charging solutions. The Partners will benefit from early access to viable commercial solutions that can be rolled out throughout their fleets and PHV EVs before this knowledge is shared across the industry.

A number of projects are looking at market models forecasting for flexibility (including the 2017 NIC projects, Transition, Fusion and EFFS) and many GB licensees have made progress in trialling and/or implementing these systems. This Project will not duplicate such work, and will specifically provide solutions and commercial models for releasing value from EV charging flexibility that can be integrated into existing platforms.

The 2018 Charge NIC bid by SP Energy Networks (SPEN) is also targeting EVs. Based on the Initial Submission Proposal (ISP) and extensive discussions with SPEN, we see this project as complementary to ours. While Charge will take a broad approach to aligning transport and network planning, it will not include commercial fleets and PHV EVs. It has been agreed that datasets created by Optimise Prime will be shared with SPEN to inform their transport and network planning work (WP1 of Charge). Optimise Prime profiled connections work is also complimentary to the relevant Charge work, as it is focusing on optimising connections for commercial depots, which is not being considered by Charge.

Finally, the scale of data collection proposed in this Project will address DNOs lack of sufficient data on the usage and demand patterns of commercial EVs, enabling effective planning. The data collected by the Project will enable comparisons across use cases and geographies and will be of sufficient scale to more accurately forecast the long-term impacts of large-scale EV adoption.

4.5.2 Innovation risk

This Project requires funding outside of the licensee's business-as-usual funding; a number of aspects of the Project present innovation risk for the licensee and Partners.

While significant growth of the EV sector is predicted, there are currently uncertainties around what the network impact will be and where reinforcement will be required due to the small number of EVs on the road, especially in the commercial sector. This will not be the case in the future; we are approaching the tipping point for economic and technical viability of commercial EVs. Both licensees and commercial customers must ensure that solutions are available in preparation for this. To do so the networks must work with early adopters of EVs to test solutions and minimise future network impact.

Usage models of commercial EVs have not yet been created. As a result, the availability, value and cost of flexibility from commercial EVs cannot be accurately quantified, nor can the network impacts. Were a Network Licensee to attempt to request flexibility from these sources for grid stability purposes, there would be a significant risk of the request not being fulfilled.

The current regulatory environment for EV charging is still evolving. Legislation through the Automated & Electric Vehicles Bill, which has recently been given Royal Assent, will give some clarity going forward. The use of smart chargers, the sharing of data and the interoperability of EV chargers may (or may not) be required through secondary regulation. The detail of these provisions is currently unknown. There is a risk that the business case for investments, for licensees, fleets and PHV operators, made at this time may become redundant by future legislation.

For many fleets and PHV operators, the use of EVs, especially Light Commercial EVs, is not currently financially justifiable and, in some cases, is not technically possible. This is because there are very few commercial EVs on the market. Those that exist are relatively expensive compared to diesel equivalents, have shorter range and more limited payloads, reducing their utility. Commercial operators take a risk in adopting EVs earlier than they would do so otherwise, potentially missing out on future price declines and technical advances. Discussion between our fleet and PHV operator partners and manufacturers have indicated that appropriate EV models will be available in time for the trials of this project, although there remains uncertainty on volumes available.

4.6 Relevance and timing

We are at a critical time in the development of EVs. In the periods up to 2030 and 2050 there will be a significant shift in the volume of EVs. National Grid[35] estimates there will be up to 10 million plug-in vehicles by 2030 and 37m by 2050 in its 2 degrees scenario. Forecasts have continued to become more aggressive and UK Power Networks has made significant upward revisions in the forecast for EV penetration in its license areas, as seen in Figure 10, showing a much steeper line in the more recent forecast.

While commercial vehicles only comprise 20% of the 37.7m[36] vehicles on UK roads, there are a number of factors converging to accelerate their transition to electric power. Currently, EVs are still more expensive to purchase than diesel equivalents. However total cost of ownership price parity is likely to be achieved earlier for commercial customers[37], due to higher mileages and air quality measures in cities such as London, encouraging commercial fleets and PHV drivers to switch to EVs more quickly.

[35] National Grid Future Energy Strategies http://fes.nationalgrid.com/fes-document/
[36] Analysis of Vehicle Licensing statistics https://tinyurl.com/y82yxxog
[37] TCO Analysis https://tinyurl.com/yd4swmlr

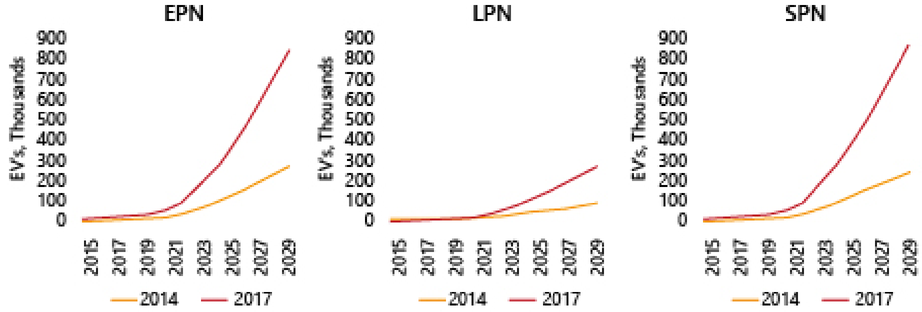

Figure 10 - EV growth forecast for UK Power Networks area

Vehicle availability has been a major barrier to commercial EV adoption, especially in the LCV (van) segment. A number of new commercial EV models will be released during the Project's lifetime, with improved range and capacity[38], enabled by improvements in battery technology and investments by manufacturers. This will make EVs a practical choice for fleets needing to transport goods and equipment over 2019-21. Globally, the number of EVs on the market is expected to grow from 155 at the end of 2017 to 289 by 2022, providing operators a greater range of EVs that can fulfil their needs.[39]

The UK government has set a requirement for the end of new internal combustion engine vehicle sales by 2040 in order to meet the commitment to reduce greenhouse gas emissions by 80%, versus 1990 levels, by 2050. In response to this, and also taking into account local air quality issues, a range of low and zero emission zones are being planned and implemented by a number local authorities from 2019 onwards. Some local authorities have also prescribed additional requirements for vehicles such as taxis and PHVs; Transport for London requires all new taxis to be zero emissions-capable, extending to new PHVs in 2020.[40] Fleet and PHV operators which operate in these zones need to plan their transitions, including the necessary charging infrastructure, by the early 2020s to ensure compliance with these regulations or face financial penalties. DNOs need to be equipped with solutions that will help them address these changes and meet the needs of their customers.

Finally, patterns of vehicle ownership are changing, with personal vehicle ownership in urban areas decreasing and use of delivery and Mobility-as-a-Service (MaaS), such as ride sharing, increasing substantially. This is increasing the importance of commercial vehicles and their contribution to environmental issues. Specifically, registrations of vans have increased by 34% in the last five years[41]. Between 2015 and 2017 the number of licensed PHVs in England increased by 23%, with a 39% increase recorded in London[42], the focus area for this Project. Driven by environmental responsibility, a growing number of commercial organisations have made commitments to significantly decarbonise their vehicles by deadlines up to 2030, including Uber and Centrica.

The project is also timely in relation to electricity network funding and wider government strategy. The impact from the at-scale implementation of EVs is likely to be realised in the RIIO-ED2 price control period, which begins in 2023. To adequately plan investment requirements in this period, Licensees need to understand the scale of the impact from commercial EVs and how much this might be mitigated by smart charging and flexibility. The outcomes from this Project will contribute to the licensees' ability to do so effectively. Learning from the project will also support Ofgem's current work on potential reform of network access and future charging arrangements.

[38] Models from LDV, Mercedes Benz, Renault, VW & Ford https://tinyurl.com/yasmh4p9
[39] Bloomberg Electric Vehicle Outlook https://tinyurl.com/y88rxefn
[40] TfL; Cleaner, Greener PHVs https://tinyurl.com/y9rxr5sj
[41] SMMT Van sales statistics https://tinyurl.com/y7x2bqen
[42] DfT Taxi statistics https://tinyurl.com/y9b2gsnq

Our approach delivers learnings at key stages of the Project, including practical knowledge, insights, methods and tools. We will share these, together with an extensive dataset gathered from the three trials. Our work will be closely integrated with all other relevant studies.

5.1 Learning generated

Through the Trials, the Project will generate a set of capabilities to minimise the impact of commercial EVs on networks.

This will include techniques to forecast the impact of EVs on the network, an understanding of the flexibility available in commercial EV fleets and new profiled connection offers to depot-based fleets. In addition, the Project will generate a large set of raw data from which future insights will be derived. These learnings will allow DNOs to maximise the utilisation of network capacity, reducing the need for reinforcement and lowering costs to customers.

The fleet and PHV operators will gain an understanding of how they can optimise their EV charging investments to minimise cost. This will allow them to achieve a faster roll-out of EVs based on a lower total cost of ownership.

Data and learnings generated by the project will be made available to allow stakeholders and the wider electricity, fleet and PHV industry to optimise their vehicle electrification plans.

Both 'traditional' and 'digital' approaches to knowledge capture, learning dissemination and data sharing will be applied to the project. It will build on the best practice, experiences and tools from UK Power Networks, Hitachi and the other Partners.

5.1.1 Dissemination of Project outputs and learnings

The predicted growth in EV take-up, particularly for commercial fleets and PHV operators, means that the Project will capture and disseminate large amounts of data and learnings throughout the Trials. We will therefore disseminate outputs and learnings at key stages throughout the Project. This will include outputs from data analysis and modelling, and qualitative data, such as customer experiences. These key stages are shown in Appendix 10.4.

The learnings will be collected and made available in three main forms:

- Data archive – to allow other DNOs, academics or interested parties to utilise anonymised data created by the Project (not including existing data provided by Project Partners for the purpose of analysis).
- Trial reports – reports during and at the end of the project will outline the key learning outcomes from each of the trials and signpost to the underpinning data.
- Replicable solutions – the learning and data from this Project will also underpin the development of practical tools to improve the planning for network investment, charging infrastructure and make their operations more efficient.

Key areas of learning include:

- Data on the electricity demand from commercial EVs. This will allow DNOs to improve the accuracy of their forecasts and optimise future network investments more effectively.

- The efficacy of profiled connections in reducing the need for network reinforcement.
- Analysis of the potential to influence charging activity through incentives. This includes consideration of technical, economic and behavioural issues, allowing DNOs to implement optimal demand response strategies as they transition to DSOs.
- Data from Method 1 on the aggregation trials and learning around flexibility contracts with the DNOs.
- How behind the meter planning and optimisation can reduce costs for depot based EV fleets.
- How technology can reduce the cost of home-charging EV fleets.

The data gathered will provide UK Power Networks and other DNOs with real life insights. They will demonstrate the effect on the network of implementing a range of smart technologies and how these can be influenced to increase benefits to the network.

The diagram below (Figure 11) demonstrates how each of these areas of learning and resources will be developed as a part of the three Project Trials.

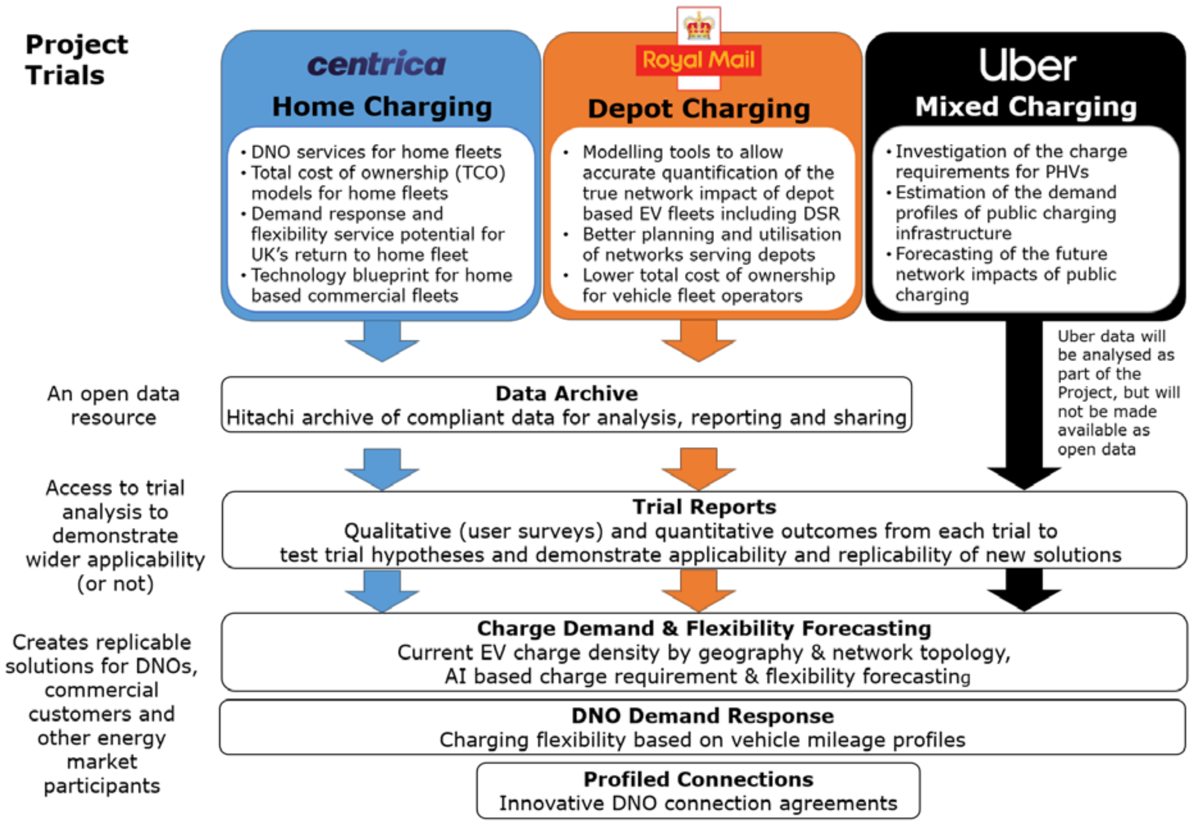

Figure 11 – Knowledge dissemination from the Trials

To maximise learning, the Project will build on existing learning from Project Partners and other projects, such as the residential private owner models developed through Low Carbon London, My Electric Avenue and Electric Nation. We will also ensure that learning synergies are exploited between other EV charging projects, such as the Innovate UK V2G trials and the proposed SPEN NIC project, Charge. The Project will take a leadership role to bring the key stakeholders together to build a shared, incremental learning approach, as outlined in Section 5.2.

5.1.2 Applicability of learning to Network Licensees

All DNOs will face the same challenges when planning for and managing increasing numbers of EVs on their networks. As previously stated, the initial demand will be driven by commercial fleets and PHV operators. The impacts and innovative solutions for commercial EVs are poorly understood at the scale required to make effective long-term investment decisions (see section 4.4.1).

To ensure that it will deliver relevant learning to the wider DNO community, the Project has been developed in partnership with Scottish & Southern Energy Networks (SSEN). In collaboration with UK Power Networks and SSEN the Project will trial two use cases, centred on London, bridging four network licence areas. A map of the project area is shown in Appendix 10.2.6. Continuing collaboration with SSEN throughout the Project will ensure that the Trials are widely relevant, ultimately producing a profiled connection planning tool for EV depots and a rich dataset of commercial EV charging information that can be utilised throughout the industry.

The two DNO groups and the Project Partners will own a joint dissemination strategy (see section 5.2) for all other GB DNOs. Involvement of two major network operators means that the Project will maximise the potential for applicability of learning across GB, whilst keeping the number of project participants to a manageable level.

We have co-ordinated with Scottish Power Energy Networks (SPEN) to ensure there is no un-necessary duplication with their project Charge. We are working with SPEN to ensure our data on EV fleets will be able to input to their technical reporting and transport planning work. We will not be looking specifically at where to put on street/public chargers, but will look to support SPEN's work in this area with data from our trials. SPEN have de-scoped fleet EV trials from project Charge to avoid un-necessarily duplicating Optimise Prime. We have also identified cost reductions in shared knowledge dissemination (see Section 5.2), should both bids be successful.

SPEN is a partner on UK Power Networks' Active Response project and there are regular communications between the two organisations. This will ensure learnings are shared and duplication is avoided. A robust dissemination plan has been developed to ensure that other DNOs can receive the learning from the Project and replicate the solutions, as highlighted in Section 5.

5.1.3 Applicability of outputs to the fleet and PHV operator sector

Understanding the most cost effective approach to EV transition is a challenge for all fleet and PHV operators. The learning and tools from this Project will provide the foundational technology and knowledge for a cost effective transition, in partnership with all relevant DNOs.

To ensure the outputs are applicable across the sector and relevant to all GB DNOs, we are working with three Partners with different operating models and national coverage across the UK – a return to home fleet, a depot based fleet and a PHV operator. The depot fleet trial will include multiple depots and we plan to trial Method 2 with a variety of depot sizes and locations.

In addition to this, Hitachi Capital is a Partner in the Project. Hitachi Capital's Vehicle Solutions Division is active in the UK Fleet management market, managing over 23,000 light commercial vehicles for approximately 80 clients – ranging in size from Small and Medium Enterprises (SMEs) to national fleets. We will work with Hitachi Capital's experienced fleet consultants as we design the Methods and take their advice regarding applicability to the wider fleet market. We also intend to survey Hitachi Capital Vehicle Solutions' customers to gauge acceptance of the Methods, and applicability of the business models with a wider group of stakeholders.

5.1.4 Sharing of learning with other industry stakeholders

In addition to DNOs, other key stakeholders include:

- **Energy market participants** (suppliers, aggregators, transmission system operators (TSOs) etc.) – These organisations will directly benefit from the Project learnings. They will be key participants in the value chain required for the commercial deployment of the solutions developed as a part of this Project
- **Energy Networks Association** – The learning will underpin the wider work of ENA in supporting the EV transition through its Open Networks project, both throughout and beyond the Project
- **Energy Systems Catapult** – The Project Partners have established links with the ESC (and other catapults) who will look to utilise the learning and data from this Project to support their aligned work
- **Local authorities** – Local authorities will be key stakeholders in the trial, facilitating its delivery and using the learning to help shape their local strategic objectives and priorities
- **Ofgem and central government** (including the Office for Low Vehicle Emissions, OLEV) – The Project will provide the knowledge base to establish the most effective strategic and regulatory interventions to support the EV transition
- **Academia** –Trial reports and the data from the Project will be available to academia to advance and gain new insights.

Our approaches to collaboration and dissemination to these key audiences are set out below.

5.2 Learning dissemination

A shared dissemination strategy will be led by Hitachi, UK Power Networks and SSEN, and supported by the other Project Partners.

The learnings will be disseminated to DNOs through existing NIC/NIA channels. It will take a more digital focus to data analysis and dissemination than has been traditionally used by similar projects.

The diagram below summarises the different dissemination approaches that will be taken:

Figure 12 – Dissemination approaches

Open Data Archive and reports – Hitachi will lead this activity, bringing extensive experience in the management, analysis, visualisation and sharing of the large and diverse datasets, such as those that will be generated through the Project. The big data innovation lab will act as a single dissemination resource to all DNOs and the key audiences will be directed through the three other dissemination channels below.

The platform will provide secure access to a range of anonymised datasets allowing for further analysis by third parties. Funding has been budgeted within the project with the aim of stimulating engagement with the data. This funding will be used to run a competition to allow academic institutions and other external organisations to submit proposals for data analysis projects that will create further learnings for the DNOs.

Regular reports will be published as the Project progresses, highlighting key learnings, together with a comprehensive report of findings at the end of the Project.

Press, social media and web content – The Project communications strategy will ensure all Project partners have a shared understanding of the key Project messages and communications milestones. This will ensure a coordinated, multi-channel approach to reaching the key audiences. Press releases and social media channels will be used to announce key events and a Project webpage will host Project reports and information.

Stakeholder forums/workshops – The key audiences will require different approaches and messaging to ensure the key learning points relating to their own requirements are effectively disseminated. Hitachi, UK Power Networks and other Project Partners bring a wealth of experience of using tailored, innovative, interactive and participatory approaches to knowledge dissemination in both small and large group environments.

We have agreed to share some learning events with SPEN, should their project Charge be awarded funding. This has reduced the cost of this project by £12k and minimises duplication between similar activities.

Industry presentations – In addition to the main DNO events, the Hitachi will ensure that the key findings and signposting to further information are disseminated through a range of forums covering the audience in section 5.1.3, such as fleet and PHV management events, policy forums and energy and mobility conferences.

5.3 IPR

The delivery of this Project by all Project Partners, and any tools that are developed, will adhere to the default IPR arrangements set out within the NIC governance. Project contractors, consultants and suppliers will be required to comply with the default IPR arrangements as part of the selection criteria of the competitive tendering.

In addition to complying with the default IPR arrangements, the new datasets generated by the Project will be shared and made openly available through knowledge dissemination to allow other parties to continue to benefit from the outputs of the Project. We also recognise the need for businesses to have access to such tools as the depot optimisation system and the site planning tool to enable the use of profiled connections at scale. If successfully developed and proven, both will be made commercially available post project. To help stimulate competition in the market and prepare for the mass adoption of commercial EVs, the site planning tool methodologies and reference design will be made freely available to other parties in GB to replicate and build.

The site planning tool will be part-funded from UK Power Networks' and Hitachi Europe's own contributions to the project and NIC will only fund a part of its development.

Section 6: Project Readiness

Rigorous preparation and planning prior to contract award means we will make a 'fast start' in January 2019. Successful project delivery is ensured through effective governance and transparency of progress and issues.

We have developed and will run the Project in accordance with Hitachi's project delivery methodology and quality standards. These procedures will ensure that the Project is subject to the appropriate level of review and governance, including a stage gate review process, in accordance with project management best practice.

The proposed Project is highly innovative and, as such, will have a higher risk profile than more traditional projects, where the requirements and outcomes can be precisely defined at the start. This section explains why we are confident that we have carried out the necessary planning to assure Ofgem and all the parties involved that the Project will be delivered on time and on budget. It also confirms that we have produced the documents, plans, Project governance and have the relationships in place to be ready to make a fast start.

6.1 Evidence that the project can start in a timely manner

We have invested in a significant amount of preparatory work to enable the Project to start in a timely manner in January 2019. The outcomes of this work are:

- Strong support from UK Power Networks and SSEN, including senior management;
- Highly engaged and committed partners, Royal Mail, Centrica and Uber;
- Experienced, dedicated, and qualified Project team members;
- Clearly defined Project delivery and governance structures;
- A robust Project plan enabling Project commencement on day one; and
- Clarity on the contractual and commercial arrangements between consortium members.

Each of these is covered in the six sections below.

6.1.1 Strong support from UK Power Networks and SSEN

Hitachi, UK Power Networks and SSEN have worked closely during the development of this proposal to ensure that the scope and outputs of the Project meet their needs, the requirements of NIC governance and address pressing issues within the industry. We are confident that this document sets out a scope of work that is strongly supported by both network operators and that they will play a significant role in the delivery over the next three years.

This support is from:

- Key members of the UK Power Networks Executive Management team, who have committed management time and ensured the availability of input and support from in-house specialists; and
- In-house specialists, who have provided input and committed to continued support. They are engaged through regular meetings in the development of the project plan with internal senior managers and other senior discipline leaders with expertise in key areas.

The Project has progressed through UK Power Networks' internal Innovation Governance process (SR 07 005i). This ensures that all the relevant internal stakeholders are fully engaged and formally committed to the Project.

6.1.2 Highly engaged and committed partners, Royal Mail, Centrica and Uber

Our Project approach is based around the two use cases set out earlier in this document (Section 2). We have engaged with Royal Mail, Centrica and Uber to represent each of the use cases. This will generate the scale of commercial EVs required for the Project findings to be definitive. We have collaborated to understand their challenges, EV plans and roles in this Project, resulting in a high level of commitment to the Project by all members. This is demonstrated by the significant investment that each organisation is making.

6.1.3 Experienced, dedicated, and qualified Project team members

The Project consortium has the experience and capability to successfully deliver large, complex, technical projects to time, cost and quality targets.

Hitachi is a leading global technology company committed to bringing about social innovation. It has a long and successful track record delivering thought leadership and technology solutions in the energy and transport sectors. Hitachi will lead the Project with a team highly experienced in energy networks and infrastructure; energy forecasting; business models and data analysis; state of the art technologies and platforms. UK Power Networks and SSEN will support and guide the Hitachi team, ensuring the Project has the maximum positive impact on the GB DNOs. All Project Partners have actively engaged in the development of our full submission to ensure that the Project can commence in a timely manner.

To ensure a prompt Project start, we have identified the key project team personnel (see Appendix 10.6). They have the correct balance of seniority, technical skills and knowledge, with many years of experience of delivering innovative projects. The remainder of the team will be selected prior to project award.

