ACTIVITIES 1

Helping Fleets Achieve Accelerated Electrification

Optimise Prime Initiative in the UK

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Optimise Prime was the world's largest commercial electric vehicle innovation project in the UK, which aimed to accelerate the transition of fleets to zero emission vehicles by reducing barriers that could be caused by electricity distribution networks. Over the last four years, Hitachi has led a group of partners, including major UK fleets, electricity networks and technology providers, in order to gather data on the usage of commercial EVs and trial new methods that will reduce impact on electricity infrastructure. The project has recently concluded, exceeding its original goals by involving over 8,000 EVs across the UK. The data gathered will help power networks and local authorities plan to meet future EV charging demand, while the project also proved that new connection and demand-side-response products will help fleets and networks electrify cost effectively. Hitachi is building on the project's findings to provide services that help fleet operators accelerate their electrification.

Introduction

Poor air quality in cities is a significant driver of early mortality—in 2019 it was estimated that around 4,000 lives were lost each year in London as a result toxic air, primarily emitted by road transport[1]. To combat this, recent years have seen significant policy changes to reduce local air quality issues, such as congestion charging and the Ultra-Low Emissions Zone, coupled with national and international efforts to achieve net zero transportation. To comply with these requirements, as well as corporate sustainability goals, fleet managers must manage a significant transition to new vehicle technologies.

The wider availability of electric vehicles (EVs) is now allowing more commercial fleets to electrify, with the global EV100 consortium recently announcing that its members have over 400,000 EVs on the road[2]. This rapid transition poses significant challenges for local authorities, infrastructure operators and electricity distributors, who need to ensure that infrastructure is in place to support EV growth while managing cost incurred by the public. To overcome these challenges, a partnership approach is required—Hitachi Europe and Hitachi Vantara brought together a consortium including electricity distributors UK Power Networks and Scottish and Southern Electricity Networks, major vehicle operators Royal Mail, Centrica, and Uber, and leasing company Novuna Vehicle Solutions to form Optimise Prime. The project's objectives were to gather quantitative data on large scale EV operations while trialing innovative techniques to limit the impact of increased electrical demand on the electricity network. The aims of Optimise Prime were introduced in *Hitachi Review* Vol. 69, No. 4[3] published in 2020 and this article provides an update on the findings from the project and how Hitachi is using these learnings to develop solutions for the electrification of fleets.

How Commercial Fleets Are Adopting Electric Vehicles

Data from over 8,000 EVs were collected and analyzed throughout the Optimise Prime trials. This included telemetry and charging data from light commercial vehicles operated by Royal Mail and British Gas, in addition to trip data private hire vehicles (PHVs) operating on the Uber platform. Study of this data highlighted the range of different journey patterns amongst the fleets. While British Gas's return-to-home fleet generally started charging in the early evening, when demand on the electricity network is highest, Royal Mail's postal delivery fleet often charged in the early afternoon or late evening (see Figure 1), depending on shift patterns at specific depots. PHVs charged throughout the day, however their demand peaked overnight.

Understanding these patterns is useful to the network operator, who may presume that all new EV load impacts their peak demand, potentially triggering network upgrades. With accurate charging data, realistic load growth predictions for their networks can be created, avoiding unnecessary network infrastructure upgrades. This keeps costs down for electricity bill payers.

The analysis of data helped identify seasonal changes in demand, caused by both vehicle efficiency and variations in vehicle activity—for example in the British Gas fleet, vans needed 30% more energy overall in the winter with range per kWh reducing by 7% for every 10°C decrease in temperature.

Future demand growth was forecast based on the data gathered by the project and the electrification plans of the partner fleets. These forecasts for each fleet revealed insights into how demand for electricity and charging infrastructure is likely to develop as the transition to EVs continues to accelerate.

Once all Uber vehicles in Greater London are electrified it was estimated that, if drivers opt for 7 kW charging near their homes, an additional 33,600 chargers may be needed throughout Greater London. As the capacity of EV batteries increases it's expected that demand will shift, with less 'on-shift' charging required during the day, and as the rollout moves from 'first adopters' to all drivers, the locations where charging infrastructure is needed will change (see Figure 2).

New Technology and Commercial Models Can Reduce Impact on Electricity Distribution Networks

Smart charging, where charging times and speeds are altered in order to reduce cost or manage load, has been

Figure 1 | **Unmanaged Load at Royal Mail Depots**

The figure shows how peak load often falls outside the electricity network's evening peak.

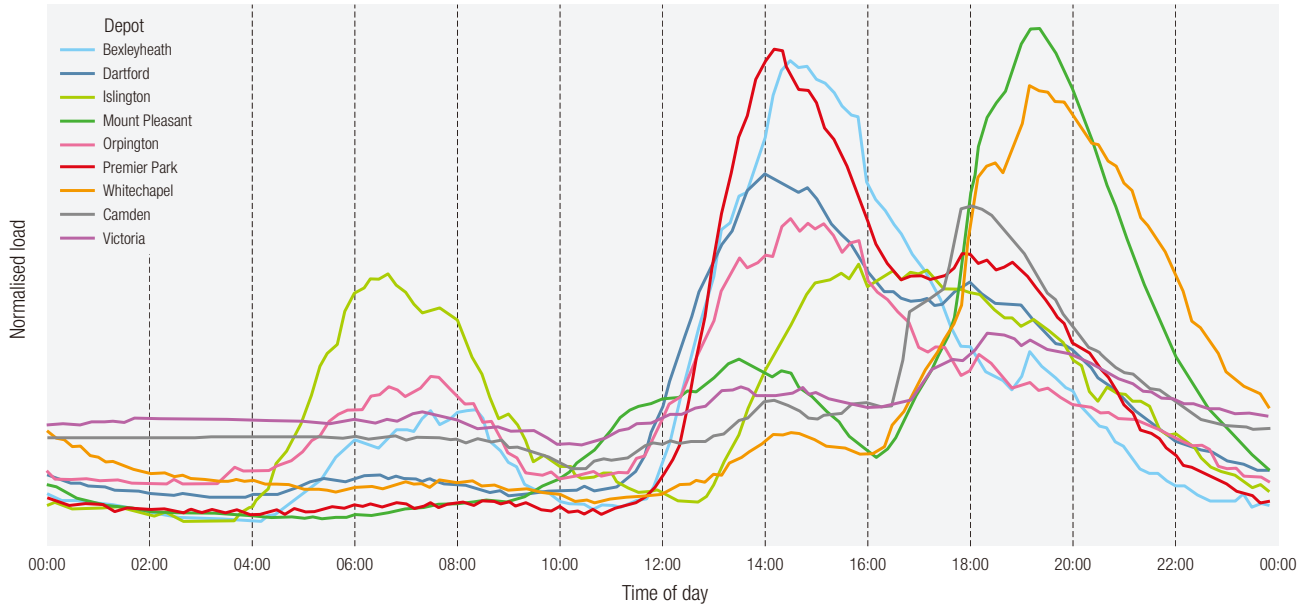