6.1.4 Clearly defined project delivery and governance structures

We have created a Project Execution Plan (PEP), based on Hitachi and UK Power Networks' extensive experience of project management best practice and learning. The PEP will act as a guide to the Project as it progresses through the start-up, design, and delivery stages. It specifies the Project's overall aims, key success criteria, organisation structure, the governance structure enabling clear decision making, and the key reporting and control processes that support that governance structure. This approach will provide transparency, facilitate cohesion and collaboration amongst the stakeholders, and avoid duplication of work.

We have defined the project management and governance structure that will enable the Project to start in a timely manner. The Project will be delivered using seven workstreams, as set out in Table 9.

Table 9 - Workstreams

Workstream	Title
WS 1	Trial 1 – Home Charging
WS 2	Trial 2 – Depot Charging
WS 3	Trial 3 – Mixed Charging
WS 4	IoT Platform, Network Forecasting & Flexibility Analysis

WS 5	Business Model
WS 6	Reports and Documentation
WS 7	Project Management and Sharing Learning

The first three workstreams represent the core of the Project; they are the three large-scale trials that will allow the Project team to gather data and real world insights for each of the three use cases. We have assumed that each trial will run for 15 months and will run concurrently.

The data and learnings from Workstreams 1, 2 and 3 will be used in Workstreams 4 and 5 for detailed modelling and analysis. This will result in practical recommendations and proposals, including, the value proposition of smart charging, data models for forecasting the impact of commercial EV roll out, the profiled connection planning tool and the business model requirements.

Workstreams 6 and 7 are supporting functions. Workstream 6 will provide ongoing support to the other workstreams to ensure that the data, analysis, modelling and other outputs are appropriately captured, recorded and documented. This workstream will also provide guidance and assistance in the development of the contracted set of deliverables and reports.

Workstream 7 has two vital activities. It will ensure project delivery is effective and efficient through the use of best practice project management processes, tools and techniques, and governance arrangements. It will also design and deliver the learning dissemination activities set out in Section 5: Knowledge dissemination.

The design and development of the Common Platform, part of Workstream 4, will underpin the trial delivery. This innovative application will provide the connectivity, data repository and analytical functions required to support the trials.

For information on the proportion of funding allocated to each Project Deliverable, please see Section 9.

The delivery organisation is shown in Figure 13.

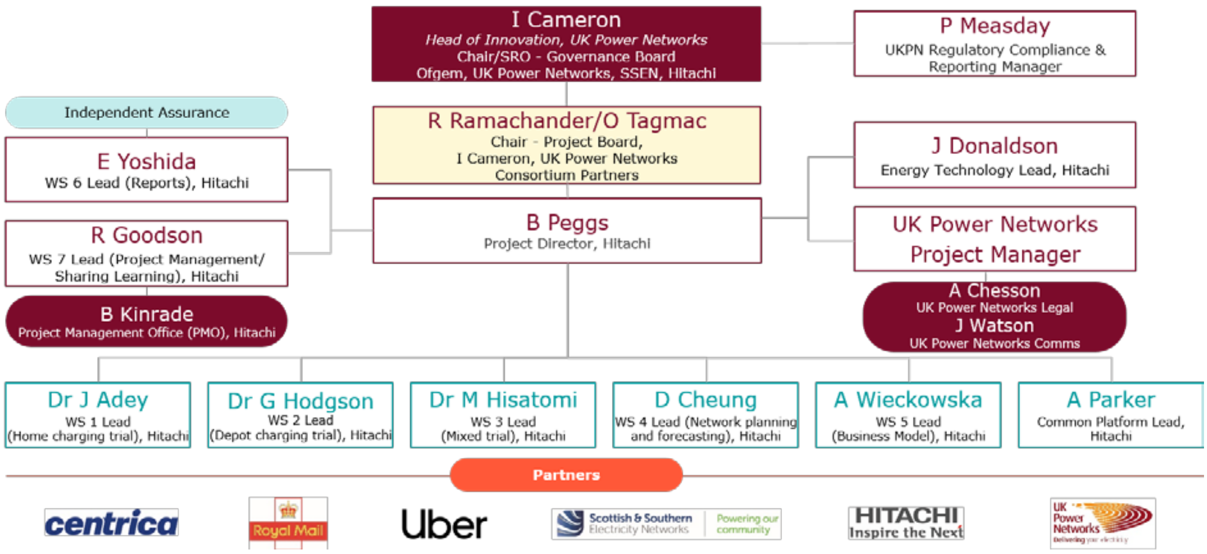

Figure 13 – Delivery Organisation Chart

A single point of contact for the Workstream Leads and the Project Board will mean there is accountability and clear direction. The key project roles and responsibilities are:

- The Project Director is responsible for the day-to-day management of the project. This includes, but is not limited to, reviewing the project progress against the plan, presenting the project progress report to the Project Board, updating the project plan, monitoring project risks and project budget. They will be responsible for ensuring that all the Partners are delivering their elements of the Project as planned. They will proactively manage risks and issues. When required, they will escalate matters to the Project Board.
- The Energy Technology Lead provides the project vision and strategy. He will work closely with the Project Director, Workstream Leads, the Common Platform Lead and the other partners to ensure that the project is being designed and delivered in accordance with this. For example, confirming that the analysis is statistically and technically robust. He will review and approve all key project deliverables.
- The Project Management Office (PMO) provides support to the Project Director. This will include provision of regular, frequent progress reports and coordination of the Learning Sharing activities.
- The Workstream Leads report to the Project Director. They are responsible for the successful delivery of their in-scope work and deliverables, and coordinating with other workstreams and the other partners.
- The Common Platform Lead is responsible for the design and delivery of the IT apps, data services and the IoT platform that are required to underpin the delivery of the workstreams.

The proposed governance arrangements are as follows:

- Fortnightly written progress reports from Workstream Leads – using a template that captures progress, risks, issues, change control, decisions required.
- Fortnightly progress meetings with Workstream leads, chaired by the Project Director. Notes and actions will be distributed within 24 hours.
- Written monthly progress reports to the Project Board to allow full financial and project control, written by the Project Director.
- Defined change control process – potential changes subjected to impact assessment prior to approval.
- Quarterly Project Board meetings – attendees from Hitachi and all consortium members will review progress, risks/issues, costs/benefits and provide strategic direction, when required. This will be chaired by Ram Ramachander or Oylum Tagmac of Hitachi. This group is ultimately responsible for the project and will make decisions that have an overall impact on the benefits and outputs that the Project will deliver.
- Governance Gates with the Governance Board at key stages to assess the overall performance of the Project and to confirm that the project should progress to the next phase. These would be chaired by Ian Cameron, Director of Innovation, UK Power Networks in the role of (Senior Responsible Officer).

6.1.5 A robust project plan enabling project commencement on day one

The project plan has been drawn up using extensive experience from Hitachi and UK Power Networks. It incorporates lessons learned from earlier large NIC and LCNF innovation projects. The plan has been validated by the senior management teams from the Project Partners for their inputs on the Project scope and delivery phases. This combined input, feedback and guidance ensures that the resulting project plan is robust.

The detailed project plan (detailed in Appendix 10.4) will enable the project to start in January 2019 with minimal further planning and mobilisation time and cost. Key project phases are shown in Figure 14 and the summary timeline is shown in Figure 15.

Figure 14 - Project Phases

6.2 Identification of key project risks

Experienced team members have identified projects risks and defined mitigating actions.

The Project consortium members have a strong track record for minimising project overruns and delivering projects within budget. We will ensure successful project delivery through good project management practices, which define project control processes in detail and provide effective mechanisms to manage and control the Project scope, cost and schedule.

The Project will implement five key control measures. These defined processes and documented controls will help the Project Director and the Project Board to maintain control of the Project, ensuring the project delivers to its overall aims, as defined in the Project proposal.

The Project will employ the following processes to minimise the possibility of cost overruns or shortfalls in the targeted benefits.

1. Risk and Issue Management – this process ensures the capture, communication and escalation of key risks and issues within the project and defines where decisions will be made and how these will be communicated back to the workstream where the risk or issue has arisen. The initial Risk Register is included in Appendix 10.5.
2. Change Control – this process will be used to control and confirm any changes to the agreed baseline of the project, whether the change relates to time, cost or quality. A key interaction in this process is between the delivery team and the Project Board to understand the impact and, if appropriate, approve the proposed change. (Refer to section 6.4).
3. Review Process – all formal outputs from the project will go through a formal review process. An output will not be deemed complete until it has passed this review process. The Workstream Leads and Project Director are responsible for ensuring all outputs are placed under review. It has been agreed that for certain documents, a peer review by the SPEN Charge team will be sought to share early learning, ensure the projects are still aligned and avoid any duplication of efforts.
4. Approval Process – this will be implemented to ensure all deliverables are adequately approved before they are agreed as complete and released. The Project Board will ensure each deliverable is completed to the quality, cost and timescales as agreed in the initiation documents and detailed plans and designs for each workstream.
5. Sign-off Process – the process of internal review and modification used to sign off all formal documents, ensuring accuracy and quality.

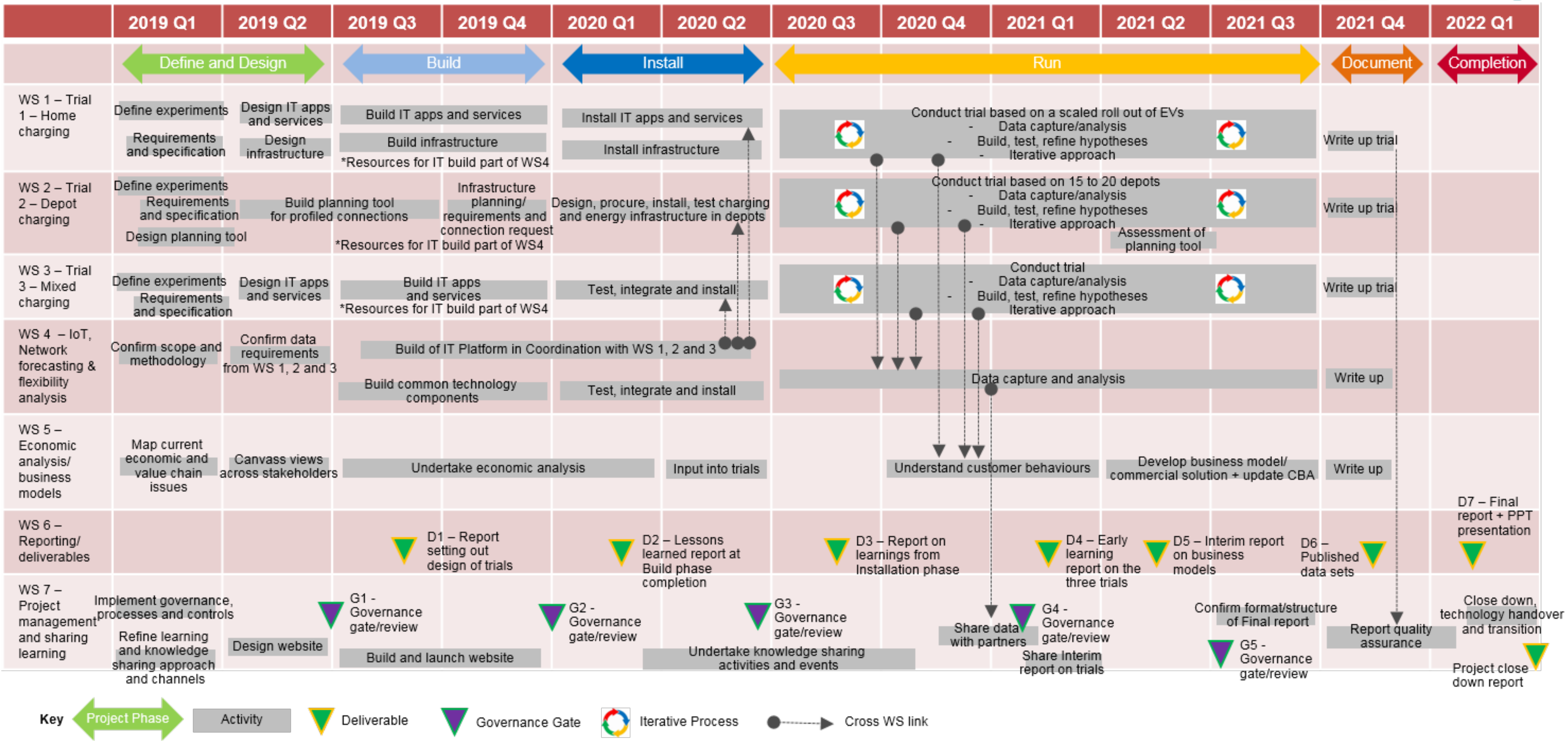

Figure 15 – High level project delivery timeline

In addition to the project monitoring and reporting procedures, we will embed risk management within project roles and responsibilities, as follows:

- The Project Board will assess change requests, review the impact on the project business case, and identify and review risks and issues associated with major change requests.
- The Project Board is responsible for the operational management of the project, focusing on reviewing progress against the plan, and resolving risks and issues.
- Regular risk reviews will be undertaken by the Project Director, with results reported to the Project Board.
- The Energy Technology Lead will review and approve all key project deliverables to ensure they are fit for purpose. Change requests may be initiated by the Energy Technology Lead directly or by the workstreams. Change requests initiated by the workstreams will be reviewed by the Energy Technology Lead.
- Quarterly Project Board meetings will track and discuss progress and risks to project delivery.

The Project has produced an initial Risk Register and risk management process for the project that demonstrates how these roles interact. The Risk Register details the identified risks and mitigation strategies (see Appendix 10.4). This register will be a living document and will be reviewed and updated at least once a month for the duration of the Project.

6.2.1 Clarity on the contractual and commercial arrangements between Project partners

Through developing this submission, Project Partners have discussed contracts, intellectual property (IP) rights and commercial arrangements between the partners. This ensures that if the bid is successful, the Project will be able to start promptly, given that the foundation work on the legal and commercial fronts has been completed. Further details, including a contract map can be found in Appendix 10.7.

6.3 Accuracy of information

The Partners have endeavoured to ensure all of the information included within this full submission is accurate. Information included within the proposal has been gathered from Hitachi, UK Power Networks, SSEN, and the other Project Partners. This information has been reviewed to confirm and refine understanding, whilst evaluating the validity and integrity of the information.

6.4 Managing Change and Contingencies

As described in section 6.2, one of the effective mechanisms to manage change is the Change Control process. This formal process ensures changes are properly documented and the Project Board has agreement of any changes. It is one of the five project control processes described earlier in this section and is illustrated in Figure 16.

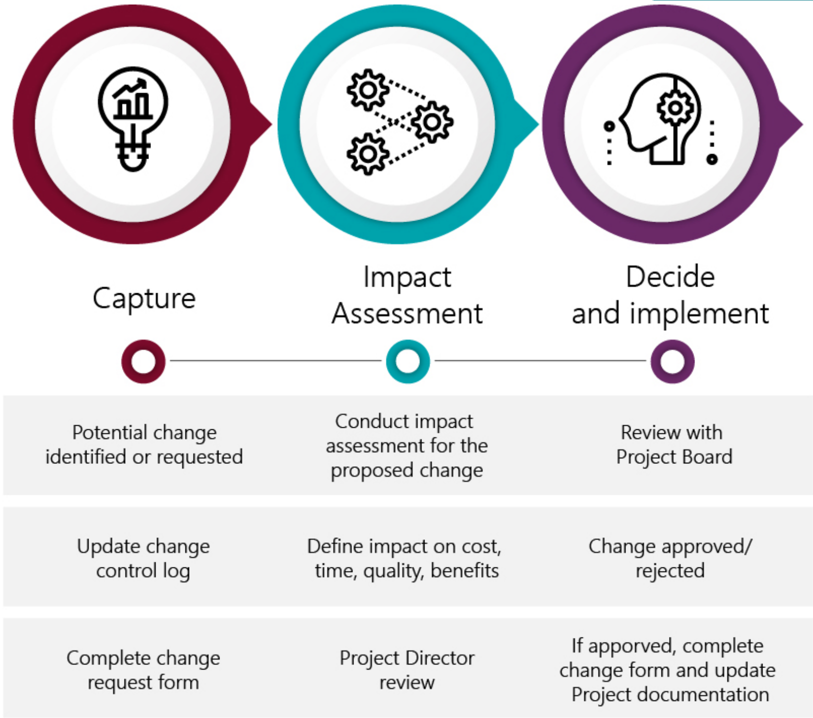

Figure 16 - Change Control Process

Based on the Risk Register, the Project bid includes an appropriate sum of money for contingency. The project will carefully track and manage the draw down against this over the period of the project only as required.

6.5 The project plan will still deliver learning in the event that the rollout of commercial EVs in the trials is lower than anticipated

The Project has been designed to help DNOs improve network forecasting and to minimise investment in infrastructure. It will develop understanding of the likely impact of commercial EVs on the network over the coming years. In so doing, the Project will accelerate the transition to a low carbon future.

The Project has set a target of between 2,000 and 3,000 EVs to be included. This range represents a significant sample size from which to extract the maximum value from the project. A Governance Gate has proposed to be held before the Project enters the Run phase in order to confirm that there will be an appropriate number of commercial EVs in the three trials.

6.6 The processes in place to identify circumstances where the most appropriate course of action will be to suspend the project, pending permission from Ofgem that it can be halted

As part of the proposed governance arrangements, there will be a number of processes (set out below) in place to identify, assess and manage any issues that may affect the project. These processes will help maintain the smooth running of the project, and aid identification of the most appropriate course of action at any point.

The Governance Gate approval process will review the project at critical stages throughout its lifecycle. The project will have to meet the mandatory entry/exit criteria for each gate (taking into account business case, risks, issues, benefits realisation and financial position), for which the Project Director will provide evidence. If the Project does not meet the mandatory entry/exit criteria, the Governance Board has the authority to suspend the Project, where it is the most appropriate course of action, pending permission from Ofgem that the project can be halted.

The Governance Board is also able to suspend the project outside the gate approval process if it is the most appropriate course of action. This could be triggered by an escalation from the Project Board for a risk or issue that has exceeded the agreed tolerance. Again this is then subject to permission from Ofgem that the Project can be halted.

Section 7: Regulatory issues

Optimise Prime is not expected to require a derogation, License consent, License exemption or a change to the current regulatory arrangements in order to implement the Project.

Section 8: Customer Impact

Optimise Prime will be delivered with minimal impact to wider electricity Customers and our Project Partners.

The Project will develop and deploy a number of technical and commercial solutions to deliver financial and environmental benefits to customers (connected and connecting). The Project will be carried out with minimal disruption to our Partners' normal day-to-day operations.

8.1 Impact on Project Partners

As part of the Project, our Partners will be installing EV charge points at specific locations (employees' domestic properties or company depots). There is a possibility that installation method statements will require planned outages during the installation of some of the equipment. This will be delivered via normal operational procedures and in such a way as to minimise any disruption to affected Partners.

The charge point installations will be planned to take place with agreement from our Partners and at times of day when the impact will be minimal. Where relevant all outages will be recorded in DNO IIS returns in accordance with regulatory requirements.

Particularly for the depot-based use case, we will look at a range of technical and commercial solutions that can be deployed at the depot in order to make the business case for early electrification of depot-based EVs positive. These solutions will be connected behind the meter, not directly to the distribution network. However, similarly to the connection of EV charge points, the installation and commissioning of these solutions will be planned at times when the impact to the depot will be minimal.

As part of the Project flexibility trials, the Project will request that our Partners reduce their electricity demand relating to EV charging. This may be by shifting it in time, reducing the rate of charging of their commercial EVs, or even exporting electricity from the EV batteries to the distribution network.

8.2 Impact on electricity customers

For home-based vehicles where a fuel card model is currently used, the problem of accurate billing and settlement that the operators face may involve the provision of a secondary supply for commercial EV charge points. As described above any work will follow normal operational procedures and in such a way as to minimise any disruption to affected customers. We are still researching the best solution for this problem so it may not be necessary to provide a secondary supply and these interruptions will be avoided.

The work will be carried out with agreement from our customers and at times of day when the impact will be minimal. Where relevant all outages will be recorded in DNO IIS returns in accordance with regulatory requirements.

Customers will remain fully in control of their supply arrangements and will not be forced to change supplier as part of engaging in the Project. As a result, and only if and where we need to, we will engage with multiple suppliers providing services to the sites and employees taking part in the Optimise Prime trials.

Section 9: Project Deliverables

The Project's deliverables have been designed to demonstrate clear progress towards the Project objectives and disseminate data, practical methods, tools and valuable learning. Based on this approach, we propose the following deliverables and related evidence.

All reports, once issued to Ofgem, will be published on the UK Power Networks Innovation website, the Smarter Networks portal, and will also be sent directly to key stakeholders.

Prior to the issue of each deliverable, the Project will conduct a detailed review. In addition, prior to the close of the Project and in accordance with the Network Innovation Competition Governance Documents, we will obtain "Independent Verification" that the Project deliverables have been achieved.

Table 10 – Project Deliverables

Ref	Project Deliverable	Deadline	Evidence	% NIC funding requested
D1	High level design and specification of the three trials	30 August 2019	Report outlining the requirements, use cases, scenarios, technologies and locations for WS 1 (Home Charging), WS 2 (Depot Charging) and WS 3 (Mixed Charging)	15
D2	Solution build report – lessons learned	28 February 2020	Report setting out the lessons learned from the infrastructure and technology build for the trials. The report will also include a description of the methodology to be used for trials	29
D3	Learning from installation, commissioning and testing	28 August 2020	Report setting out the key learning points from the installation, commissioning and testing processes/activities	18
D4	Early learning report on the trials	19 February 2021	Report setting out how each trial is performing, data gathered, insights gained, changes required	16
D5	Interim report on business models	14 May 2021	Interim report outlining: • The preliminary economic and behavioural findings and high level options for commercial solutions/business models • Early learning on profiled connections and approaches for separation of commercial EV loads at residential level shared to support Ofgem's network access and charging reform work.	7

D6	Data sets	19 November 2021	Final datasets gathered from the trials for dissemination to stakeholders.	7
D7	Final learning report	11 February 2022	A report covering: • A summary of the work undertaken • The insights gained from the trials (incl. insights that could feed into Ofgem's network access and charging reform work) • Recommendations on approaches for separating commercial EV load at residential level and likely costs and benefits • Models for use of commercial EV flexibility by DNOs • Insights from the Method 1 aggregation trials incl. flexibility contracts to the DNOs • Recommendations on business models for fleet operators • How the trials, the infrastructure and technology should be transitioned after the Project has completed and • How to ensure integration of the Methods with DNO/DSO systems and processes • The methodologies and reference design for the site planning tool developed in Method 2 • Insights on applicability of Methods to EV stakeholders (incl. other GB DNOs, fleet operators, policy makers)	7
N/A	Comply with knowledge transfer requirements of the Governance Document	N/A	1. Annual Project Progress Reports which comply with the requirements of the Governance Document 2. Completed Close Down Report which complies with the requirements of the Governance Document 3. Evidence of attendance and participation in the Annual Conference, as described in the Governance Document	N/A

Figure 15 in Section 6 shows the high level timeline for the Project and relates the key deliverables to the workstreams. The detailed schedule is provided in Appendix 10.4.

Section 10: List of Appendices

Appendix 10.1 – Benefits Tables: Forecast of benefits of benefits resulting from the Project's Methods

Appendix 10.2 – Technical Description of the Project : Further details of problems and technical solutions described in Section 2: Project Description

Appendix 10.3 – Business Case Modelling : Description of the business model methodology used in Section 3: Project business case

Appendix 10.4 – Project Plan : Detailed project plan

Appendix 10.5 – Risk Register and Contingency Plan : Table of risks and mitigations

Appendix 10.6 – Project Team and Organogram : Role descriptions of key project team members

Appendix 10.7 – Partners : Further details of the Project Partners and their contributions to the Project

Appendix 10.8 – Letters of Support : Letters from the Project Supporters

Appendix 10.1 – Benefits Tables

KEY

Table 11 – Project Methods

Method	Method name
Use Case 1	Home charging
Use Case 2	Depot charging

Electricity NIC – financial benefits

Table 12 – Electricity NIC – Financial benefits

Scale	Method	Method Cost	Base Case Cost	Forecasted Benefits (£)			Notes and cross-references
				2030	2040	2050	
Post-trial solution *(individual deployment)*	Home Charging	£264	£283	£616	£14	£4	The business case is built at the Licensee scale and the benefits are averaged down to a single vehicle. The individual deployment is an EV providing flexibility service / with a profiled connection in 2030, 2040 and 2050. This is not cumulative as the deferred reinforcement from one EV can only be counted once. The individual deployment is not representative as costs are sensitive to locational variability as well as the proportion of profiled connections, which vary over time. Such variability is accounted for at the licensee scale by considering a series of scenarios as explained in Section 10.3.1.
	Depot Charging	£31	£44	£1,771	£47	£2	
Licensee scale ***If applicable, indicate the number of relevant sites on the Licensees' network.***	Home Charging	£264	£283	£25,842,831	£85,076,724	£86,834,332	The depot charging benefits arise from reduced connection costs are conservative as the sample depots from partner would only trigger reinforcement of secondary substations because of the relatively small depot size. Other larger fleets have potential to trigger Primary substation and other reinforcement further up the network.
	Depot Charging	£31	£44	£32,911,251	£50,210,832	£50,982,428	
	Total benefits from both methods			£58,754,082	£135,287,556	£137,816,760	
GB rollout scale ***If applicable, indicate the number of relevant sites on the GB network.***	Home Charging	£264	£283	£91,017,372	£299,636,669	£305,826,893	The scale-up across all fleets is based on current number of light commercial vehicles on the road today. It does not take into account the annual increase in numbers of vehicles. There is an average of 1.2% increase in light commercial vehicles over the last 10 years according to the Department for Transport[43].The GB scale benefits are scaled up based on the peak demand on the Licensee's three networks as a proportion of the peak demand on all 14 licensees in GB. This is conservative as UK Power Networks serve over a quarter of the GB demand but only operate three of the 14 licensee areas.
	Depot Charging	£31	£44	£115,912,051	£176,840,454	£179,557,981	
	Total benefits from both methods			£206,929,423	£476,477,123	£485,384,874	

[43] https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

Electricity NIC – capacity released

Table 13 – Electricity NIC – Capacity released

Scale	Method	Forecasted Benefits (MVA)			Notes and cross-references
		2030	2040	2050	
Post-trial solution *(individual deployment)*	Home Charging	<0.001	<0.001	<0.001	The business case is built at the Licensee scale and the benefits are averaged down to a single vehicle in stock. The capacity released per EV is less than 1 kVA. In any case, the individual deployment is not representative as the benefits are sensitive to locational variability as well as the proportion of flexibility, which vary over time. Such variability is accounted for at the licensee scale by considering a series of scenarios as explained in Section 10.3.1.
	Depot Charging	<0.001	<0.001	<0.001	
Licensee scale *If applicable, indicate the number of relevant sites on the Licensees' network.*	Home Charging	248	783	801	For both Methods, only the partners' fleets are considered when mapping to secondary substations. The assumption is that it is unlikely to have other depots connected to the same secondary site but this is a conservative estimate for the home charging Method as there could be other home charging fleets in the same area.
	Depot Charging	299	126	104	
	Total benefits from both methods	547	909	905	
GB rollout scale *If applicable, indicate the number of relevant sites on the GB network.*	Home Charging	875	2,758	2,822	The scale-up across all fleets is based on current number of light commercial vehicles on the road today. It does not take into account the annual increase in numbers of vehicles. There is an average of 1.2% increase in light commercial vehicles over the last 10 years according to the Department for Transport[44]. The GB scale benefits are scaled up based on the peak demand on the Licensee's three networks as a proportion of the peak demand on all 14 licensees in GB. This is conservative as UK Power Networks serve over a quarter of the GB demand but only operate 3 of the 14 licensee areas.
	Depot Charging	1,053	422	367	
	Total benefits from both methods	1,928	3,200	3,188	

Electricity NIC – carbon and/or environmental benefits

[44] https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

Table 14 – Electricity NIC – Carbon and/or environmental benefits

Scale	Method	Forecasted Benefits (t CO_2 Eq.)			
		2030	**2040**	**2050**	Notes and cross-references
Post-trial solution *(individual deployment)*	Home Charging	11.66	11.66	11.66	Carbon benefit for individual deployment is calculated based on the carbon emissions saved from replacing one internal combustion engine vehicle with an electric vehicle in 2022. The benefits stop at the end of the vehicle life-time, thus the same carbon figures 2030/40/50.
	Depot Charging	14.27	16.07	16.07	
Licensee scale *If applicable, indicate the number of relevant sites on the Licensees' network.*	Home Charging	275,798	330,026	330,026	The carbon benefits for depot charging vehicle is conservative because of low mileage assumptions as explained in Table 17. They accrue more in the following years due to longer vehicle life-time.
	Depot Charging	254,566	446,539	446,539	
	Total benefits from both methods	530,364	796,564	796,564	
GB rollout scale *If applicable, indicate the number of relevant sites on the GB network.*	Home Charging	1,214,846	1,453,708	1,453,708	The scale-up across all fleets is based on current number of light commercial vehicles on the road today in GB. It does not take into account the annual increase in numbers of vehicles. There is an average of 1.2% increase in light commercial vehicles over the last 10 years according to the Department for Transport[45]. The model only accounts for tailpipe emissions from internal combustion engine vehicles but both tailpipe emissions (i.e. zero) and "fuel" production emissions for EVs. This gives a conservative assessment of carbon savings as the production of diesel and diesel vehicles combined have a heavier carbon footprint than just the production of EVs[46].
	Depot Charging	1,512,593	2,772,103	2,772,103	
	Total benefits from both methods	2,727,439	4,225,811	4,225,811	
Tonnes of NOx savings at GB rollout scale	Home Charging	29,664	33,241	33,241	For every 100,000 vans that transfer from diesel to electric, we estimate that there could be annual emission savings of 1,490 tonnes of NOx emissions as explained in Section 4.2.2.
	Depot Charging	36,934	63,388	63,388	

[45] https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01
[46] http://www.nextgreencar.com/tools/emissions-calculator/

Appendix 10.2 – Technical Description of the Project

This appendix provides further detail to that in Section 2, detailing the problems that will be addressed by Optimise Prime and the technical solutions that will be designed, implemented and trialled as part of the project.

10.2.1 Method 1 – Smart demand response for commercial EVs on domestic connections

Working with the British Gas fleet, we will deploy smart charging and monitoring technologies into homes where commercial EVs are charged. This will provide data on how EVs charge (time, duration, power demand) and the flexibility associated with commercial EV charging on a domestic connection.

10.2.1.1 Forecasting

This data will be used to build forecasting models to predict what load this use case puts on the network. We expect that EVs will have variable charge requirements depending on shift patterns, the time of year, time of the week and location (urban, sub-urban, rural). This work will seek to understand how reliably load can be forecasted. This will inform network planning activities, both in the short-term via DSR activities and network reconfiguration, and in the long-term through network reinforcement. To support this work, we will fit EVs with telematics systems to capture location and state of charge, to allow for a detailed understanding of how and where EVs consume charge. This is required because EVs can charge at home and also at public charge points.

10.2.1.2 Demand Side Response (DSR) flexibility

In this use case, flexibility arises since the EVs are typically plugged in and charging between 6pm and 6am. Since the schedules of the EVs are known ahead of time, this allows for the smart charging system to optimise the charging schedules in response to external price signals as part of a DSR programme.

In most cases, the higher mileage driven by commercial EVs results in longer charge times. Therefore, the flexibility resulting from smart charging is potentially reduced as compared to the domestic case. Secondly, different usage patterns also reduce the available flexibility that can be unlocked through DSR. For example; each night, a proportion of British Gas engineers are on emergency call out and require their EV to be fully charged at all times. This further reduces the flexibility available to the DNO. However, there is potentially more predictability as EVs follow shift patterns that are typically known ahead of time, and many drivers will not be required to be on-call.

This Project will explore and quantify how much flexibility commercial EVs are able to provide to maximise the efficient utilisation of network capacity. This part of the Project will be delivered via REstore.

REstore, part of Centrica Business Solutions is one of the leading energy technology companies specialising in Demand Side Management. The company offers Demand Response services to Industrial, Commercial and Residential consumers and offers cloud-based Demand Side Management solution platform FlexPond™ to Utilities.

REstore is a leading provider in the fast-growing European Primary Reserve/Frequency Control markets and operates in all ancillary services and capacity markets in Europe. The company’s proprietary solution FlexPond™ is used by more than 200 of Europe’s largest industrial energy consumers, and a range of utility clients that include five of Europe’s top-50 utilities and grid operators. This means that the consortia can leverage additional value from working with Centrica by utilising this expertise to further add learning to the programme.

REstore will act as the interface between the smart charging module of the Hitachi Solution and the DNO/Market by aggregating the individual EV loads into one response and then sending dispatch signals to the devices via the Hitachi solution. For the purposes of this trial we will primarily be testing load shifting, ie moving charging to less constrained times and not the discharge of the batteries.

Method 1 will therefore provide the networks with a detailed understanding of the load that this use case represents on the network and the associated potential for DSR activities. The latter will inform DNO network planning decision making processes by introducing a potentially more cost-efficient alternative to traditional load-related network reinforcement. Method 1 will therefore have a Direct Impact on the distribution network as defined in the NIC Governance document[47].

10.2.2 Method 2 – Depot energy optimisation and planning tools for profiled connections

The optimal design of the energy infrastructure required to support the electrification of a depot requires specialist knowledge that the fleet or PHV operator is unlikely to have.

Typical questions that must be considered by fleet or PHV operators are as follows:

- What is the required energy demand of the EVs and how does this change over time?
- What rate of charging is required – slow, fast, rapid?
- How many chargers are required?
- What is the business case for energy storage installed on-site?
- What is the business case for other energy generation installed on site?
- Can technologies such as vehicle-to-building (V2B) and building energy management systems (BEMS) reduce costs?
- What additional value can be created from demand response activities?
- What back-up generation/supply should be provided?
- What is the optimal load profile that should be requested from the DNO?

Method 2 will develop a number of tools and processes that allow the calculation and deployment/implementation of an optimal connection profile at fleet depots (in the future and after the Method is proven, this could be expanded to include other types of connecting customers).

The site planning tool is the tool which, based on a number of inputs from the fleet operator (such as number of electric vehicles, operational schedules, on site demand, availability on site energy assets), will advise on an optimal demand profile for the specific site. This profile can then be used by the fleet operator to request a 'profiled' connection from their local DNO. This gives confidence to the customer that what they are requesting as a connection from the DNO meets their actual needs and is not a connection imposed by the DNO based on network constraints at the local substation.

The DNO will then assess the request for a 'profiled' connection using their profiled connection assessment tool, which in our case is an enhanced version of our currently used network power flow analysis tools. When the assessment is complete, the DNO sends a costed proposal back to the customer.

The depot optimisation system (software), through a smart depot controller (hardware), controls and optimises on site assets (i.e. assets at the depot), including the EV charge points, making sure that all load demand needs are met whilst keeping within the limits of the agreed 'profiled' connection with the DNO. This gives confidence and assurance to

[47] https://www.ofgem.gov.uk/system/files/docs/2017/07/electricity_network_innovation_competition_governance_document_version_3.0.pdf

the DNO that the customers with 'profiled' connections stay within their connection limits. This will become particularly important when such connection offerings are scaled up and become common. In these cases, failure from DNOs to ensure compliance of customers on 'profiled' connections, may compromise the resilience and reliability of the network. The depot optimisation system will also coordinate the participation of EV charge points in any demand response activities.

Method 2 comprises the three tools, each of which is essential. The Method enables depot operators to specify the optimal infrastructure design, resulting in a profiled connection request to the DNO. The Method enables the DNO to maximally allocate network capacity, avoiding unnecessary reinforcement and delays to connection requests. The Method enables compliance with the profile, altering demand in a measurable, controllable way.

Method 2 has a Direct Impact to the network in compliance with the NIC governance requirements as it is reduces and/or shifts the electrical demand of commercial Customers.

Both the site planning tool and depot optimisation system, if successfully developed and proven within Optimise Prime, will be made commercially available post-project.

10.2.2.1 Flexibility in depots

As in the home charging case, flexibility arises since the EVs are typically plugged in and charging overnight. Predefined schedules allow for smart charging to optimise the charging schedules in response to external price signals.

On-site generation and storage, combined with other sources of demand response (e.g. HVAC controllers) potentially can provide more flexibility for the DNO. Additionally, depots may already be subject to half hourly time of use tariffs which may have an impact on consumption profiles.

Therefore, the value and type of flexibility available to the DNO is different to the home charging case and requires specific investigation.

10.2.2.2 Depot optimisation with profiled connections

The depot Method will enable the specification and design of optimal energy infrastructure for a depot using a site planning tool. After this is implemented, a depot optimisation system, together with a smart controller, will control and optimise the EV charging infrastructure of the depot. The goal of this system is to minimise the charging costs while conforming to the various constraints, including vehicle schedules and charge demand, the connection profile arrangement and any other on-site energy infrastructure.

As in the Home, this method will explore and quantify how much flexibility depots are able to provide to maximise the efficient utilisation of network capacity. We will quantify the potential of this flexibility in the same way as the Home Method, i.e. magnitude, duration, responsiveness, value and predictability.

10.2.2.3 Site Planning Tool

The site planning tool will provide a simple interface for depot operators to input their vehicle schedules, mileage, site energy profiles and other constraints related to the depot such as available space, location and existing energy tariffs.

The tool will then a calculate an optimal configuration of charging and energy assets, designed to minimise charging costs for the site, for a given capex/opex ratio and investment timescale.

The tool will output a range of information including:

- Estimated charging costs for the EVs
- EV charging schedules
- Infrastructure requirements
- The load profiles of the site to allow for a profiled connection request to the DNO.

The tool will be web-based and will interface with the profiled connection planning tool (see Appendix 10.2.4), allowing the DNO to quickly service profiled connection requests saving time and money for the customer. The site planning tool will be part-funded from UK Power Networks' (50%) and Hitachi Europe's (10%) own contributions to the project and NIC will only fund a part of its development (remainder 40%).

We recognise the need for fleet operators to have access to such a tool as the Site Planning tool to enable the success of profiled connections at scale. To help stimulate competition in the market and prepare for the mass adoption of commercial EVs, the Site Planning Tool methodologies and reference design will be made freely available to other parties in GB to replicate.

10.2.3 Hitachi Scope

To reduce cost, the Hitachi platform will reuse existing pre-engineered Hitachi technologies. The system will be built around Hitachi Pentaho, a leading big-data and analytics platform that provides the core functionality as required by this project. Key features of Hitachi Pentaho include:

- **Broadening use-case-agnostic integration solution:** Pentaho Data Integration (PDI) provides data integration across a broad spectrum of relational Database Management Systems (DBMSs), Java Database Connectivity (JDBC)/Open Database Connectivity (ODBC) access, and cloud-based data management solutions. During the past three and more years, Pentaho has positioned its data integration tool as an agnostic solution that is increasingly capable of delivering against independent targets and enterprise-class demands. PDI includes a large number of prebuilt data access and preparation components, a rich GUI for data engineers, orchestration of integration components and an integrated scheduler that can interoperate with enterprise system schedulers.
- **Experience in cloud, on-premises and hybrid:** Pentaho's customer reference base includes examples of all three deployment models of data integration, including very large customers across back-office, IoT and machine/sensor data solutions, as well as traditional data integration demands. Loads to Amazon Redshift and integration with Amazon Elastic MapReduce (EMR), and Cloudera, as well as embedded R, Python and Spark Machine Learning library (MLlib) models in the integration stream, capitalise on deployment needs.
- **Market-awareness of open source and roles:** PDI already works well within Apache Spark and other distributed processing environments and is addressing issues such as load balancing with task isolation to enhance distributed processing operations. Pentaho leverages open-source solutions (such as Kafka) to mix real-time integration with batch/bulk capability. Pentaho's existing capability in BI has been added to the PDI capability that allows users to visualise data integration results in-line and identify data quality problems before moving to production deployments.

10.2.3.1 System Components

The architecture of the solution is shown below in Figure 17.

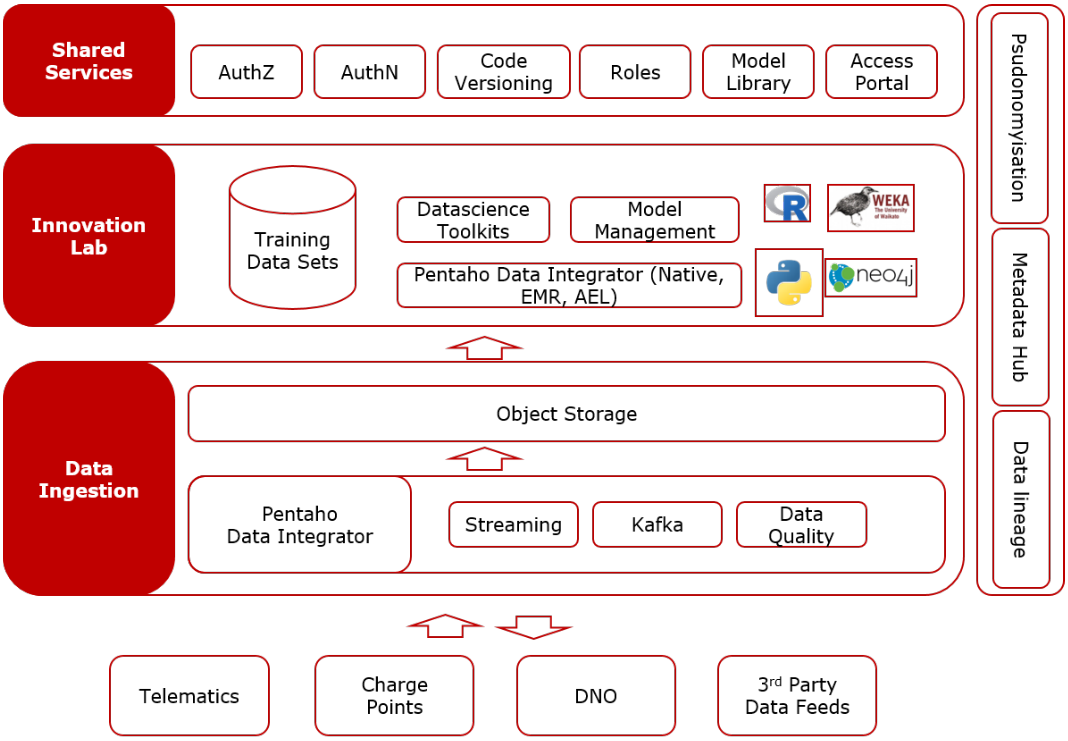

Figure 17 - Hitachi System Solution Architecture

The core system components in this architecture are as follows:

Data Ingestion Layer:

The Data Ingestion layer will be responsible for loading and storing all data needed to support analytical capabilities. Data will be loaded into a scalable object store for use in the innovation lab environment. The Pentaho platform will provide simplified tools to ensure the integrity and quality of the data, reducing maintenance overheads and costs associated with data cleansing.

The data ingestion layer allows for simple seamless connectivity to other systems. For example, subject to the appropriate security policies, the data stored in the system will be accessible to the DNO's existing analytics platform allowing for integration with the DNO's existing workflows.

Data Innovation Lab:

The Innovation Lab provides an experimental environment for data discovery and advanced analytics to be performed. The lab will be configured to enable a specialist team of data scientists to process and gain new insights from the data.

The lab provides a common set of machine learning and analytics algorithms for the data scientists to use. By utilising a common library of algorithms, the teams can generate insights quickly, minimising coding errors, and having access to the latest techniques and approaches. The system will additionally allow for the creation of new algorithms as required, and these can be integrated seamlessly into existing workflows.

DevOps Platform:

- **React to Data In Real Time**
  Run containers alongside data ingestion, databases and real-time analytics on the complete platform for modern applications.

- **Internet of Things**
  Harness the power of connected devices and sensors to create ground-breaking new products, disrupt existing business models, or optimise the supply chain.

- **Anomaly Detection**
  Detect in real-time problems

- **Predictive Analytics**
  Manage risk and capture new business opportunities with real-time analytics and probabilistic forecasting of customers, products and partners.

- **In-The-Moment Personalization**
  Deliver a unique experience in real-time that is relevant and engaging based on a deep understanding of the customer and current context.

Shared Services and Security:

The Hitachi platform has been deployed in numerous highly secure IT environments and offers sophisticated access controls. However, the integration of multiple IT systems can create additional complexities when considering security and data protection. The project consortium members and any subcontractors will therefore adhere to the following principles to ensure the integrity of the project:

- Each consortium member is responsible for the information security and integrity of their own systems. There is an expectation that these will be of the highest industry standard.
- The consortium members retain the right to audit each other's relevant systems, standards and processes as part of the consortium agreement.
- Where data passed from one consortium member to another has a control, security or data protection implication, the originating consortium member has the responsibility to ensure that the data is accurate and meets all legal requirements around the rights of data subjects including obtaining consent for third party processing.
- The DNO has final control over the network and can override any demand response request if it would trigger a network stability or integrity event.

The platform will provide a set of common security services including, but not limited to identity, authentication and authorisation. These will require agreement between consortium members with respect to roles and permissions. It will re-use Hitachi's standard architecture and technology services. All data collected will be fully compliant with GDPR legislation.

Use of Hitachi developed tools after Project completion:

The tools and data sets developed as part of the Project will be designed in such a way that, once the project is complete, they can be replicated and/or used on public cloud platforms or third party container systems without the continued need for the Hitachi platform.

10.2.4 UK Power Networks System Development

To minimise the cost of Optimise Prime as far as possible existing systems are being re-used. The principal IT platform proposed to be used for the project is UK Power Networks' Active Network Management platform. This is being procured during 2018 and commissioned in 2019 as part of a business as usual roll out of this functionality. This platform would have all the required internal interfaces with other UK Power Networks systems, such as their PowerON network management system, to be able to run the trials proposed in this project.

From assessing the requirements for this platform it is anticipated that minor modifications may be required to be able to deliver the functionality at the network levels involved in Optimise Prime. An estimated amount for this is included in the project budget. Due to the ongoing competitive procurement process it is not possible to include further details at this time as the supplier is not yet known.

There is a risk that this platform may not be operational in time for the project trials (due to start in mid-2020, sometime after the ANM platform is due to be operational) in which case the contingency is to modify the Distributed Energy Resource Management System (DERMS) developed as part of the Power Potential[48] project.

This platform facilitates engagement with and control of Distributed Energy Resources (DERs) to provide services to National Grid System Operator (NGSO). It is designed to operate on the SPN EHV network in the Kent area, as opposed to the Low and High voltage networks in the London area, so would need some changes to be able to be used for this project. In either case, should the budget allocation for this work not be used it will be returned to customers as per normal practice in NIC projects.

For some time UK Power Networks has been using a cloud based Geospatial Analytics (GSA) tool based largely on open source components. This integrates a variety of information sources within the company and presents the information geospatially for different purposes or use cases. In order for UK Power Networks to maintain and use the full dataset from this project it is intended to use GSA, which will require some modification for this purpose. As it is a cloud based application the data storage volume and processing power are low cost. As the platform components are open source it is low cost to add new data interfaces as required for new use cases. As such it is ideal for this project application.

UK Power Networks have two main network modelling tools: Digsilent Powerfactory and Ambertree D-Plan. In order to support the design of profiled connections it is required to make some minor modifications to these platforms to support these outputs. This will support new staff work flows to be able to design and assess profiled connections. The cost in the project budget for this work has been estimated by UK Power Networks internal experts. The detail of this will be determined during the initial design phases of the project.

10.2.5 Network Impacts and cost apportionment

For the Home Charging Method we are considering commercial vans that connect to and charge at domestic premises connected on the LV network typically with 60A-100A single phase service cut-outs.

At these sites where additional demand triggers reinforcement this is required to be borne by the DNO (i.e. socialised to all customers). An example of the apportionment to the DNO (i.e. socialised) in each case is shown by the "x% DNO" in Figure 18.

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[48] Power Potential https://tinyurl.com/y7atngke

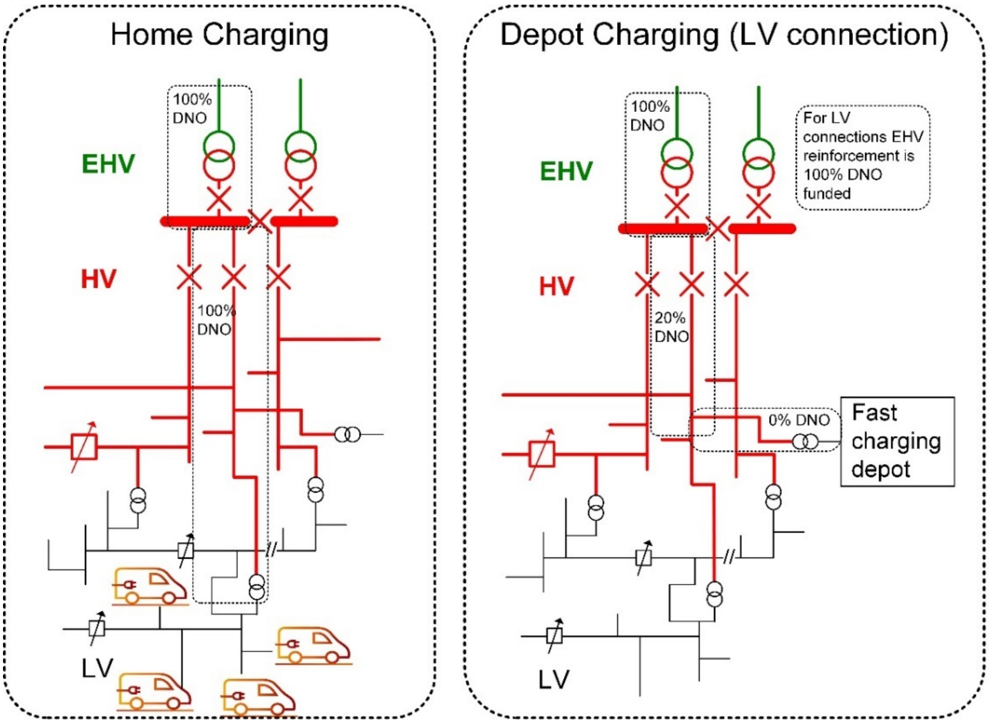


Figure 18 - Single Line Diagrams for the Home Charging Use Case (left) and the Depot Charging Use Case (right)

The allocation of additional demand from commercial EVs to substation sites for the business case development work is described in Section 3.3 and Appendix 10.3.

For the depot charging method most of the depots we have assessed to develop the cost estimate connect at LV. In this case any dedicated assets required to support the connection are paid for by the connecting depot. For assets that are "shared use" the costs are apportioned between the depot and the DNO (i.e. socialised to other customers) according to the portion of the capacity used (see '% DNO' in Figure 18). As per DNO Standard Licence Condition 14.20 any required reinforcement greater than one voltage level above the point of connection is paid for by the DNO. This is explained at greater length in UK Power Networks "Statement of methodology and charges for connection to the electricity distribution systems of Eastern Power Networks plc, London Power Networks plc & South Eastern Power Networks plc"[49].

While investigating and scoping this project UK Power Networks have identified an opportunity to "game" the rules. Consider the example in Figure 19. This is typical of a rapid charging depot such as a large Royal Mail depot or a public rapid charging hub. We would anticipate this to have a capacity of around 1MW to 2MW, or more, and be HV connected. If the customer on this occasion had a long term plan for greater capacity but by having greater visibility of information was aware that they could meet a short term need by requesting 2MW and by doing so just trigger the expensive EHV reinforcement.

The cost of this upgrade would be apportioned, and as the additional capacity at this level is likely to be significant (20MW or more) the majority of this cost would be paid for by the DNO (i.e. socialised to other customers). Once this work is complete there is then nothing to stop the same customer requesting the rest of the capacity at no additional cost.

49 https://tinyurl.com/ydbusfjv

This is a clear risk associated with profiled connections, where other customers are left with the cost that should appropriately be borne by the connecting business. This is clearly not desirable and is something that is going to be investigated further as part of the project, with input from UK Power Networks and SSEN connections and DSO teams. Learning from this will also be shared with Ofgem to help inform their ongoing work on network access and charging reform.

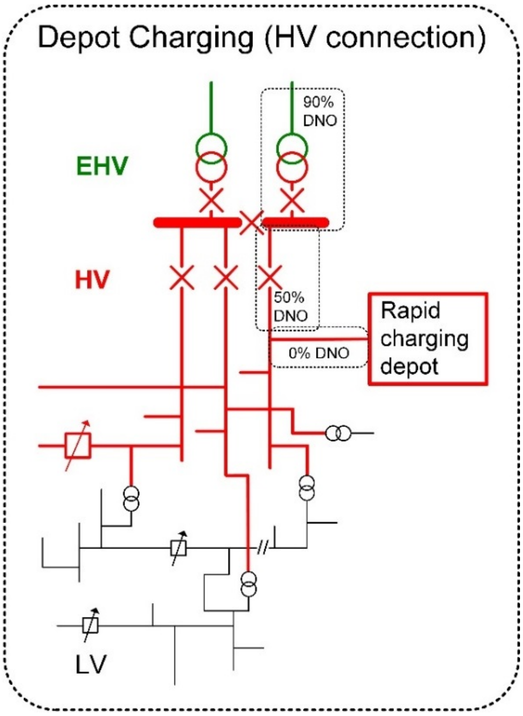


Figure 19 - Single Line Diagram for a HV connected rapid charging depot

Optimise Prime will also provide learning that can feed into Ofgem's network access and charging reform in the following areas (list is not exhaustive):

- Opportunities for customers to 'game' the rules around flexibility, for example cases where customers cause network constraints to then be rewarded for resolving them.
- Size of potential hidden commercial EV load at residential level and possible associated cost of reinforcement.
- Approaches/methods to un-hiding commercial EV load at residential level and their applicability to different sized fleets.
- Tipping point for depot based EV fleets when it becomes more economic for them to change their charging approach from depot to home charging (i.e. rather than paying for a network upgrade to accommodate EV charging at their depot, encourage employees' to take the vehicles at home and charge them there).

10.2.6 Partner vehicle densities

The following graphic, based on the Royal Mail fleet, is a heatmap demonstrating the density of their vehicles that can be electrified as a result of this Project over the four licence areas. As expected, there is a high density of vehicles that operate in the London area. However, this heatmap demonstrates the diversity of locations in which the Partners' vehicles operate. This will allow the trials to test charging behaviour in a wide range of urban, sub-urban and rural settings.

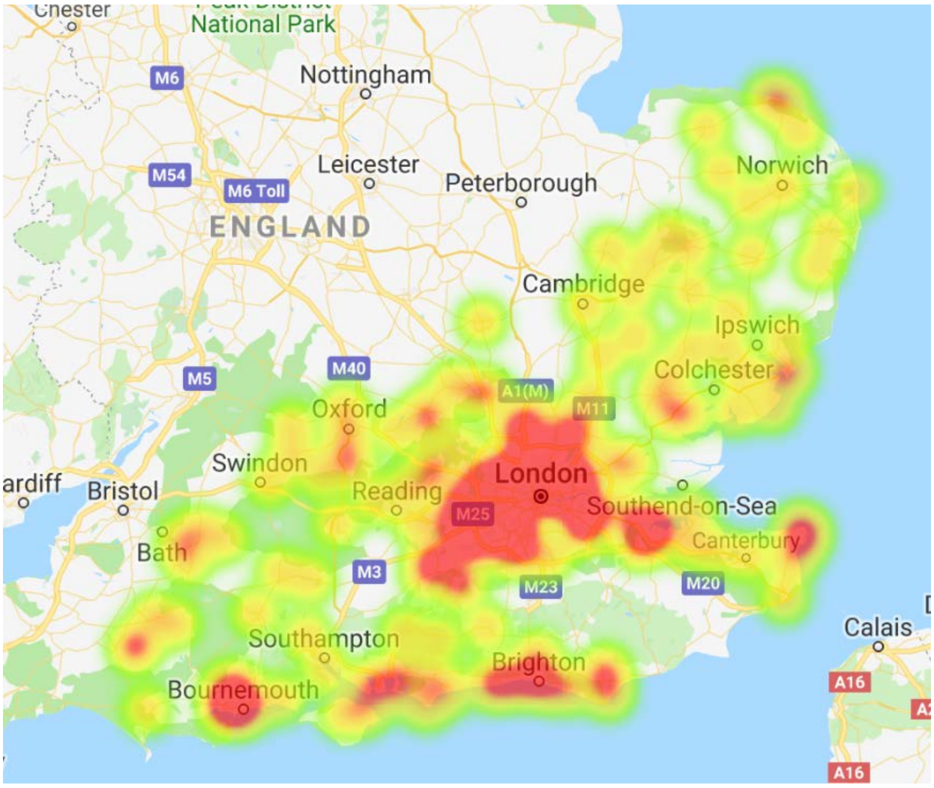


Figure 20 - Heatmap showing the Royal Mail vehicle densities suitable for electrification in the license area

Appendix 10.3 – Business Case Modelling

Optimise Prime will save GB DNOs and electricity customers £207m by releasing over 1,900 MVA of capacity on the distribution network by 2030. It will provide better forecasting, resulting in more accurate investment plans. It will help GB achieve its carbon emission and air quality targets by delivering over 2.7m tCO_2 eq. of carbon savings by 2030. ROI will be reached by 2025/26.

10.3.1 Business Case Methodology

The business case was built by comparing the electrification roadmap of fleets and their adoption of flexibility in the Base case scenario and the accelerated uptake through the Methods. All Methods being trialled will bring financial, capacity and carbon benefits.

A reasonable unit for individual deployment of the Methods would be a single vehicle. However, the business case does not assess benefits per vehicle as a single vehicle cannot impact or deliver enough flexibility to the networks. Load impact is assessed based on the extent of electrification and flexibility from 2022 to 2050. The vehicle and depot addresses provided by the partners were mapped to the network and used as a basis to scale across all fleets based on the number of light commercial vans on the road in GB[50]. The same exercise was performed for the Base case and Method to develop two scenarios for each use case.

Figure 21 and Figure 22 describe the Problems being addressed by the two Methods and show the various elements that drive the benefits post-trial.

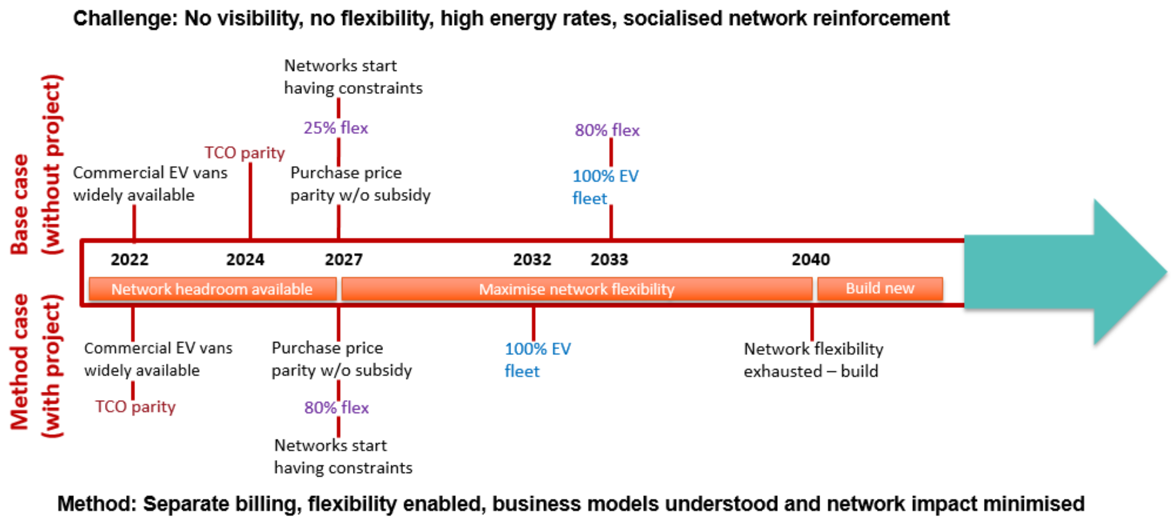


Figure 21 – Timeline for Use Case 1 - home charging commercial fleets.

[50] https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01

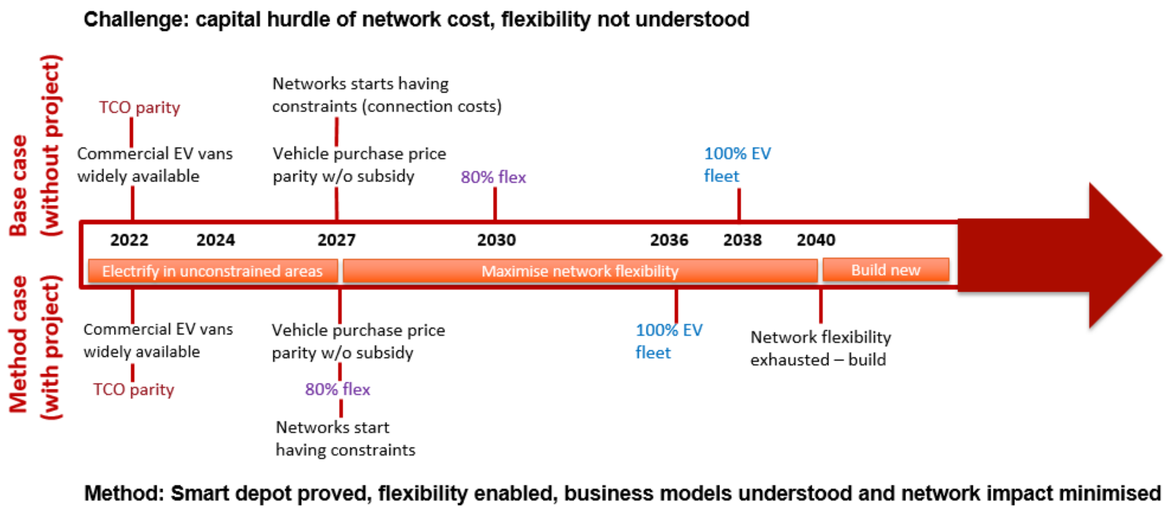


Figure 22 – Timeline for Use Case 2 - depot charging commercial fleets.

10.3.1.1 Load growth and network impact

UK Power Networks latest load growth model forecasts load growth on secondary and primary substations within its licensee area. The model takes EV inputs from the Network Innovation Allowance (NIA) project “Recharge the Future”. Commercial fleets were not included in the model as data was not available. The additional load from commercial fleets were assessed based on the uptake and assumptions described above.

10.3.1.2 Site selection for modelling

In order to assess the load impact of fleet EVs on the network, a sample of individual EV charging locations and depot locations were taken from the partners and mapped to the networks. It is important to note that the accuracy of the network impact, and therefore the benefits from deferred reinforcement, relies not only on the load growth or the existing site capacity but the combination of the two. In other words, substation currently near its capacity limit but experiences limited load growth will see limited benefits whereas an unconstrained substation with forecasted load growth will be more heavily benefited.

The sample sites selected for the modelling take into account various cases that reflect the aforementioned points in order to capture the full picture. They can be characterised into three major categories and their indications on the business case are listed in Table 15.

Table 15 - Sample site characteristics and their indications on the business model.

Site characteristic in the Base case	Business case indications	
	Domestic charging Method	**Depot charging Method**
No upgrade required from 2022 to 2050	The Methods will have little impact on these sites as there is enough existing capacity for all future growth or there is no growth and/or new depot connections.	

Three or more upgrades required from 2022 to 2050	The Method will have some impact on these sites as reinforcement could be deferred but not beyond 2050 as the fleet load is a small percentage of the overall load.	The Method will have major impact on these sites as new connections are likely to trigger reinforcement. Flexibility provided by these depots can also help manage peak load in the future.
One or two upgrades required from 2022 to 2050	The Method will have major impact on these sites as the fleet load represent a large percentage of the overall load and peak reduction could completely avoid reinforcement in some cases.	

There are extreme and moderate cases in the mix and the sample sites can therefore be deemed representative based on available information. The benefits derived from the assessment on the selected sample sites are extrapolated to all of UK Power Networks' sites.

For both Methods, only the partners' fleets are considered when mapping to secondary substations. The assumption is that it is unlikely to have other depots connected to the same secondary site but this is a conservative estimate for the home charging Method as there could be other home charging fleets in the same area. The connected primary substations are also considered as the fleet EV loads will eventually aggregate up to primary sites as the volume grows. In this case, the partners' fleet volume is scaled up across all fleets in GB based on the commercial vehicles on the road today.

10.3.1.3 Reinforcement trigger point

For primary substations, network reinforcement is triggered when the demand exceeds the firm capacity of a primary substation. For distribution sites, network reinforcement is triggered when the demand is at 100% of the total transformer ratings at a distribution substation. This is especially true for Method 2 because reinforcement will be triggered by new connections. For Method 1 where reinforcement will be effectively triggered by load growth the distribution site might tolerate more load beyond 100% capacity, especially with some form of Real Time Thermal Rating. However, reinforcement would be triggered before 100% capacity reached if the substation was interconnected at LV and this was required to maintain compliance with planning standards so the assumption is still deemed valid on average.

It is important to note that a series of smart network and demand response solutions have been considered in the base case before reinforcement is triggered. For example, to connect a new depot at a constrained site, timed connection, as opposed to traditional 24/7 firm connections, is offered in the base case. We have made an adjustment on the final calculations to take into account additional capacity that would be available following the roll-out of Active Response methods assuming that project is successful. Table 18 and Table 19 detail all load related assumptions used to construct the base and Method case.

Reinforcement is carried out in set modules based on the standard transformer sizes used by UK Power Networks. The reinforcement costs on domestic connections are fully socialised but they are apportioned for depot connections should their connection requests trigger reinforcement.

The Methods will enable lower connection requirements and load reduction through flexibility. This will result in lower reinforcement costs and capacity release as the network is currently built on peak demand. Flexibility connections and services will only be offered or procured when the networks are constrained. Table 18 and Table 19 detail all load related assumptions used for the business case.

10.3.1.4 Flexibility assumptions

One of the benefits of the Methods in Optimise Prime is the increased opportunity for the EVs to provide demand response or flexibility services to the network. Based on information from partners, fleet vehicles operate up to 12 hours a day. The current mileage, and effectively the battery size taking into account a 85.7% charging efficiency[51], allows for more than five hours of flexibility. This is a conservative estimate of flexibility duration window based on the UK Power Networks' recent flexibility tenders. The availability windows used in the model is five hours a day, seven days a week and with 30 hours of utilisation a year per vehicle. A portion of the fleet is not flexible because of operational constraints (such as standby or callout services) and is discounted proportionally in the model. Detailed assumptions on flexibility are also captured in Table 18 and Table 19.

Flexibility services are currently procured for primary substations where there is a minimum requirement of 100 kW portfolio per primary substation. The fleet EVs are connected to the secondary substations so a proxy was given based on the connectivity from secondary to primary. The 100 kW portfolio requirement was applied to each fleet based on EV volume in the fleet. This is appropriate for the depot connections as the fleet operator can move EVs to the depots in areas where flexibility is procured. The vehicle addresses received from project partner also show some clustering effect for domestic charging.

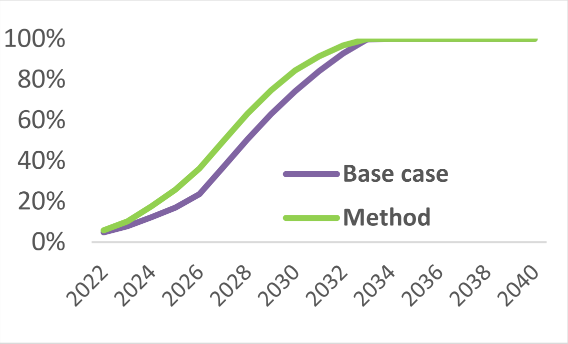
10.3.1.5 Capacity assumptions

Capacity released is defined as the peak load reduction by the two Methods. In the Home Charging Method, this is achieved through flexible charging to avoid charging at network peaks. In the Depot Charging Method, the capacity released is accrued through reduction in upfront connection requirement and flexibility service provided by the EVs on traditional 24/7 firm connections.

10.3.2 Carbon Benefits

Both Methods will deliver carbon benefits through facilitating and bringing forward fleet electrification. Figure 23 below shows the percentage of fleet electrification in the Base case and the facilitated uptake after the deployment of this project. In reality, not all fleets will reach 100% electrification on the same year but the bulk of the fleets are expected to reach 100% electrification by mid to late 2030s. The uptake forecast assumptions were made based on market intelligence and partner experience. The graphs are representative of the partners' fleets. Detailed assumptions on the electrification roadmaps and carbon benefits are documented in Table 16 and Table 17.

[51] https://ieeexplore.ieee.org/document/7046253/



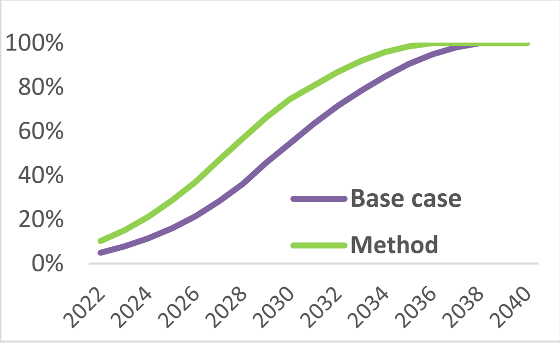


Figure 23 - Percent fleet electrification for domestic charging (left) and depot charging (right).

The fleet vehicles that are not EVs were assumed to meet Euro 6 legislation emission standards. The carbon benefits are proportional to the difference between the Base and Method case curves. Figure 24 and Figure 25 below show the annual carbon benefits by each Method as well as the cumulative benefits to 2050 at GB scale.

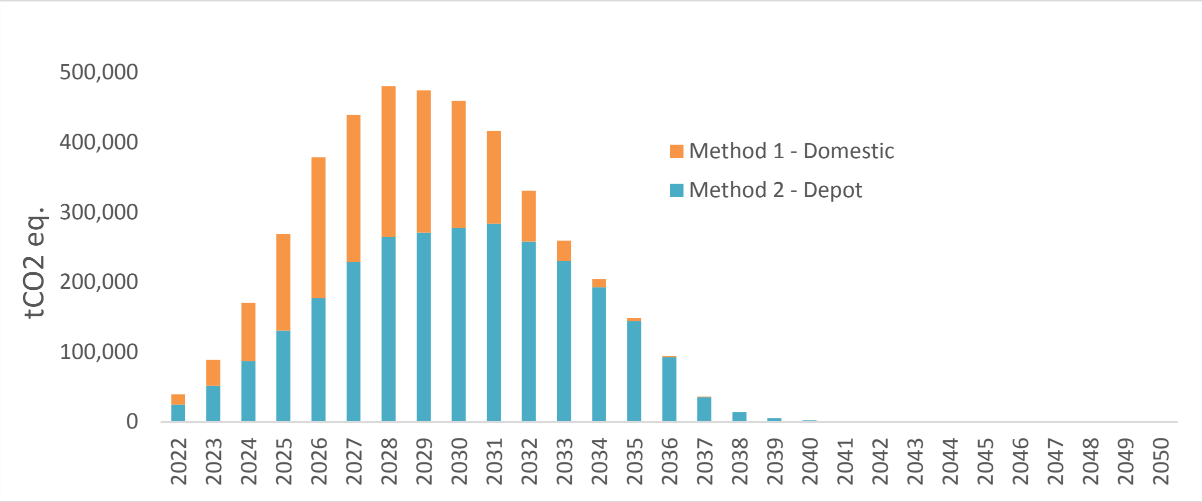


Figure 24 - Combined annual carbon benefits across GB delivered by both Methods.

The home charging fleets are expected to electrify more aggressively after purchase price parity because there is no reinforcement cost to the fleet for a 7kW charger at home. The carbon benefits are expected to tail off as all fleets are 100% electrified in both the Base and Method cases and facilitated through the Methods.

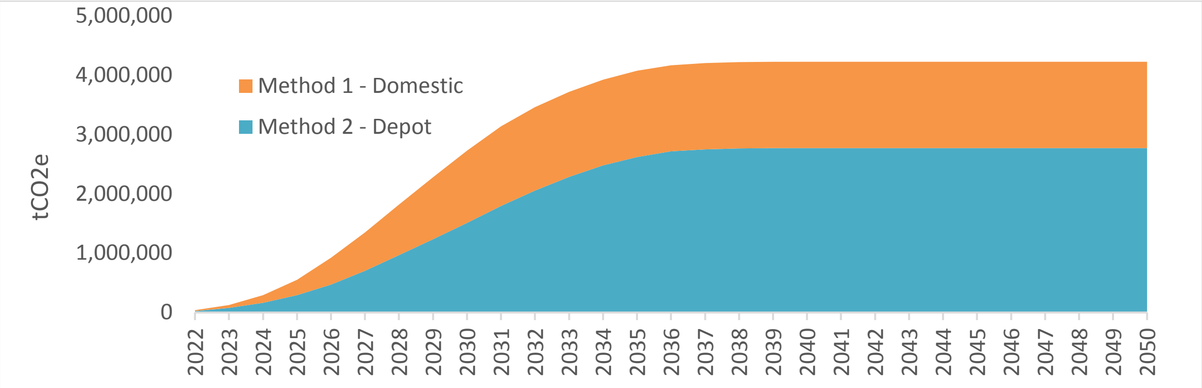


Figure 25 - Cumulative carbon benefits delivered by both Methods at a GB scale.

A full assessment of carbon emissions associated with each type of vehicle should include the carbon footprint of the vehicle production, fuel production and tailpipe emissions. The model only accounts for tailpipe emissions from internal combustion engine vehicles but both tailpipe emissions (i.e. zero) and fuel production emissions (electricity generation) for EVs. This gives a conservative estimate of carbon savings as the production of diesel and diesel vehicles combined have a heavier carbon footprint than just the production of EVs[52].

The carbon emissions from internal combustion engine vehicles were assumed to meet Euro 6 legislation emission standards of 130g/km. The carbon emissions for EVs were estimated based on the carbon emissions by electricity generation, transmission and distribution. Current carbon emissions from electricity generation in 2018 is 283 gCO_2e per kWh according to the UK Government GHG Conversion Factors for Company Reporting[53]. As per the RIIO-ED1 cost benefits analysis template, a linear decarbonisation pathway was applied to reach 10 $gCO_2.e$/kWh by 2050 for carbon emissions associated with power generation.

10.3.2.1 Other environmental benefits

For every 100,000 vans that transfer from diesel to electric, we estimate that there could be annual emission savings of 1,490 tonnes of NOx emissions based on Defra emissions factors.[54]

Table 16 – Fleet electrification and carbon assumptions for Home Charging Method

Domestic Assumptions	Impact
Commercial vans widely available by 2022. **It is assumed that the desired models for commercial vans in both use cases will be widely available post-trial in GB due to number of models announced by OEMs[55].**	EV availability won't be a blocker to uptake
Total cost of ownership (TCO) parity by 2024 in Base case and 2022 through Method 1. Note the "fuel" costs (i.e. electricity) to the employer is 2x higher for Base than post Method according to the domestic project partner. **This is assuming the OLEV grant for vans will be extended until then[56]**	Fleets will transition 20% of their vehicle renewals at TCO parity. This point is reached earlier post-trial due to lower tariffs
EV purchase price (PP) parity without subsidy by 2027[57]	Fleets will transition 100% of their vehicle renewals at PP parity in both Base and Method case
Major network constraints by 2027	No effect as domestic connection costs are not paid by the operator

[52] http://www.nextgreencar.com/tools/emissions-calculator/
[53] https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting
[54] Cenex analysis for Hitachi based on Defra emissions factors
[55] Pp.6-7 https://www.venson.com/uploads/pdfs/PlugInVansWhitePaper-082017-279-2017-33.pdf
[56] https://tinyurl.com/ybjjsq2a
[57] https://about.bnef.com/electric-vehicle-outlook/

Vehicles have an average life-time of seven years. Partner fleet has a vehicle life-time of four to six years but other return-to-home fleets (including UK Power Networks) have 10+ years	Annual vehicle renewals as a percentage of the total fleet = 100%/7years = 14.3%/year
The split of EV and ICE renewals are based on financial capital available	Some of the vans renewals will still be ICE until PP parity as mentioned above
The annual mileage of EVs returning home to charge is 13,000 miles, which is the national average for light commercial vans[58].	Mileage of a vehicle is directly proportional to carbon benefits. Commercial vehicles on average travel more than private vehicles.

Table 17 – Fleet electrification and carbon assumptions for Depot charging Method

Depot Assumptions	Impact
Commercial vans widely available by 2022 as explained in Table 16	EV availability won't be a blocker to uptake
Total cost of ownership (TCO) parity by 2022 as explained in Table 16. This cost excludes connection costs but the networks are not expected to be constrained at this point	Fleet will transition 20% of their vehicle renewals at TCO parity
Purchase price (PP) parity without subsidy by 2027 as explained in Table 16	Fleet will transition 100% of their vehicle renewals at PP parity
Networks start to become constrained in volume by 2027. Depots will electrify in unconstrained areas first where possible but this will eventually run out	**Base:** EV transition staggers because of prohibitive connection costs **Method:** Reduced capacity requirements facilitate EV transition
The depot charging partner operates a lower mileage fleet (<8,000 miles/year) as some of their vans only travel 15-20 miles per day. However, that's not representative of all depot charging fleet so 10,000 annual mileage was chosen. National annual average mileage is 13,000 as explained in Table 16	Shorter mileage generally gives a longer vehicle lifetime, which pushes back the 100% electrification because of existing ICE stock This also gives a conservative estimate of carbon benefits per year
Vehicles have an average life-time of 10 years based on less annual mileage as explained above. 10,000 annual mileage is used for depot charging compared to 13,000 for domestic as explained in Table 16	Annual vehicle renewals as a percentage of the total fleet = 100%/10 years = 10%/year
The split of EV and ICE renewals are based on capital available.	Some of the vans renewals will still be ICE until PP parity as mentioned above.

[58] https://tinyurl.com/ybr44cqv

10.3.3 *Financial Benefits*

Financial benefits come from deferred and avoided reinforcement on the networks as a result of flexibility and reduced capacity requirement for depot connections. Both the Base case costs and Method costs are made of reinforcement costs and flexibility payments. The difference between the two is the financial benefits. Figure 26 and Figure 27 show the financial benefits delivered by both Methods at GB scale. All figures are in 2018/19 values, using a discount factor of 3.5% for the first 30 years and 3% thereafter, in accordance with the submission guidance documents.

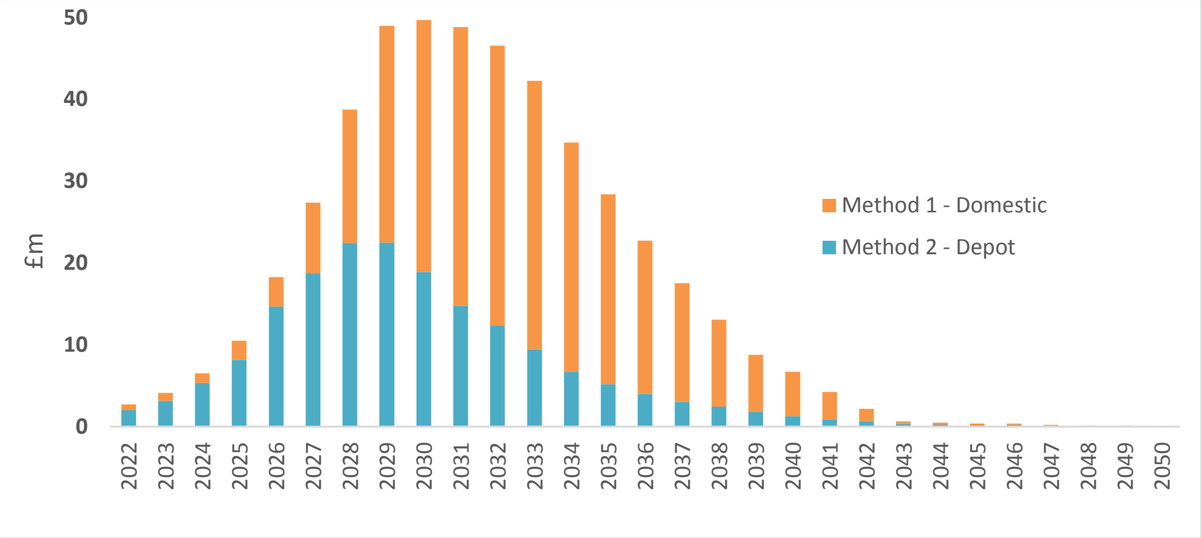


Figure 26 - Annual combined financial benefits delivered by both Methods at GB scale.

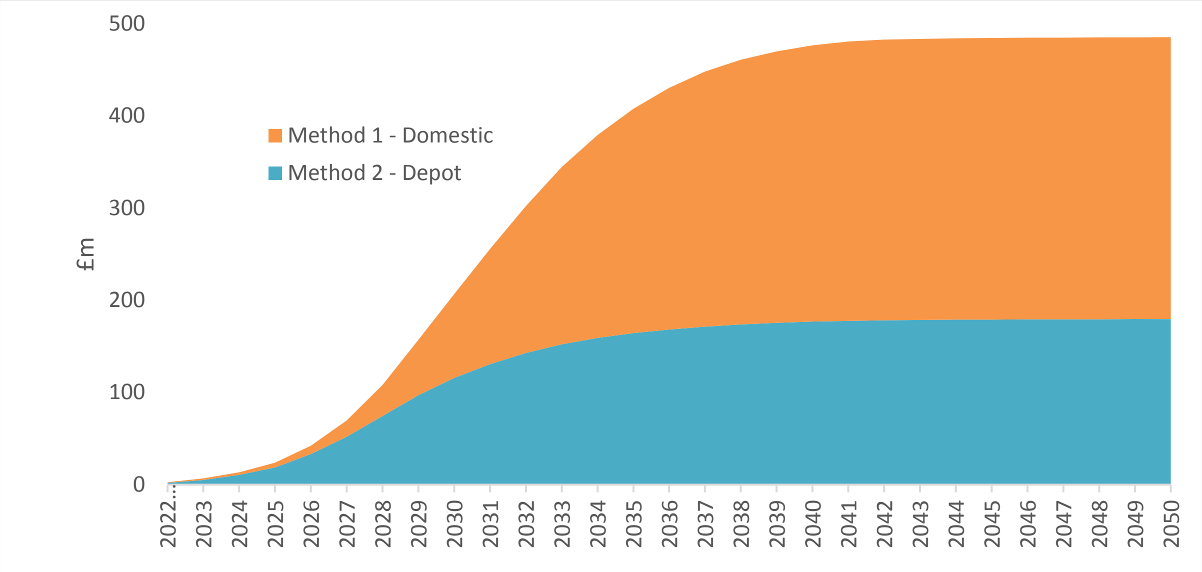


Figure 27 - Cumulative financial benefits delivered by both Methods at GB scale.

Financial benefits increase in the late 2020s as the networks become constrained. Once flexibility is unlocked it is expected to be spread quickly as fleet operators have control of a large volume of vehicles. Benefits start to plateau as flexibility picks up in the Base case in the 2030s. In fact, for the depot charging fleets there will be more volume providing flexibility services in the Base case than through Method 2 as there is a higher stock of 24/7 firm connections. The overall benefits are balanced out by the benefits accrued from profiled connections.

There are more financial network benefits from Method 1 because all reinforcement costs are socialised at the domestic level. The benefits from profiled connections are overshadowed because the associated reinforcement costs are not completely socialised. Figure 29 shows the benefits accrued from only profiled connections to further demonstrate this. The reinforcement costs are modular and connectees are only financially responsible for the proportion of the capacity they request. This is explained in more detail in subsection 10.2.5. The forecasted benefits of the depot charging fleets are conservative because the sample of depots from the project partner would only trigger reinforcement of secondary substations.

Furthermore, Figure 28 and Figure 29 below explain the financial benefits curves by Method. The graph on the left is the total benefits for Method 1 as all benefits are accrued through deferred reinforcement through flexibility. The graph on the right only shows financial benefits through reduced connection costs for Method 2. The connection benefits see a steeper increase in the late 2020s because it is expected that depots will electrify in unconstrained areas (i.e. minimum connection costs) until that option is exhausted.

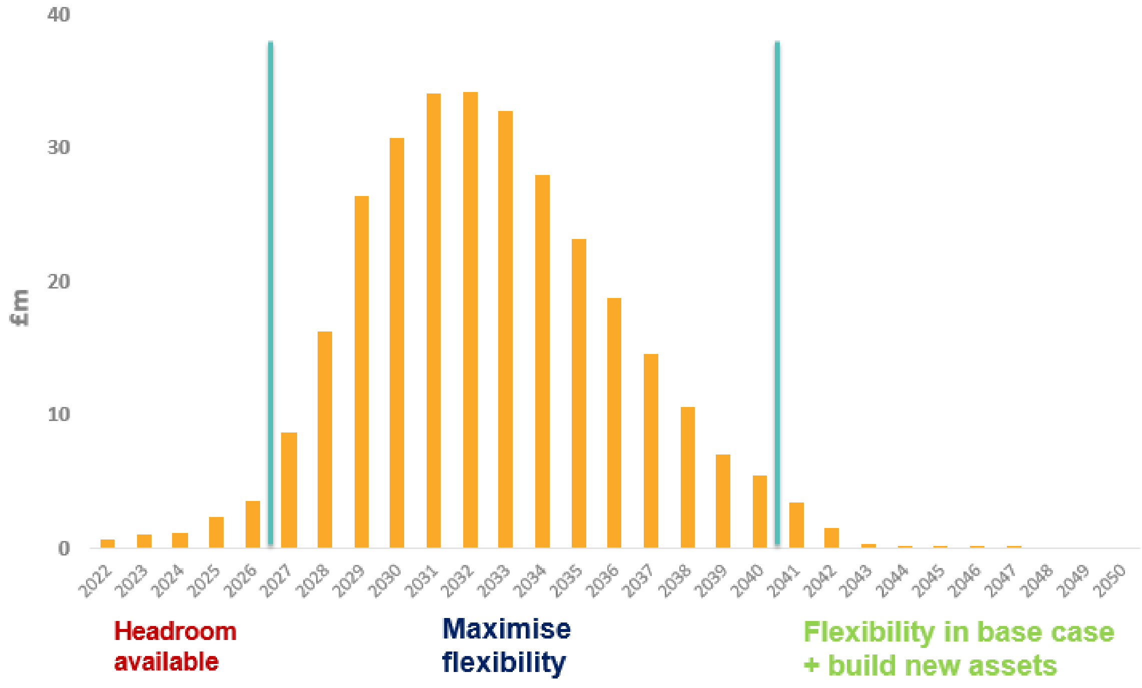


Figure 28 - Financial benefits accrued for Method 1 – Domestic

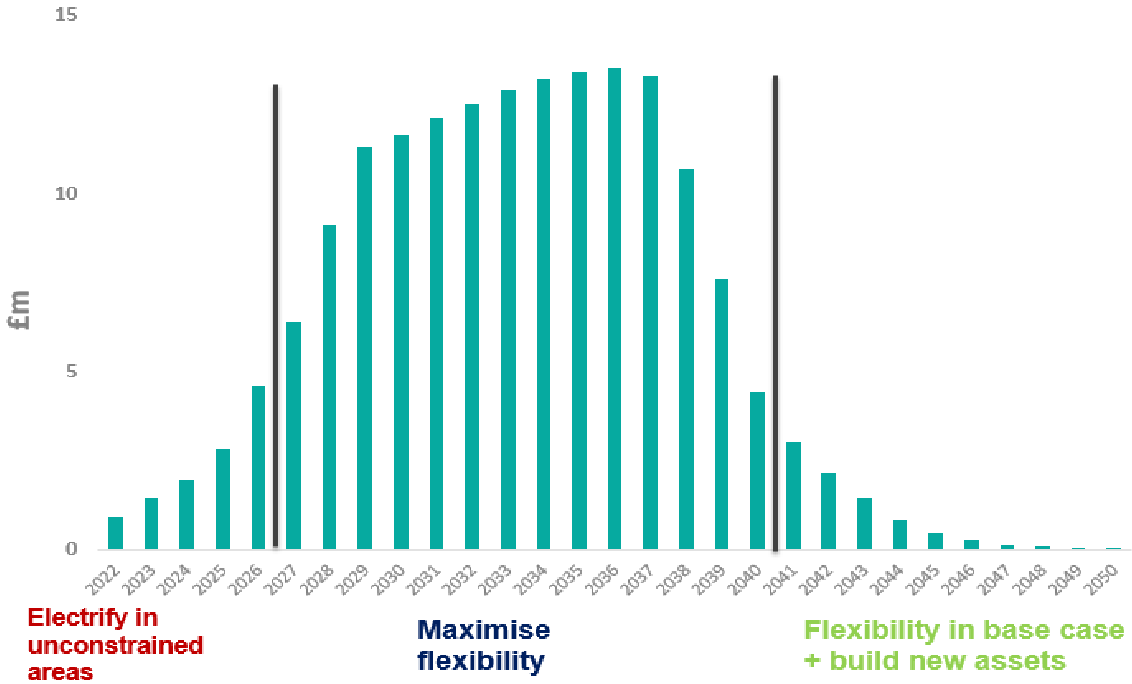


Figure 29 – Financial benefits accrued through profiled connections for Method 2 - Depot Charging

10.3.3.1 Breakeven Analysis

The breakeven analysis is based on the project costs funded by GB customers through the NIC and the benefits delivered across GB post-trial. Figure 30 shows that if successful the project breaks even in 2025/26 and delivers more benefit than customers' initial investment in 2026/27.

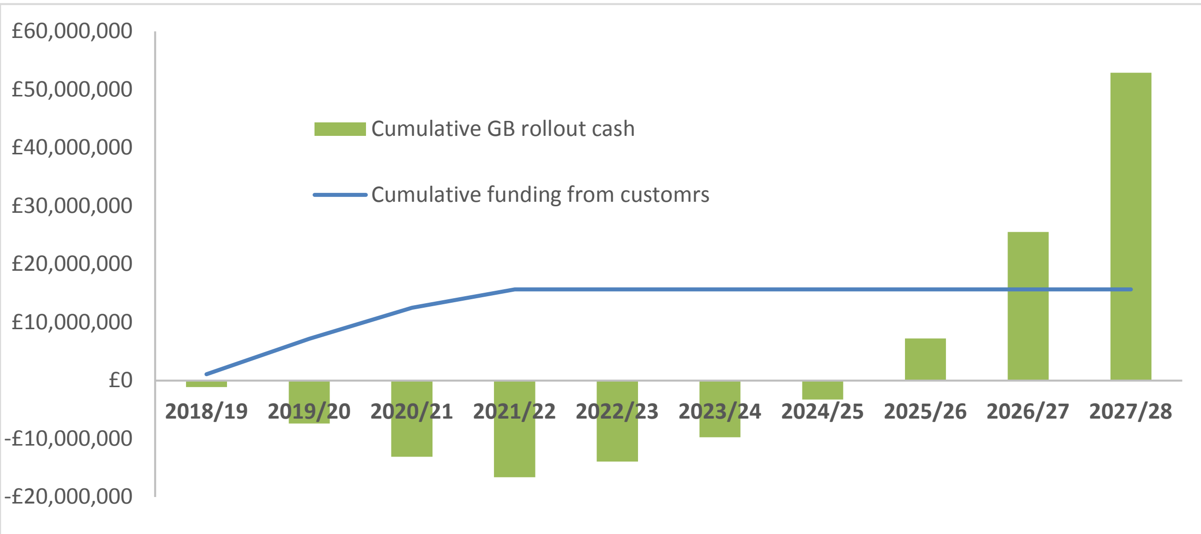


Figure 30 – Breakeven analysis

Table 18 – Load and network impact assumptions for Method 1 – Domestic charging

Domestic Assumptions	Impact
Each van has a 7kW smart charger. These chargers are able of being time-shifted.	It is assumed that 7kW of power is drawn from the grid but only 85.7% of the power is delivered to the EV due to charging inefficiency.
Time-of-Use (TOU) tariffs **Base: TOU tariff takes effect based on nominal customer adoption as it is ultimately employer benefits. Ofgem transfer statistics show on average 14% of customers switched energy suppliers in the last 10 years. This will be the adoption rate.** **Method: TOU tariff takes effect immediately as it will be implemented by the employer for the unique EV van charger supply point**	Low Carbon London conducted a trial to test the effect of TOU tariffs and reported an overall peak reduction ranging from an average of 5-10% up to 20% from the most engaged customers. **Impact on Base:** 5% peak reduction for domestic household **Impact on Method:** 15% peak reduction as employers are more engaged
Apart from TOU tariffs, all load reduction is a result of flexibility to DSO **Base: Fleets will provide flexibility later because of operational risks and logistical difficulties: Only 25% of the fleets will provide flexibility by 2027 and 80% by 2033.** **Method: Fleets will provide flexibility immediately as the van charging is now handled by the employer. 80% of the fleets will provide flexibility by 2027.**	Peak reduction due to flexibility from EV charging is assumed to be 50%. WPD's NIA project Electric Nation showed peak load could be reduced to a third through smart charging for private EVs but commercial EVs are expected to be less diverse so 50% reduction is chosen.
Fleets operate from 6AM to 6PM. Current battery size would only take 3-4 hours to fully charge at 7kW.	There is enough time for flexibility as the flexibility window is 4-5 hours.
15% of the fleet is inflexible as they are on call	These EVs are assumed to charge at full rate (i.e. 7kW) at peak times and will not have TOU tariffs or provide flexibility services.
Final impact on the networks was adjusted with Active Response[59] roll-out.	There will be more capacity on the networks than forecasted as Active Response will release some capacity.
All charge points purchased post-trial will be smart chargers as mandated by the Automated and Electric Vehicle Bill.	This assumption applies to both base case and Methods. Method cost therefore does not account for the extra costs of a smart charger compared to regular charger.

[59] Details of this project at https://tinyurl.com/yc3nhn4y

Table 19 – Load and network impact assumptions for Method 2 - Depot charging

Depot Assumptions	Impact
Each van has a 7kW smart charger. These chargers are capable of being time-shifted.	It is assumed that 7kW of power is drawn from the grid but only 85.7% of the power is delivered to the EV due to charging inefficiency.
When the networks are constrained in the *base case*, *Timed connections* will be offered. The rest are on 24/7 traditional connections.	Timed connections restrict usage at peak times, effectively releasing capacity. A 50% reduction on 24/7 traditional connection requirement is applied. This aligns with findings from the SEUL project funded by Innovate UK.
When the networks are constrained, *profiled connections* will replace timed connections through *Method 2*. The rest are on 24/7 firm connections.	Profiled connections restrict usage at peak times and potentially new peaks, effectively releasing further capacity. A 75% reduction on 24/7 firm connections is assumed.
Depots are assumed to have time-of-Use (TOU) tariffs for energy savings. TOU tariff is assumed to be compatible with timed and profiled connections because energy cost savings out-weighs connection cost savings.	TOU tariffs will introduce a 15% peak reduction as explained in Table 18. This has minimum impact on the benefits as it is expected to be the same for both the Base and Method case.
Learnings from *Method 2* help facilitate flexibility services ***Base*: 80% of the fleets will provide flexibility by 2030.** ***Method*: 80% of the fleets will provide flexibility by 2027.**	Flexibility will introduce a 50% peak reduction as explained in Table 18. Only those on 24/7 firm connections can provide flexibility services. Over time, there will be more flexibility volume in the Base case due to higher volume of firm connections so the benefits accrued from flexibility decreases as the Base case catches up on flexibility.
Delivery fleets operate 8:30AM to 2PM and collection fleets operate from 12PM to 8PM. Current battery size would only take 3-4 hours to fully charge at 7kW.	There is enough time for flexibility as the flexibility window is 4-5 hours.
15% of the fleet is inflexible as they do delivery and collections.	These EVs are assumed to charge at full rate (i.e. 7kW) at peak times and will not have TOU tariffs or provide flexibility services.

10.3.4 Capacity Benefits

Capacity benefits come from reduced peak load on the networks as a result of flexibility and profiled connections. This is based on the same assumptions and analysis described in the sections above.

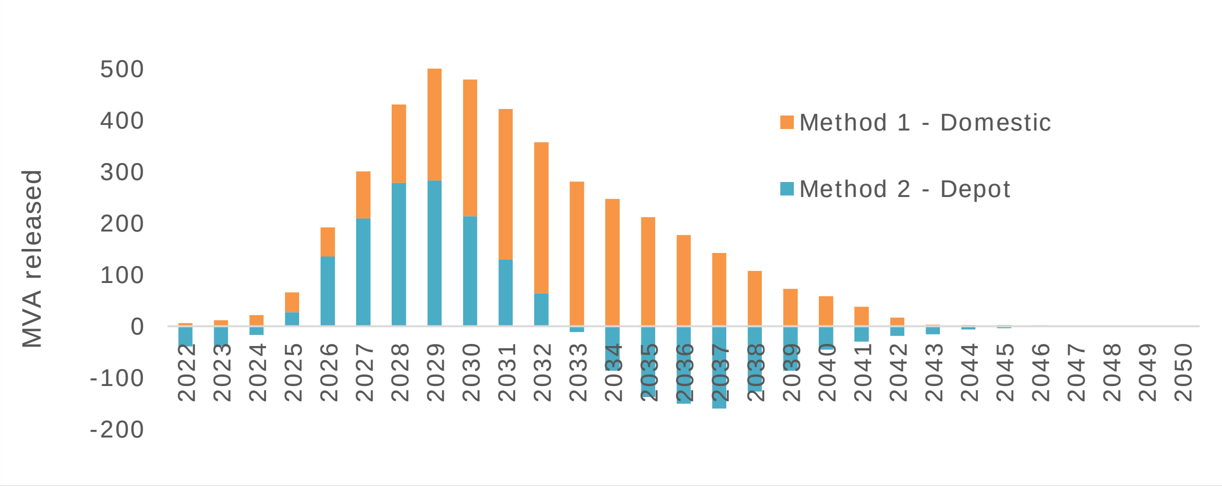


Figure 31 – Annual combined capacity benefits delivered by both Methods at GB scale

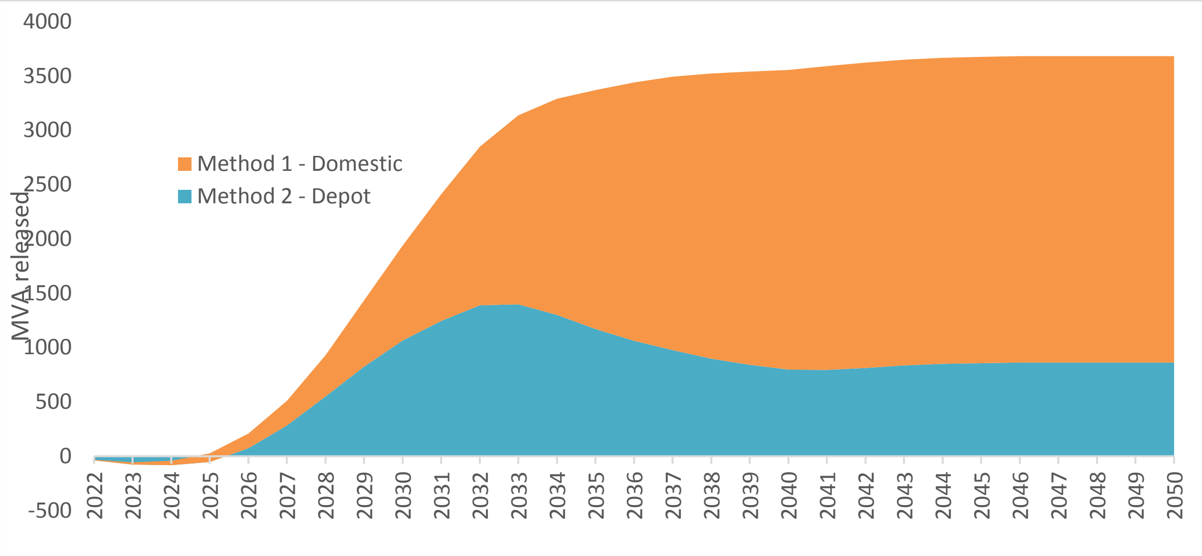


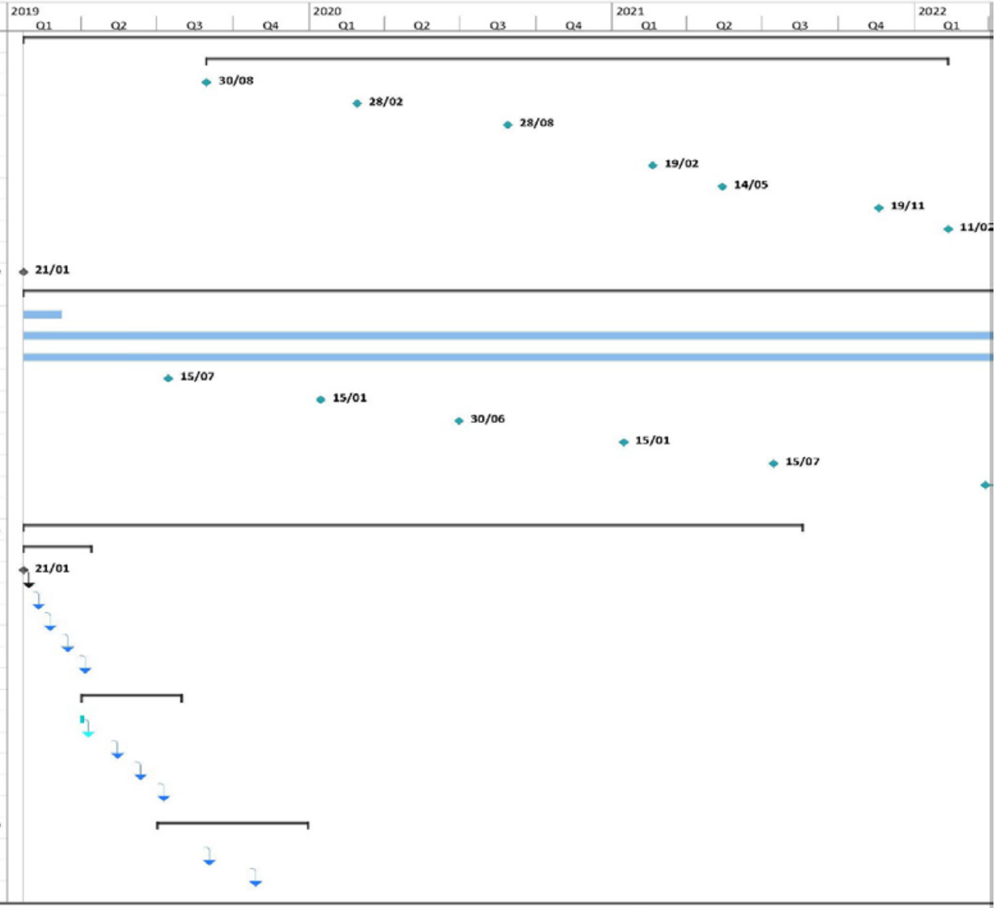
Figure 32 – Cumulative capacity benefits from both Methods at GB scale.

Figure 31 and Figure 32 show the annual and cumulative capacity benefits, respectively. Capacity benefits from Domestic Charging follow the shape of financial benefits as the deferred or avoided reinforcement is solely due to peak reduction. In the Depot Charging case, the released capacity becomes negative as there are more EVs providing flexibility because they are on traditional firm connections. There are slight negative capacity benefits at the beginning due to the transition of vehicles to EV being accelerated forward but this is not reflected in the financial benefits as there is headroom available in the networks to accommodate the extra load. In both Methods, capacity benefits increase in the late 2020s as the networks become constrained and flatten out as flexibility becomes the base case in the 2030s.

Appendix 10.4 – Project Plan

In this Appendix we have provided the detailed Project schedule created in Microsoft Project. This provides the baseline of Project activities and milestones. As the Project start draws closer, this will be revisited and any changes that have been agreed will be factored in. It will then be used to monitor and report progress.

ID	Task Name	Duration	Start	Finish
1	**Optimise Prime Project Plan**	**845 days**	**Mon 21/01/19**	**Fri 15/04/22**
2	**Project Milestones**	**640 days**	**Fri 30/08/19**	**Fri 11/02/22**
3	Deliverable 1. Report Document : Design of Trials	0 days	Fri 30/08/19	Fri 30/08/19
4	Deliverable 2. Report Document : Lessons Learned from Build Phase	0 days	Fri 28/02/20	Fri 28/02/20
5	Deliverable 3. Report Document : Learnings from Installation and Commissioning	0 days	Fri 28/08/20	Fri 28/08/20
6	Deliverable 4. Report Document : Trials Early Learnings Report	0 days	Fri 19/02/21	Fri 19/02/21
7	Deliverable 5. Report Document : Business Models Interim Report	0 days	Fri 14/05/21	Fri 14/05/21
8	Deliverable 6. Data : Published Data Sets	0 days	Fri 19/11/21	Fri 19/11/21
9	Deliverable 7. Report Document : Final Report plus PPT Presentation	0 days	Fri 11/02/22	Fri 11/02/22
10				
11	**Workstreams**	**0 days**	**Mon 21/01/19**	**Mon 21/01/19**
19	**Project Management (see also Workstream 7)**	**845 days**	**Mon 21/01/19**	**Fri 15/04/22**
20	Mobilisation	34 days	Mon 21/01/19	Thu 07/03/19
21	UKPN Project Management	845 days	Mon 21/01/19	Fri 15/04/22
22	Consortium Project Management	845 days	Mon 21/01/19	Fri 15/04/22
23	Bi-Annual Governance Review Gate 1	0 days	Mon 15/07/19	Mon 15/07/19
24	Bi-Annual Governance Review Gate 2	0 days	Wed 15/01/20	Wed 15/01/20
25	Bi-Annual Governance Review Gate 3	0 days	Tue 30/06/20	Tue 30/06/20
26	Bi-Annual Governance Review Gate 4	0 days	Fri 15/01/21	Fri 15/01/21
27	Bi-Annual Governance Review Gate 5	0 days	Thu 15/07/21	Thu 15/07/21
28	Governance - Completion Review Gate	0 days	Mon 28/03/22	Mon 28/03/22
29				
30	**Workstream 1: Trial 1 - Home-charging**	**673 days**	**Mon 21/01/19**	**Wed 18/08/21**
31	**Experiments and Requirements Specification**	**60 days**	**Mon 21/01/19**	**Fri 12/04/19**
32	Confirm Locations with Centrica	0 days	Mon 21/01/19	Mon 21/01/19
33	Define Experiments	10 days	Mon 21/01/19	Fri 01/02/19
34	Define Requirements and Specification	10 days	Mon 04/02/19	Fri 15/02/19
35	Produce Specification and Experiments Document	15 days	Mon 18/02/19	Fri 08/03/19
36	Specification and Experiments Document Review	15 days	Mon 11/03/19	Fri 29/03/19
37	Finalise Specification and Experiments Document	10 days	Mon 01/04/19	Fri 12/04/19
38	**IT Services and Applications - Design**	**87 days**	**Mon 01/04/19**	**Tue 30/07/19**
39	Conduct Design Workshop	2 days	Mon 01/04/19	Tue 02/04/19
40	Design IT Services and Applications	25 days	Wed 03/04/19	Tue 07/05/19
41	Review IT Services and Applications	20 days	Wed 08/05/19	Tue 04/06/19
42	Finalise IT Services and Applications	20 days	Wed 05/06/19	Tue 02/07/19
43	Approve IT Services and Applications	20 days	Wed 03/07/19	Tue 30/07/19
44	**IT Services and Applications - Implementation**	**130 days**	**Tue 02/07/19**	**Mon 30/12/19**
45	Agile Incremental Development Test and Release	40 days	Tue 02/07/19	Mon 26/08/19
46	Transition	40 days	Tue 27/08/19	Mon 21/10/19
47	Managed Service	50 days	Tue 22/10/19	Mon 30/12/19



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Task · Split · Milestone · Summary · Project Summary · External Tasks · External Milestone · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · Deadline · Progress · Manual Progress

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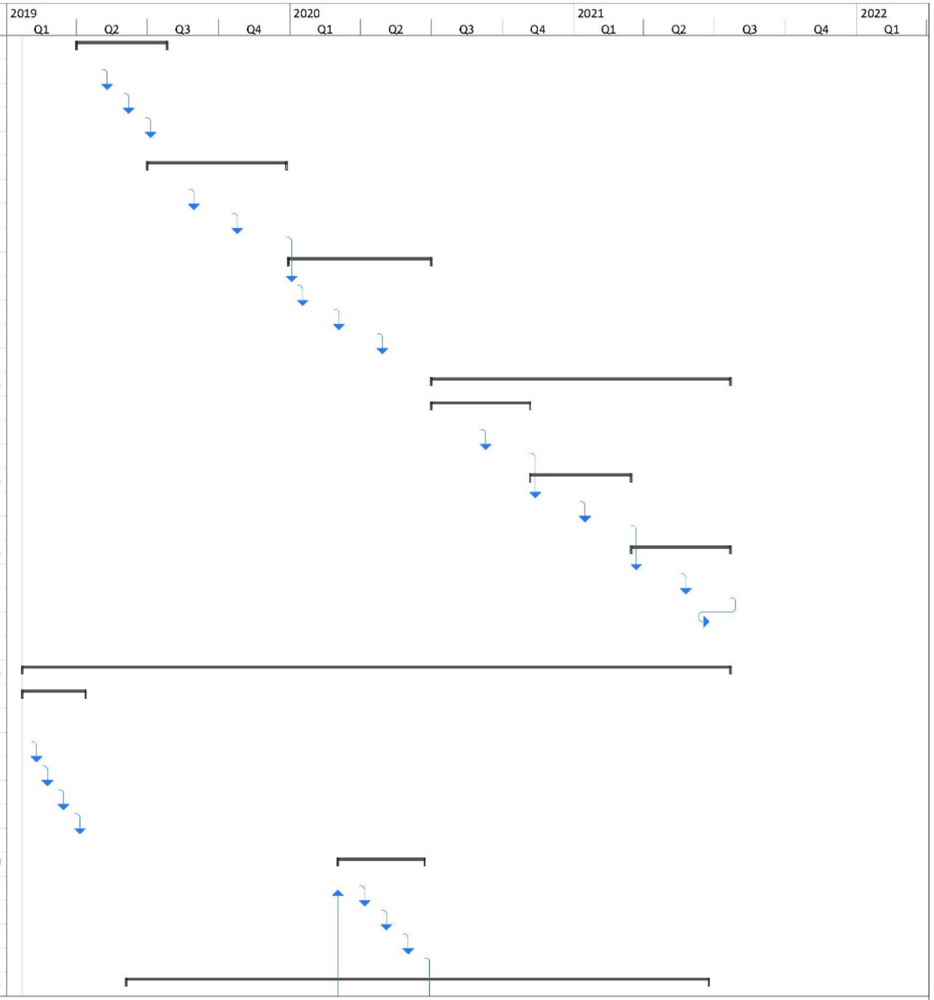
ID	Task Name	Duration	Start	Finish
48	**Energy Infrastructure - Design**	**85 days**	**Mon 01/04/19**	**Fri 26/07/19**
49	Design Infrastructure	25 days	Mon 01/04/19	Fri 03/05/19
50	Review Infrastructure	20 days	Mon 06/05/19	Fri 31/05/19
51	Finalise Infrastructure	20 days	Mon 03/06/19	Fri 28/06/19
52	Approve Infrastructure	20 days	Mon 01/07/19	Fri 26/07/19
53	**Energy Infrastructure - Build**	**130 days**	**Mon 01/07/19**	**Fri 27/12/19**
54	Procure/Manufacture Equipment	40 days	Mon 01/07/19	Fri 23/08/19
55	Test Equipment	40 days	Mon 26/08/19	Fri 18/10/19
56	Certification	50 days	Mon 21/10/19	Fri 27/12/19
57	**Energy Infrastructure - Installation**	**132 days**	**Mon 30/12/19**	**Tue 30/06/20**
58	Contract for Works	10 days	Mon 30/12/19	Fri 10/01/20
59	Site Readiness Works	40 days	Thu 02/01/20	Wed 26/02/20
60	Install Equipment	40 days	Thu 27/02/20	Wed 22/04/20
61	Test and Commission Equipment	49 days	Thu 23/04/20	Tue 30/06/20
62	**Conduct Experiments based on Scaled Roll-out of EVs - Iterative**	**276 days**	**Wed 01/07/20**	**Wed 21/07/21**
63	**Implement Experiment 1**	**92 days**	**Wed 01/07/20**	**Thu 05/11/20**
64	Data Capture and Analysis	46 days	Wed 01/07/20	Wed 02/09/20
65	Refine Hypotheses and Validate Next Experiment	46 days	Thu 03/09/20	Thu 05/11/20
66	**Implement Experiment 2**	**92 days**	**Fri 06/11/20**	**Mon 15/03/21**
67	Data Capture and Analysis	46 days	Fri 06/11/20	Fri 08/01/21
68	Refine Hypotheses and Validate Next Experiment	46 days	Mon 11/01/21	Mon 15/03/21
69	**Implement Experiment 3**	**92 days**	**Tue 16/03/21**	**Wed 21/07/21**
70	Data Capture and Analysis	46 days	Tue 16/03/21	Tue 18/05/21
71	Refine Hypotheses	46 days	Wed 19/05/21	Wed 21/07/21
72	**Workstream 1 : Produce Workstream Report**	**40 days**	**Thu 24/06/21**	**Wed 18/08/21**
73				
74	**Workstream 2: Trial 2 - Depot**	**653 days**	**Mon 21/01/19**	**Wed 21/07/21**
75	**Experiments and Requirements Specification**	**60 days**	**Mon 21/01/19**	**Fri 12/04/19**
76	Confirm Sites with Royal Mail	10 days	Mon 21/01/19	Fri 01/02/19
77	Define Experiments	10 days	Mon 21/01/19	Fri 01/02/19
78	Define Requirements and Specification	10 days	Mon 04/02/19	Fri 15/02/19
79	Produce Specification and Experiments Document	15 days	Mon 18/02/19	Fri 08/03/19
80	Specification and Experiments Document Review	15 days	Mon 11/03/19	Fri 29/03/19
81	Finalise Specification and Experiments Document	10 days	Mon 01/04/19	Fri 12/04/19
82	**Install Depot Energy Infrastructure**	**80 days**	**Tue 03/03/20**	**Mon 22/06/20**
83	Procure Infrastructure for Depots	20 days	Tue 03/03/20	Mon 30/03/20
84	Build Charging and Energy Infrastructure	20 days	Tue 31/03/20	Mon 27/04/20
85	Install Charging and Energy Infrastructure	20 days	Tue 28/04/20	Mon 25/05/20
86	Testing and Commissioning of Charging and Energy Infrastructure	20 days	Tue 26/05/20	Mon 22/06/20
87	**Profiled Connection Planning Tool**	**537 days**	**Tue 04/06/19**	**Wed 23/06/21**



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Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline	
Split	External Tasks	Inactive Summary	Manual Summary	Progress	
Milestone	External Milestone	Manual Task	Start-only	Manual Progress	
Summary	Inactive Task	Duration-only	Finish-only		

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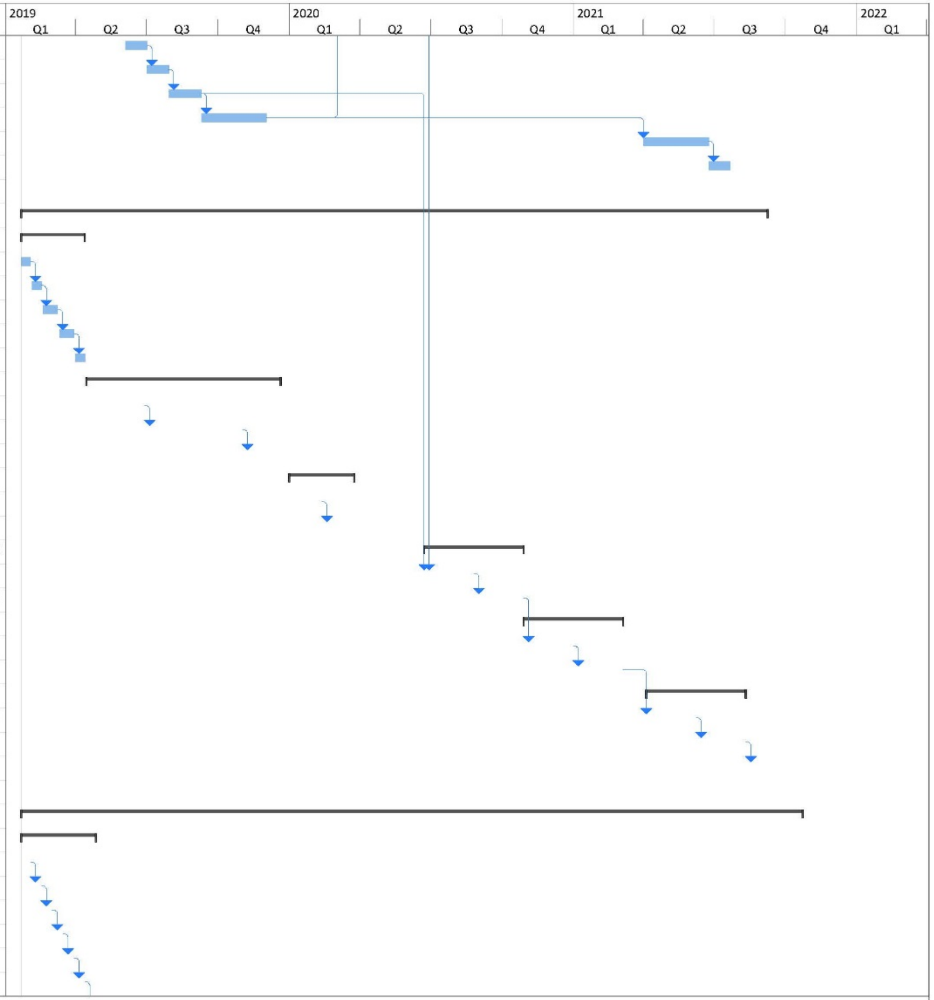
ID	Task Name	Duration	Start	Finish
88	Define Planning Tool Requirements	20 days	Tue 04/06/19	Mon 01/07/19
89	Design Planning Tool	20 days	Tue 02/07/19	Mon 29/07/19
90	Build Planning Tool	30 days	Tue 30/07/19	Mon 09/09/19
91	Use Planning Tool in Planning of Trial	60 days	Tue 10/09/19	Mon 02/12/19
92	Evaluate Planning Tool	60 days	Thu 01/04/21	Wed 23/06/21
93	**Workstream 2 : Produce Workstream Report**	20 days	Thu 24/06/21	Wed 21/07/21
94				
95	**Workstream 3: Trial 3 - Mixed Charging**	**687 days**	**Mon 21/01/19**	**Tue 07/09/21**
96	**Experiments and Requirements Specification**	**60 days**	**Mon 21/01/19**	**Fri 12/04/19**
97	Define Experiments	10 days	Mon 21/01/19	Fri 01/02/19
98	Define Requirements and Specification	10 days	Mon 04/02/19	Fri 15/02/19
99	Produce Specification and Experiments Document	15 days	Mon 18/02/19	Fri 08/03/19
100	Specification and Experiments Document Review	15 days	Mon 11/03/19	Fri 29/03/19
101	Finalise Specification and Experiments Document	10 days	Mon 01/04/19	Fri 12/04/19
102	**Design & Build data integration**	**180 days**	**Mon 15/04/19**	**Fri 20/12/19**
103	Design data integration interface for Uber data	55 days	Mon 15/04/19	Fri 28/06/19
104	Build data integration interface for Uber data	90 days	Mon 01/07/19	Fri 01/11/19
105	Prepare infrastructure for Uber data	35 days	Mon 04/11/19	Fri 20/12/19
106	**Connect and test data acquisition systems**	**60 days**	**Wed 01/01/20**	**Tue 24/03/20**
107	Connect Uber and Hitachi systems	30 days	Wed 01/01/20	Tue 11/02/20
108	Test data exchange	30 days	Wed 12/02/20	Tue 24/03/20
109	**Implement Experiment 1**	**92 days**	**Tue 23/06/20**	**Wed 28/10/20**
110	Data Capture and Analysis	46 days	Tue 23/06/20	Tue 25/08/20
111	Refine Hypotheses and Validate Next Experiment	46 days	Wed 26/08/20	Wed 28/10/20
112	**Implement Experiment 2**	**92 days**	**Thu 29/10/20**	**Fri 05/03/21**
113	Data Capture and Analysis	46 days	Thu 29/10/20	Thu 31/12/20
114	Refine Hypotheses and Validate Next Experiment	46 days	Fri 01/01/21	Fri 05/03/21
115	**Implement Experiment 3**	**92 days**	**Mon 05/04/21**	**Tue 10/08/21**
116	Data Capture and Analysis	46 days	Mon 05/04/21	Mon 07/06/21
117	Refine Hypotheses	46 days	Tue 08/06/21	Tue 10/08/21
118	**Workstream 3 : Produce Workstream Report**	20 days	Wed 11/08/21	Tue 07/09/21
119				
120	**Workstream 4: IoT Platform, Network Forecasting & Flexibility**	**720 days**	**Mon 21/01/19**	**Fri 22/10/21**
121	**Define**	**70 days**	**Mon 21/01/19**	**Fri 26/04/19**
122	Validate Requirements Scope and Outputs	10 days	Mon 21/01/19	Fri 01/02/19
123	Define the Methodology	10 days	Mon 04/02/19	Fri 15/02/19
124	Confirm Evidence Requirements	10 days	Mon 18/02/19	Fri 01/03/19
125	Confirm Data Requirements for Workstream 1	10 days	Mon 04/03/19	Fri 15/03/19
126	Confirm Data Requirements for Workstream 2	10 days	Mon 18/03/19	Fri 29/03/19
127	Confirm Data Requirements for Workstream 3	10 days	Mon 01/04/19	Fri 12/04/19



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Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Deadline | Progress | Manual Progress

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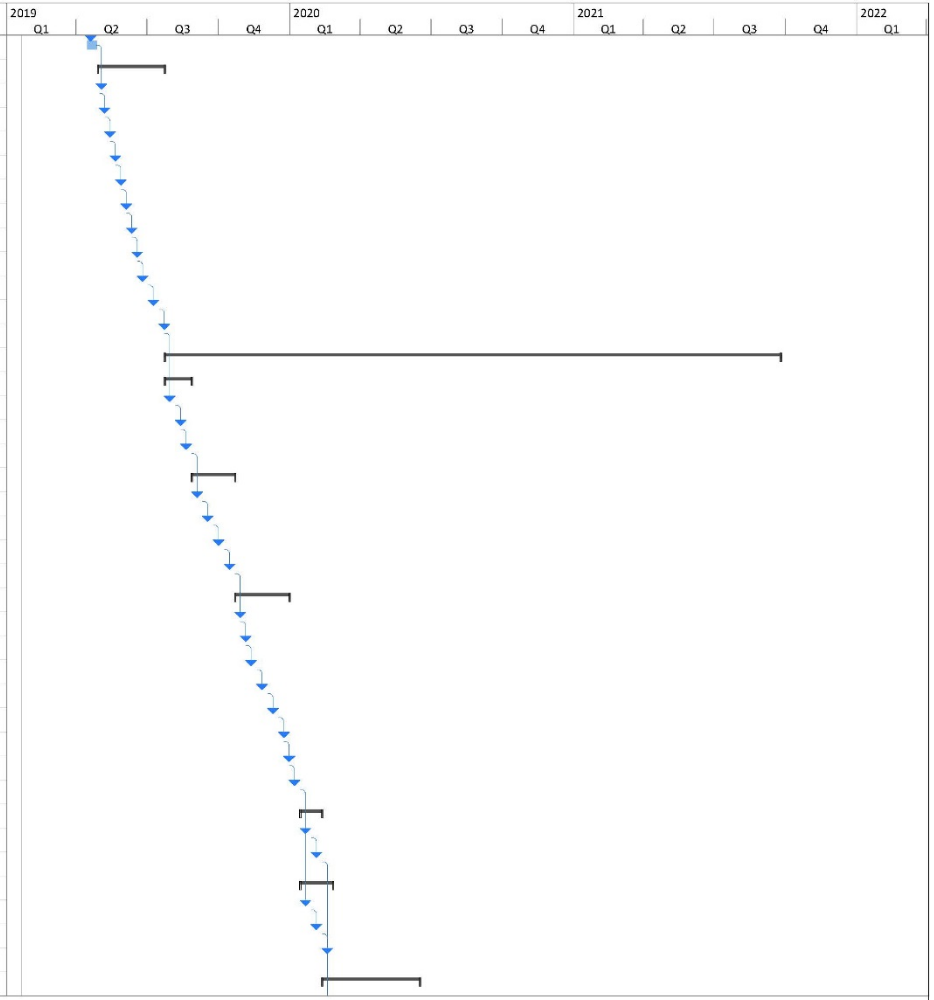
ID	Task Name	Duration	Start	Finish
128	Define Detailed Trial Schedules and Experiments	10 days	Mon 15/04/19	Fri 26/04/19
129	**IT Services and Applications Design**	**62 days**	**Mon 29/04/19**	**Tue 23/07/19**
130	Design Workshops	2 days	Mon 29/04/19	Tue 30/04/19
131	Requirements Gathering	5 days	Wed 01/05/19	Tue 07/05/19
132	Requirements Analysis	5 days	Wed 08/05/19	Tue 14/05/19
133	Backlog development	5 days	Wed 15/05/19	Tue 21/05/19
134	High Level Solution Design	5 days	Wed 22/05/19	Tue 28/05/19
135	Detailed Solution Design	5 days	Wed 29/05/19	Tue 04/06/19
136	Security Architecture Design	5 days	Wed 05/06/19	Tue 11/06/19
137	High Level Physical Archicture Design	5 days	Wed 12/06/19	Tue 18/06/19
138	Test Stategy and Planning	10 days	Wed 19/06/19	Tue 02/07/19
139	DevOps Architecture	10 days	Wed 03/07/19	Tue 16/07/19
140	Project Roadmap Planning	5 days	Wed 17/07/19	Tue 23/07/19
141	**Build IT Services and Applications**	**568 days**	**Wed 24/07/19**	**Fri 24/09/21**
142	**IT Infrastructure Deployment**	**25 days**	**Wed 24/07/19**	**Tue 27/08/19**
143	Build Scripts and Artifacts for Deployment of Infrastructure	10 days	Wed 24/07/19	Tue 06/08/19
144	Test Infrastructure Deployment	5 days	Wed 07/08/19	Tue 13/08/19
145	Build Project Environments	10 days	Wed 14/08/19	Tue 27/08/19
146	**DevOps Pipelines**	**40 days**	**Wed 28/08/19**	**Tue 22/10/19**
147	Build Continuous Integration Pipelines	10 days	Wed 28/08/19	Tue 10/09/19
148	Integrate Unit Testing and Integration Testing Frameworks	10 days	Wed 11/09/19	Tue 24/09/19
149	Integrate Static Code Analysis Framework	10 days	Wed 25/09/19	Tue 08/10/19
150	Develop Pipelines for Project Environments	10 days	Wed 09/10/19	Tue 22/10/19
151	**Agile Development - Iterative**	**50 days**	**Wed 23/10/19**	**Tue 31/12/19**
152	Sprint Planning	5 days	Wed 23/10/19	Tue 29/10/19
153	User Story Design	5 days	Wed 30/10/19	Tue 05/11/19
154	Development	10 days	Wed 06/11/19	Tue 19/11/19
155	Functional Testing	10 days	Wed 20/11/19	Tue 03/12/19
156	DevOps Integration	10 days	Wed 04/12/19	Tue 17/12/19
157	Product Owner Reviews	5 days	Wed 18/12/19	Tue 24/12/19
158	Sprint Refinement as input to Sprint Planning	5 days	Wed 25/12/19	Tue 31/12/19
159	**'Release' Performance Testing**	10 days	Wed 01/01/20	Tue 14/01/20
160	**Data Security Review**	**20 days**	**Wed 15/01/20**	**Tue 11/02/20**
161	Review Solution Detailed Design	10 days	Wed 15/01/20	Tue 28/01/20
162	Refine Security Practices	10 days	Wed 29/01/20	Tue 11/02/20
163	**Solution Testing**	**30 days**	**Wed 15/01/20**	**Tue 25/02/20**
164	System Integration Testing	10 days	Wed 15/01/20	Tue 28/01/20
165	Penetration Testing	10 days	Wed 29/01/20	Tue 11/02/20
166	User Acceptance Testing	10 days	Wed 12/02/20	Tue 25/02/20
167	**Transition to Managed Service Run**	**90 days**	**Wed 12/02/20**	**Tue 16/06/20**



Project: Optimise Prime Project P
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Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Deadline | Progress | Manual Progress

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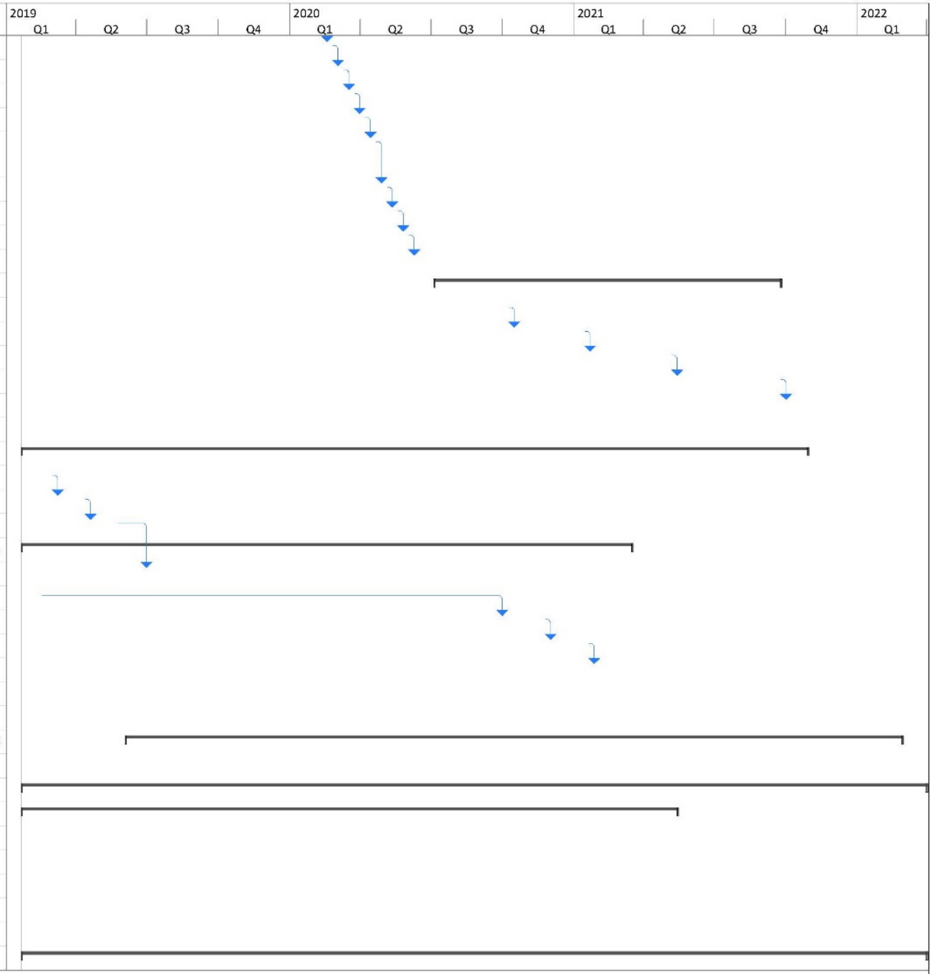
ID	Task Name	Duration	Start	Finish
168	Mobilisation	10 days	Wed 12/02/20	Tue 25/02/20
169	Standards and Compliance Considerations	10 days	Wed 26/02/20	Tue 10/03/20
170	Security, Acccess, Egress	10 days	Wed 11/03/20	Tue 24/03/20
171	Technical Design Assurance	10 days	Wed 25/03/20	Tue 07/04/20
172	Build of Production Environment Security and Egress Controls and Monitoring	10 days	Wed 08/04/20	Tue 21/04/20
173	BAU Delivery Documentation	10 days	Wed 22/04/20	Tue 05/05/20
174	Build Service Desk and Service Wrap to Support Production	10 days	Wed 06/05/20	Tue 19/05/20
175	Build out services to support Production	10 days	Wed 20/05/20	Tue 02/06/20
176	Training Considerations	10 days	Wed 03/06/20	Tue 16/06/20
177	**Run and Analyse**	**320 days**	**Mon 06/07/20**	**Fri 24/09/21**
178	Scaled Roll-Out	70 days	Mon 06/07/20	Fri 09/10/20
179	Data Capture and Analysis from WS1, WS2 and WS3	70 days	Mon 12/10/20	Fri 15/01/21
180	Develop Key Findings and Recommendations	80 days	Mon 18/01/21	Fri 07/05/21
181	Develop Methods, Models and Tools for Use by DNOs	100 days	Mon 10/05/21	Fri 24/09/21
182	**Workstream 4 : Produce Workstream Report**	20 days	Mon 27/09/21	Fri 22/10/21
183				
184	**Workstream 5: Business Model**	**725 days**	**Mon 21/01/19**	**Fri 29/10/21**
185	Map Current Ecomonic Value Chain	30 days	Mon 21/01/19	Fri 01/03/19
186	Understand Commercial Drivers	30 days	Mon 04/03/19	Fri 12/04/19
187	Engage Key Internal and External Stakeholders to Canvas Broader Viev	30 days	Mon 15/04/19	Fri 24/05/19
188	**Economic Analysis**	**563 days**	**Mon 21/01/19**	**Wed 17/03/21**
189	Perform Economic Analysis	190 days	Mon 01/07/19	Fri 20/03/20
190	Input into Trials	20 days	Mon 21/01/19	Fri 15/02/19
191	Understand Customer Perceptions and Behaviours	40 days	Thu 01/10/20	Wed 25/11/20
192	Develop Business Models	40 days	Thu 26/11/20	Wed 20/01/21
193	Develop Updated Cost Benefit Analysis	40 days	Thu 21/01/21	Wed 17/03/21
194	**Workstream 5 : Produce Workstream Report**	20 days	Mon 04/10/21	Fri 29/10/21
195				
196	**Workstream 6: Reports and Documentation**	**715 days**	**Mon 03/06/19**	**Mon 28/02/22**
205				
206	**Workstream 7: Project Management and Shared Learnings**	**834 days**	**Mon 21/01/19**	**Thu 31/03/22**
207	**Sharing Learnings**	**605 days**	**Mon 21/01/19**	**Fri 14/05/21**
208	Refine Learning and Knowledge Sharing Approach and Channels	30 days	Mon 21/01/19	Fri 01/03/19
209	Define Approach to Branding and Marketing	30 days	Mon 21/01/19	Fri 01/03/19
210	Build and Launch Sharing Mechanisms (e.g Web Site)	30 days	Mon 01/04/19	Fri 10/05/19
211	Deliverable : Share Data with Partners	30 days	Thu 01/10/20	Wed 11/11/20
212	Deliverable : Produce Interim Report on Trials (Public)	30 days	Mon 05/04/21	Fri 14/05/21
213	**Project Management**	**834 days**	**Mon 21/01/19**	**Thu 31/03/22**



Project: Optimise Prime Project P
Date: Wed 25/07/18

Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Deadline | Progress | Manual Progress

Page 5

Appendix 10.5 – Risk Register and Contingency Plan

In this Appendix we have provided the initial version of the Risk Register for the Project. This will be reviewed and updated on a monthly basis as the Project progresses. Key risks will be reviewed and discussed at the fortnightly Workstream Leaders meeting chaired by the Project Director. Risks and issues will be a key part of the Project reporting cycle.

The table shows the actions that will be undertaken to mitigate the risks. A Contingency sum will be identified and managed to cover any costs that relate to a mitigated risk becoming an issue.

Table 20 – Risk Register

Risk Register

ID	Type	Status	Description	Impact	Risk Probability	Risk Impact	Risk Score	Mitigation / Planned Actions	Mitigated Probability	Mitigated Impact	Mitigated Score	Owner	Last Updated	Date Closed
R1	Risk	Open	Project costs are higher than expected	Project overspend requiring additional partner contribution or request to Ofgem for additional funding	3	5	15	Ensure realistic costs with appropriate contingency based on experience with FSP. Effective risk and issues management. Effective tendering process. Review costs, cost forecasts and scope at the end of each phase.	2	4	8	PM	27/07/2018	
R2	Risk	Open	Some aspects of the technical solutions are not achievable to the desired specification within the project budget	The Project will not be able investigate all of the available techniques	3	4	12	Project scope is based on integration and evolution of existing techniques. Effective risk management processes in place. Effective tendering process. Review costs, cost forecasts and scope at the end of each phase	1	4	4	Energy Techno logy Lead	27/07/2018	
R3	Risk	Open	Solution design and implementation is more complex than initially thought	Potential over-spend on solution development	3	4	12	Appropriate levels of contingency included in project costs and timescales. Effective risk management processes in place. Review costs, cost forecasts and scope at the end of each phase	1	4	4	PM	27/07/2018	

Risk Register

ID	Type	Status	Description	Impact	Risk Probability	Risk Impact	Risk Score	Mitigation / Planned Actions	Mitigated Probability	Mitigated Impact	Mitigated Score	Owner	Last Updated	Date Closed
R4	Risk	Open	Solution does not deliver anticipated benefits	Lower than expected value delivered	3	4	12	Monthly tracking of progress and of anticipated benefits	1	4	4	PM	27/07/2018	
R5	Risk	Open	Partner/supplier performance is not adequate	Outputs delayed or inadequate and potential overspends	2	4	8	Robust procurement process Suitable incentives where required Shared responsibilities for deliverables	1	3	3	PM	27/07/2018	
R6	Risk	Open	Suitable equipment suppliers cannot be found	Project will be delayed or require re-scoping	2	5	10	Realistic requirements specified at FSP Early consultation with suppliers	1	5	5	PM	27/07/2018	
R7	Risk	Open	It is not possible to test equipment adequately prior to commencing the trial	Project may need to be re-scoped	2	5	10	Good understanding of supply chain Realistic requirements specified Potential test locations identified early on	1	5	5	PM	27/07/2018	
R8	Risk	Open	Unable to agree on Project contracts between UK Power Networks and partners	Project unable to proceed	2	5	10	Early discussion of contractual arrangements between partners	1	5	5	PM	27/07/2018	
R9	Risk	Open	Partner or supplier may withdraw from Project	Partner or supplier needs to be replaced	3	4	12	Robust procurement and due diligence Suitable incentivisation as required	1	3	3	PM	27/07/2018	
R10	Risk	Open	Suitable sites for trials not available	Demonstrations and trials cannot proceed	2	5	10	Site requirements developed as per the Design process and typical site conditions as early as possible	3	3	9	PM	27/07/2018	
R11	Risk	Open	Lack of business support from key departments in organisation in consortium/ partners	Project suffers delays or cannot proceed	2	4	8	Gain support early from senior management teams in each organisation. Early identification of an issue	1	5	5	PM	27/07/2018	

Risk Register

ID	Type	Status	Description	Impact	Risk Probability	Risk Impact	Risk Score	Mitigation / Planned Actions	Mitigated Probability	Mitigated Impact	Mitigated Score	Owner	Last Updated	Date Closed
R12	Risk	Open	Changes to key personnel	Project delays due lack of availability of personnel for key roles	3	4	12	Consider alternative personnel for each project team member. Develop a comprehensive on boarding/ induction pack and keep Project documentation up to date.	1	3	3	PM	27/07/2018	
R13	Risk	Open	Specification and build of trials and technology solution takes longer than planned	Project delays	2	5	10	Realistic timescales and contingency included in the Project plan. Review of costs and task durations at the end of each phase and revision of cost forecasts and scope as required.	1	3	3	PM	27/07/2018	
R14	Risk	Open	IPR requirements deter some suppliers from involvement	Suppliers must be replaced	2	4	8	Early discussion of IPR requirements with suppliers Alternative suppliers identified	1	4	4	PM	27/07/2018	
R15	Risk	Open	Integration of equipment and systems not achievable or takes longer than planned	Project delayed or cannot proceed	2	4	8	Collaborative design process with all key Project partners	1	4	4	PM	27/07/2018	
R16	Risk	Open	Major issues with equipment causing damage to network or causes injuries	Equipment is damaged or individual is injured	3	4	12	Analysis of this potential is carried out early in the project and recommendations are incorporated into the design.	1	3	3	PM	27/07/2018	
R17	Risk	Open	Partners may change their plans for the timing of the roll out of EVs and infrastructure	Re-planning and potential for Project delays	2	4	8	Work with partners in the early stages to ensure plans are realistic and build in contingency	1	5	5	PM	27/07/2018	

Risk Register

ID	Type	Status	Description	Impact	Risk Probability	Risk Impact	Risk Score	Mitigation / Planned Actions	Mitigated Probability	Mitigated Impact	Mitigated Score	Owner	Last Updated	Date Closed
R18	Risk	Open	The target number of EVs may not be available for the start of the trials due to lack of supply of LCVs at a competitive price in market or fewer PHV drivers adopting EVs.	Re-assess number of EVs required. Could delay Project until EVs available.	2	5	10	Work with partners in the early stages to ensure plans are realistic and build in contingency. Have alternative partners available if required	1	5	5	PM	27/07/2018	
R19	Risk	Open	Delays to the procurement and installation of infrastructure	Delays to the start of the trials	2	4	8	Plan procurement and installation as early as possible. Identify alternative suppliers if delays are likely. Monitor supply chain. Early discussions between our partners and car manufacturers to secure sufficient number of EVs	1	5	5	PM	27/07/2018	
R20	Risk	Open	OLEV EV subsidies are curtailed earlier than forecast	EV roll out slows and business case affected	2	4	8	Closely monitor legislative proposals with OLEV. Lobby where needed	1	5	5	PM	27/07/2018	
R21	Risk	Open	Adequate TCO for EVs cannot be achieved	Fleets do not invest in EVs or infrastructure	1	5	5	Project phased so this is identified at early opportunity to allow project to be halted	1	5	5	PM	27/07/2018	
R22	Risk	Open	Legislative changes mandate project methods, or make them illegal by mandating alternative methods	Project business case is not achievable	1	4	4	Closely monitor legislative proposals with OLEV. Lobby where needed	1	5	5	PM	27/07/2018	

Appendix 10.6 – Project Team and Organogram

The structure of the delivery team is shown in the diagram below.

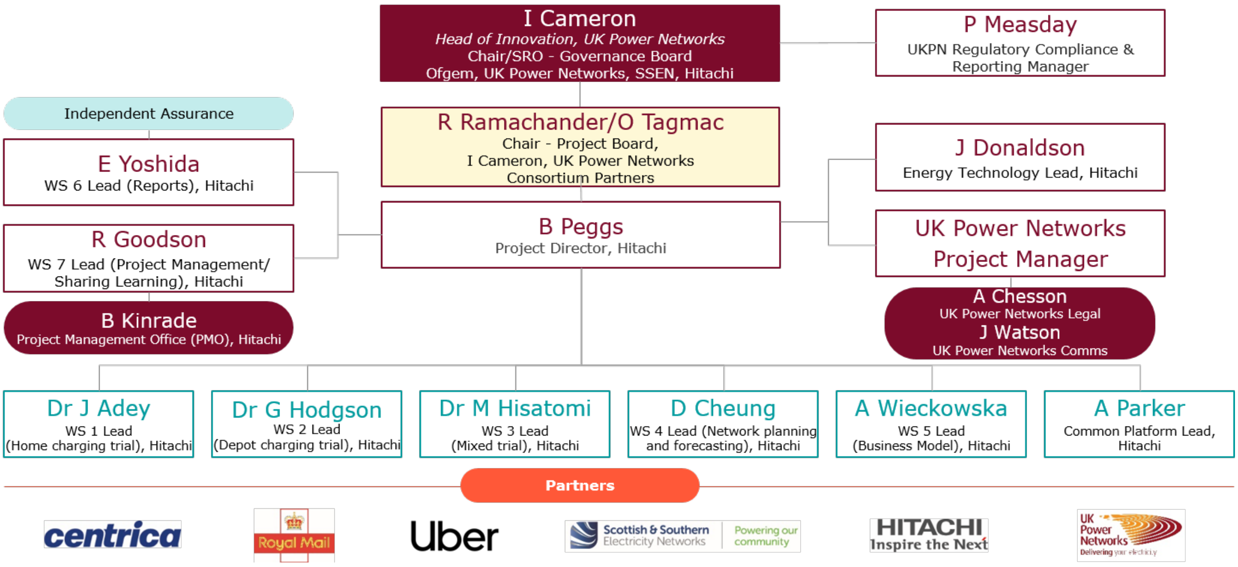


Figure 33 - Delivery Organisation Chart

The key roles and Project team members are set out below:

Ian Cameron, Head of Innovation, UK Power Networks. Ian will act as the Project's Senior Responsible Officer (SRO) monitoring progress. He will chair the Governance Board meetings. The Governance Board meetings will have representatives from Ofgem, UK Power Networks, SSEN and Hitachi.

Ram Ramachander / Oylum Tagmac, Hitachi. Ram or Oylum will chair the Project Board. This will be held every quarter and will require the Project Director and the Energy Technology Lead to report progress and issues. The Board will provide input and guidance as required. It is expected that a representative from each of the partners attends these meetings.

Brian Peggs – Project Director, Hitachi. Brian is the Customer Engagement Lead for Hitachi Vantara in EMEA, responsible for ensuring successful customer engagements and alignment of the respective business to business activity. He has a 32 year career spanning multiple market sectors, including automotive, where he was a business lead. He has worked in private and public sector consultancy, professional services delivery and large outsourcing engagements. He has been working with and solving solutions through a data driven approach and has recently implemented a customer live services analytics and reporting solution for Hitachi Vantara, which has created the foundation for Hitachi Vantara's global Smart Data Centre solution offering.

He will be the day-to-day contact point for the Project and will be responsible for its success by effectively leading and managing the various workstreams and partners. He will chair fortnightly progress meetings and report monthly to the Project Board. He will be responsible for proactively resolving issues and, where required, escalating issues to the Project Board.

Jim Donaldson CEng MEng – Energy Technology Lead. Jim is the Director of Innovation and leads the Smart Energy activities for Hitachi's European Social Innovation

Business. He is a chartered engineer and holds a MEng in Engineering Science from Oxford University. A specialist in software development, electronics and AI, and a holder of five patents, Jim has worked in the energy sector for over 10 years, enabling digital technologies to accelerate the development of a low carbon infrastructure. Prior to Hitachi, Jim was the co-founder of an Oxford University spin-out, developing innovative products to reduce domestic energy consumption. At Hitachi, Jim leads technology strategy, focussing particularly on helping customers to adopt new low-carbon transport solutions.

Dr Jonathan Adey – Workstream 1 Lead. Jonathan has over 10 years of experience in the Energy and Mobility Industry, having developed a number of key strategic Smart Energy, Mobility and IoT projects. He led a Hitachi team to secure over £10m of investment in a pioneering Smart Islands IoT demonstration project on the Isles of Scilly and is now establishing a ground-breaking V2G and mobility project as a part of the wider programme on the Islands. Prior to joining Hitachi Jonathan worked for two of the largest UK local authorities, developing and delivering award winning projects and programmes in the areas of climate change and sustainability. Jonathan is a Chartered Scientist and Fellow of the Energy Institute, he also sits on the Tech UK Smart Cities board, which provides an industry voice to both central and local government.

Dr Graeme Hodgson – Workstream 2 Lead. Graeme is a Chartered Engineer with 28 years of experience in a variety of roles within the telecommunications, energy and defence industries. His recent work has been with the Energy Systems Catapult researching alternative ways of delivering electricity to EVs as part of an “energy as a service” offer. Prior to that he spent two years in the defence industry leading a team of Systems Engineers and before that two years with Moixa launching their domestic battery system and undertaking initial work on their GridShare platform. Before joining the energy industry he spent more than 20 years in the telecommunications industry where he enjoyed a variety of assignments from researching AI to deploying large scale network infrastructure and product managing a programme for 3G terminal devices. He also has extensive experience of policy and regulation having been a Policy Manager at Ofcom where he was intimately involved with the creation of Openreach. In 2008 Graeme moved into energy via a MSc in renewable energy followed by an Engineering Doctorate focused on flexible demand services within the GB electricity system.

Dr Makiko Hisatomi – Workstream 3 Lead. Makiko has over 15 years of ICT innovation experience. She managed the EnergyPath Network project as Deputy Project Manager for the Energy Technologies Institute. This involved her in simulator design for commercial/technical viability of community energy. She has most recently worked on the requirements definition of an IoT platform which aggregates home optimisation and EV/battery management system for Hitachi’s Smart Energy Islands project.

Douglas Cheung – Workstream 4 Lead. Douglas has over 14 years’ experience in the implementation of smart technologies and electronics. His experience spans from managing and delivering projects for both private and public sectors, including energy, water, HVAC, oil and gas, dairy, pulp and paper and steel industries, to engineering/technical support and business development. Douglas’ main area of technical work is the design, development and delivery of Smart Grid/Smart Cities projects working with SMEs and Local Authorities, with a focus on network management, energy storage and EV solutions.

Anna Wieckowska – Workstream 5 Lead. Anna brings a combination of project management, stakeholder engagement and change management experience with policy and social science background (recent MSc in Environmental Policy at the London School of Economics). She has over ten years’ of experience in management consulting, including the delivery of Carbon Trust Public Sector Carbon Management Programmes, where she has supported 25 organisations in the development and embedding of carbon reduction targets and priorities. She was part of the project management team for the NEDO UK Smart Communities project in Manchester and has led Hitachi's delivery team on the ETI Smart Systems and Heat Programme's Consumer Response and Behaviour project. She was responsible for the commercial model development on the Isles of Scilly Smart Energy Islands project.

Eiji Yoshida– Workstream 6 Lead. Yoshi has deep experience in the areas of system integration, solution delivery management, technical liaison and software outsourcing management. His most recent activity was bi-directional EV charger development and delivery for a client in Netherlands. He can also design and develop Proof-of-Concepts covering from the edge device to the cloud service which would be useful in the early stages of the project.

Richard Goodson – Workstream 7 Lead. Richard will act as the Project Management Lead and brings 34 years of experience in project management and the project office function. Richard has worked for Hitachi since 2007 and has been a Vice President of the Consulting business. He has worked with the Carbon Trust and with the Energy Technology Institute on the Smart Systems and Heat Programme. Richard will be supported by Ben Kinrade who will take the role of the PMO Manager. Ben will also coordinate our activities to widely share learnings, insights and data from the project.

Andrew Parker – Common Platform Lead. Andrew has over 20 years' experience with Hitachi acting as Architecture lead on Global Transformation projects. Andrew will oversee the delivery of a modern scalable DevOps cloud neutral platform with inbuilt integrated Analytics and Machine learning capability. Ensuring that a set of common standards and practices are used in the acquisition, retention/sharing of data sets and machine learnings. Andrew has extensive experience in the exploitation of technical capabilities to deliver enterprise scale solutions that significantly move an organisation forward in how large data volumes are managed and processed.

Appendix 10.7 – Partners

Leading the Optimise Prime consortium is led by Hitachi (with three Group companies, Hitachi Vantara, Hitachi Europe and Hitachi Capital collaborating). The consortium includes a diverse set of partners, each with the ambition to be an early EV adopter, by way of electrifying vehicles, establishing new business models and commercial solutions or enabling the underlying infrastructure to support the EV transition. The Partners chosen for this Project bring different sets of EV transition challenges which are reflective of the most common issues faced by commercial fleets and PHV operators across the UK.

Table 21 summarises the role of each partner within Optimise Prime, their contributions to the project and the benefits they are deriving from it.

Table 21 - Partner contributions and benefits

	Role	Scope value	Contribution (£m)	Benefits derived from project	Justification of contribution
HITACHI Inspire the Next	Project lead: management, implementing IoT Platform, lead on analytics and dissemination	£17.68m of which Hitachi is part funding 25%; consisting of IT infrastructure , analytics resources, services, project and trial management	4.36	• Learnings on the challenges for fleets to transition to EV to support our fleet customers -this is why we have brought Centrica to the consortium. • Learnings on how analytics and data science solutions can help DNOs better manage the grid and extract greater efficiency. • Project in line with our Social Innovation principles. • Gain better understanding of the value streams associated with behind the meter optimisation, and the value of such solutions to DNOs in particular.	• Hitachi is significantly discounting its commercial rates for time and ICT systems as a project contribution. • As the project lead a significant proportion of costs are related to the running of the project (labour and overhead costs on project management and data analytics) and its trials and do not result in long term benefit to Hitachi. • Hitachi aims to learn about fleet, DNO and energy optimisation challenges through the analysis in the trial and it does not intend to use the project to directly fund products it will readily offer after the project closure.
UK Power Networks	Lead DNO partner, network constraint information and flexibility expertise	£3.57m, financial contribution of 52% (10% of Initial Net Funding)	1.85	• Early access to solutions, and data for optimising forecasts and investment plans. • Benefits to customers (connected and connecting).	• NIC Governance requires the Funding Licensee to contribute 10% of the Initial Net Funding. This is more than half of UK Power Networks' costs.
Royal Mail	Depot Charging Partner: Electrifying Royal Mail vans and depot infrastructure	£10.78m, 92% contribution for 233% more electric vans than planned with required infrastructure	9.88	• Solution allowing Royal Mail to electrify economically, accelerating decarbonisation of their fleet. • Environmental, economic and reputational benefits from a faster transition to ultra low emission vehicles.	• Provision of vehicles and chargers to the project is entirely covered by the Partner. • Funding requested covers additional project management staff costs directly related to participation in the project.
centrica	Home Charging Partner: Electrifying British Gas vans; integrating REstore platform	£1.77m, 90% self funded REstore development and 150% more electric vans than planned	1.59	• Improved total cost of ownership for fleet EVs. • New energy and aggregation offerings that can be offered in the future by Centrica and REstore. • Environmental, economic and reputational benefits from a faster transition to ultra low emission vehicles.	• Provision of vehicles and chargers to the project and development of the REstore platform is entirely covered by the Partner. • Funding requested covers additional project management staff costs directly related to participation in the project.
Uber	Mixed PHV Partner: PHV charging data widens scope of charging pattern understanding	£0.42m, 87% contribution of data provided free to the project	0.37	• Understanding of the challenges and solutions for the electrification of PHVs, including the identification of charging patterns and constraints.	• Funding requested covers additional resource required to extract and manage data that is required by the project. • Data is provided to the project without charge.
Scottish & Southern Electricity Networks	DNO Partner: EV expertise and ensuring replicability of solutions developed	£0.47m, contributing 10% of costs	0.05	• Early access to solutions, and data for optimising forecasts and investment plans. • Benefits to customers (connected and connecting).	• Funding requested mainly covers project management staff costs for the duration of the project.

10.7.1 The Optimise Prime consortium partners

Hitachi – Lead Partner

Hitachi first proposed the idea for this project following UK Power Networks' call for innovation in 2017.

Hitachi's global strategy is to deliver Social Innovation – developing technology that benefits society. Hitachi achieves this through a co-creation working in close partnership with clients to address their challenges.

Hitachi brings extensive experience in delivering energy innovation projects, including the ERDF funded Smart Energy Islands (and related NIA project Smart Energy Isles), ETI's Smart Systems and Heat Programme, the NEDO Smart Community Demonstration Project in Greater Manchester and the JumpSmart Maui vehicle-to-grid demonstrator in Hawaii.

Hitachi also brings a unique set of industry domain knowledge in both the areas of Transportation and Energy, along with expertise in both operational technology and IT to deliver the Internet of Things (IoT) platform and smart solutions, which will interface with the DNOs and fleet and PHV operator partners.

Hitachi will also provide of a significant amount of Background IP, technical and commercial knowledge to the Project. They will gain insight into the challenges of the energy, fleet and mobility service providers and sectors adopting EV technologies that they will utilise to develop future commercial offerings for these sectors.

Hitachi Capital Vehicle Solutions will bring fleet management and EV expertise. They also manage a fleet of around 60,000 vehicles in the UK, providing a safety-net to help ensure the project reaches its 2,000-3,000 EV target.

Distribution Network Licensee Partners:

London Power Networks plc is the funding Licensee for this Project, it will be working with the other UK Power Networks Licensees, Eastern Power Networks plc and South Eastern Power Networks plc covering the London, South East and East Anglia regions. We are also working with Scottish & Southern Electricity Networks, whose Southern Electric Power Distribution plc Licensee area covers parts of West London and Southern England adjacent to the UK Power Networks area.

The growth of EVs brings considerable uncertainty to GB DNOs. DNOs need to understand the impact of EVs to enable them to plan effectively for networks upgrades – ensuring that grid operation can be maintained.

DNOs must deliver value to network users and must compare the costs and benefits of smart energy management solutions, such as demand response, to traditional grid reinforcement.

UK Power Networks will support Hitachi in the running and governance of the Project, guiding the Project to ensure that it delivers the required benefits to the distribution network. UK Power Networks will also provide DNO services throughout all the workstreams, which will also including consultancy services and feasibility studies for sites and connections, engineering and support knowledge dissemination.

SSEN is a Partner. It will allow the Project to cover a wider geographical area, including the whole of Greater London. Collaborating with a second DNO group will help to ensure that the methods and solutions developed by the Project are applicable throughout the

GB DNOs. SSEN also brings strong experience of working on EV-focused projects, including the third party led My Electric Avenue LCNF project.

Through this Project both DNOs will gain a firmer understanding of the grid impacts of commercial EVs, and EV charging infrastructure, based on a large scale trial. It will be able to measure the cost and effectiveness of smart control solutions (including customer acceptance), informing the adoption of this technology in the future.

Uber - Private Hire Vehicle Operator (Mixed Charge Partner)

Uber is the fastest growing private hire vehicle (PHV) operator in the UK. Over 70,000 partner-drivers use the app in the UK, with the majority in and around London. The company has ambitious electrification plans for its most popular private hire product (UberX) in London. Uber plans to transition the London based UberX drivers operating on its app to electric vehicles by 2025.

Uber is the Project Partner for **Workstream 3 - Mixed Charging**. Uber's contributions to this Project will be through sharing anonymised driver journey data on up to 1,500 electric vehicles which will allow to study and analyse the routing, driver behaviour, usage patterns and network impacts. Uber will also promote and encourage Project participation to its driver partners and EV infrastructure partners, when reasonable and appropriate.

Uber's contribution to the project is based on the calculated value of the data that the company will provide. The contribution figure of £0.4m is based on the minimum contribution. Uber will potentially contribute up to £1.08m should sufficient data of use the project be available.

Uber will benefit from the shared learning of working closely with other consortium partners throughout the Project, taking learnings around depot charging, identification of charging patterns and constraints and connection management as it considers the future implementation of EV charging hubs.

Centrica – Energy Company (Home Charging Partner)

Centrica is both a fleet and a technology partner. Its home-based British Gas fleet will participate in the Project, **Workstream 1 – Home Charging**; while Centrica will also provide charging solutions for the home-based fleets as well as demand response services from subsidiary, REstore.

Centrica's British Gas fleet operate the third largest commercial fleet in the UK, including 13,000 maintenance vans which are predominantly kept at home by drivers. This project is expected to help Centrica transition 150% more vehicles than they had originally planned over the next three years by making the transition to electric more economical than diesel. Centrica are projected to invest £9.8million in EVs and the installation of smart charging infrastructure over the life of this project. Centrica will also participate in **Workstream 4 – IoT Platform, Network Forecasting & Flexibility Analysis**. Centrica wishes to gain insight into how technology can be used to accelerate the transition of its fleet to EV, and how it can streamline the management of EV charging.

In addition to its fleet learning, Centrica will use the learnings from this Project to evaluate the role of EVs in its commercial offerings to its larger customers in its Distributed Energy and Power business and its retail customers as well. Additional insights for home energy management (through Centrica's Connected Home business), local energy markets and the REstore aggregation platform are also desired learning outcomes. The REstore EV aggregation services will also be provided by Centrica as part of their partner contribution.

Royal Mail – Postal Services (Depot Charging Partner)

Royal Mail provides postal delivery and courier services throughout the UK. It manages the largest vehicle fleet in the UK with over 48,000 vehicles based at 1,700 delivery offices. National and local emissions regulations mean that Royal Mail must transition to an Ultra-Low Carbon Vehicle fleet, the company also expects to realise environmental and economic benefits from the switch to alternative fuels.

Royal Mail is the Optimise Prime depot charging fleet partner for **Workstream 2 – Depot Charging**. It will invest in EVs and infrastructure and provide access to its vehicles and depots for the purpose of the Project. This project is expected to help Royal Mail bring forward their EV transition plans by three years, if possible electrifying 1,000 vehicles. This is more than 233% of Royal Mail's originally planned transition of 100 EVs per year. Royal Mail is expected to invest £23.6 million on procuring new EVs and smart charging infrastructure over the life of the Project.

Royal Mail will also participate in **Workstream 4 – IoT Platform, Network Forecasting & Flexibility Analysis** to understand and learn what benefits could be achieved though flexibility.

Through this Project and by working with the Optimise Prime consortium, Royal Mail aims to identify solutions (technical, operational and commercial) to transition to EVs at scale faster and more cost effective through the management of vehicles, grid connections and depot energy infrastructure.

10.7.2 Partnership Structure

All of the Optimise Prime partners have agreed and signed a Memorandum of Understanding (MoU) intended to establish a shared commitment and framework to collaboratively design and develop the Optimise Prime project. Industrial Partners have also signed a Letter of Intent (LoI) that sets out the intended specific partner commitment and proposed benefits and basic commercial and IP agreement principles.

A collaboration agreement, shown in Figure 34 will be created to cover the following aspects of the project:

- Purpose and scope of the Project
- Project Management roles and obligations
- General responsibilities and liabilities
- Process for addition of new parties and variation of agreement
- Warranties
- IPR Ownership and requirements relating to Background and Foreground IPR
- Permitted use of IPR and licence requirements to use each other's IPR in accordance with Ofgem governance
- Control of publications and announcements

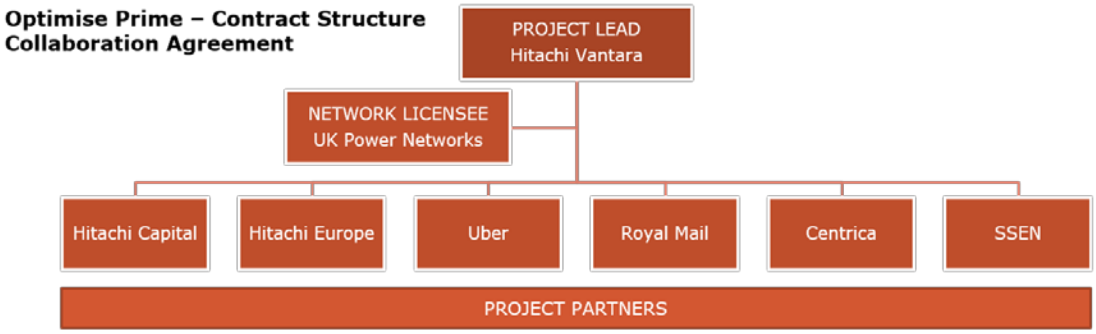


Figure 34 – Collaboration Agreement

In addition to this, a series of project agreements will be made between Project Partners, as shown in Figure 35, to govern the following issues:

- Specific project focused responsibilities, workstreams and deliverables of each Project Partner
- Key people involved in project
- Programme and milestones
- Requirements re. provision of data by Project Partners
- Insurance and liabilities
- Payment of milestone payments and financial management

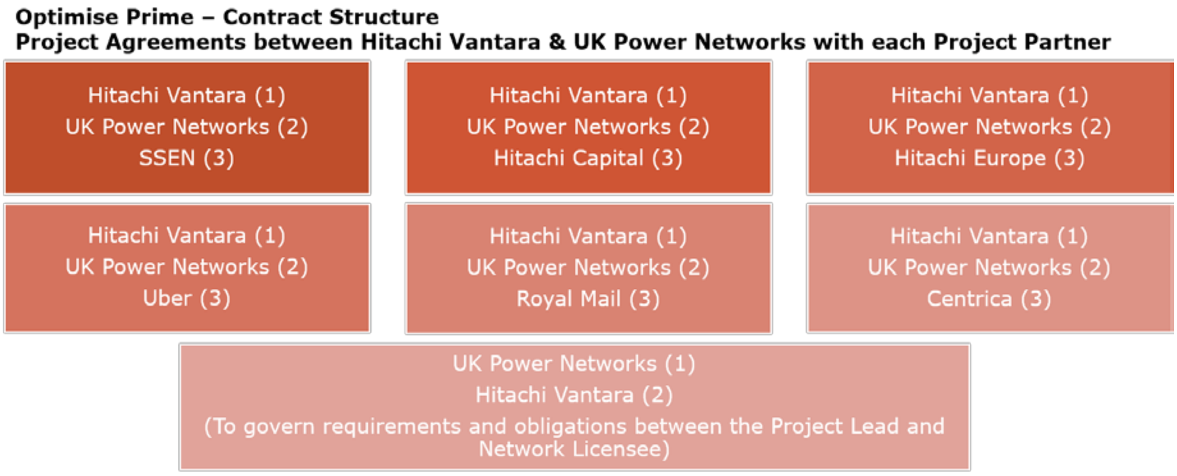


Figure 35 - Project Agreements

Appendix 10.8 – Letters of Support

10.8.1 Office for Low Emission Vehicles

Office for
Low Emission
Vehicles

Ian Cameron, Head of Innovation
UK Power Networks
Newington House
237 Southwark Bridge Road
London
SE1 6NP

16 July 2018

Dear Ian,

Letter of Support for Optimise Prime, Network Innovation Competition bid 2018

The government's ambition is to put the UK at the forefront of a global revolution in motoring and help to deliver cleaner air, a better environment and a strong, clean economy. As part of the Road to Zero strategy, the Office of Low Emission Vehicles is supporting the transition away from diesel and petrol-powered vehicles with the aim of at least 50% of cars and 40% of vans sold being ultra-low emission vehicles by 2030 and 100% by 2040.

To achieve these goals it is vital to ensure that the energy system can meet future demand from electric vehicles in an efficient and sustainable way. We believe that the use of smart technologies and innovative business models, such as those proposed in this project, have the potential to enable better utilisation of existing grid infrastructure, facilitating the additional capacity required. This project complements the unprecedented investment that the government is making in electric vehicle charging infrastructure, including Vehicle-to-Grid, and in promoting the design and manufacture of electric vehicles in the UK.

The transition to ultra-low emission vehicles will be led by industry and consumers; as such we welcome the collaborative approach proposed between UK Power Networks, technology companies and vehicle fleet operators to develop and trial solutions that are cost effective for both the electricity networks and commercial vehicle users. Commercial vehicles, especially diesel vans, currently contribute disproportionately to CO_2 and NO_x emissions; due to this it is critical that the barriers to the electrification of commercial vehicles are removed.

We would be delighted to support the Optimise Prime project, should your bid be successful.

Yours sincerely,

Nicholas Brooks
Head of Energy, Office for Low Emission Vehicles
Email: nick.brooks@olev.gsi.gov.uk

MAYOR OF LONDON

Date: 1 August 2018

Ian Cameron
Head of Innovation
UK Power Networks
Newington House
237 Southwark Bridge Road
London
SE1 6NP

Dear Ian,

I am writing to express my support for the UK Power Networks Optimise Prime Network Innovation Competition bid 2018.

Accelerating the delivery of electric vehicles and charging infrastructure is critical in the coming years to tackle the urgent environmental challenges facing our capital, as well as safeguarding London's environment over the longer term. To do this, industry, businesses and the public sector need to come together and work together to decide how, when and where this happens.

The Mayor's Electric Vehicle Infrastructure Taskforce aims to develop a cross-sector Delivery Plan for the capital and it is helpful that UKPN have joined this initiative as it is imperative London's low voltage network can deliver our ambition. The Taskforce has received huge support across the board, showing it is not just an environment or transport issue but one that is vital to the good growth of our city.

We would be delighted to see the Optimise Prime project taken forward. Enabling the world's biggest commercial electric vehicle trial with some of the UK's largest commercial vehicle operators will lead to an invaluable demonstration project. The smart solutions and business models being trialled have potential to make it easier for fleet operators to switch to electric vehicles and the extensive datasets will support the work of our Taskforce.

This investment will help to develop an integrated energy system that can deliver secure, affordable and ultimately zero carbon energy to our residents, businesses and transport system. Furthermore, by helping businesses switch away from diesel we can improve the health of Londoners, support economic growth and make our city an even better place to live.

Yours sincerely,

S A Rodrigues

Shirley Rodrigues
Deputy Mayor for Environment and Energy

City Hall, London, SE1 2AA - london.gov.uk - mayor@london.gov.uk - 020 7983 4000

Transport for London

Ian Cameron, Head of Innovation
UK Power Networks
Newington House
237 Southwark Bridge Road
London
SE1 6NP

Transport for London
Transport Innovation Directorate

Palestra
197 Blackfriars Road
London
SE1 8NJ

tfl.gov.uk

1 August 2018

Dear Ian

Letter of Support for Optimise Prime, Network Innovation Competition bid 2018

This letter is written in support of UK Power Networks' (UKPN) Optimise Prime bid into the Network Innovation Competition.

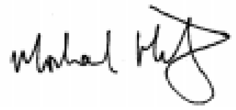
The Mayor, through TfL and working with stakeholders, will seek to make London's transport network zero emission by 2050, contributing towards the creation of a zero carbon city. The Mayor's aim is to encourage more Londoners to make the switch from diesel to electric cars, which is vital to tackling the city's air pollution and to meeting tighter air quality standards. In May this year the Mayor launched a new taskforce dedicated to boosting the infrastructure needed to increase the take-up of electric vehicles across the capital. He will also encourage the boroughs, Government and all those involved in the taskforce to work together and redouble efforts to install vital charging points.

It is essential that London's electricity grid is able to respond to these demands. Our own experience in working with UKPN to connect charging infrastructure at a number of bus garages, shows that the grid serving London could be a constraint to the Mayor's plans. We are at the early stage of transition; by 2020 approximately 300 single deck buses serving central London will be zero-emission – the aim is for the whole TfL bus fleet of over 9,000 vehicles to emit zero exhaust emissions by 2037 at the latest.

Optimise Prime will generate a vast amount of data which could be used by all the UK's distribution network operators to improve their load forecasts which are then used for planning network upgrades and informing investment plans. Specifically for London, Optimise Prime – by analysing routing information from the participating commercial vehicle fleets, could also inform the Mayor's taskforce about appropriate locations for additional public charging infrastructure.

The project's proposed planning tool and the profiled connections assessment tool could also help depot based fleets – such as London's buses, to be electrified more cost effectively by optimising their capacity needs. At Transport for London we understand how innovation plays a vital role to ensure the UK electricity system can deliver cost effective solutions to network constraints at the lowest cost and impact to all customers. As such, we would be happy to support the Optimise Prime project, should your bid prove successful.

Yours sincerely,



Michael Hurwitz
Director of Transport Innovation
Transport for London
michaelhurwitz@tfl.gov.uk

SP ENERGY NETWORKS

Network Planning & Regulation

Ian Cameron, Head of Innovation
UK Power Networks
Newington House
237 Southwark Bridge Road
London, SE1 6NP

Date
30th July 2018
Contact / Extension
0141 614 1953

Dear Ian,

Letter of Support for Optimise Prime, Network Innovation Competition bid 2018
We believe there is a growing certainty that the rate of uptake and ultimate scale of EVs will have a major impact on electricity networks in the future. We are therefore in full support of UK Power Networks Optimise Prime project and see it, along with our own Charge proposal, as a vital step to improving our understanding of the impact of EVs on our networks and ensuring we can facilitate the Low Carbon Economy at the lowest overall cost to customers.

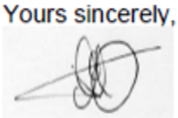
Like UK Power Networks, we are committed to facilitating the transition to a low carbon energy and transport system. Our Charge project, similarly to Optimise Prime, is focusing on innovative ways of enabling the uptake of electric vehicles (EVs). However, through our discussions to date, it is clear that these two projects are distinct and will be addressing very different areas, both of which are required to facilitate the transition to electrified transport.

Optimise Prime by focusing on commercial EVs and gathering operational data from a significant number of fleet vehicles will create a unique new dataset that will add to the global body of knowledge in this area. This data will complement the work we are proposing in our Charge project, and the complementary project outputs will enrich industry charging infrastructure planning work and the connection propositions for EV charging points.

It has been constructive discussing with you the synergies between our two projects. As a result of these discussions we are committed to work collaboratively with one another, sharing outputs and combining our dissemination activities.

We are delighted to support this bid and recognise the important learning it will provide to industry.

Yours sincerely,



Jim McOmish
Head of Distribution Networks

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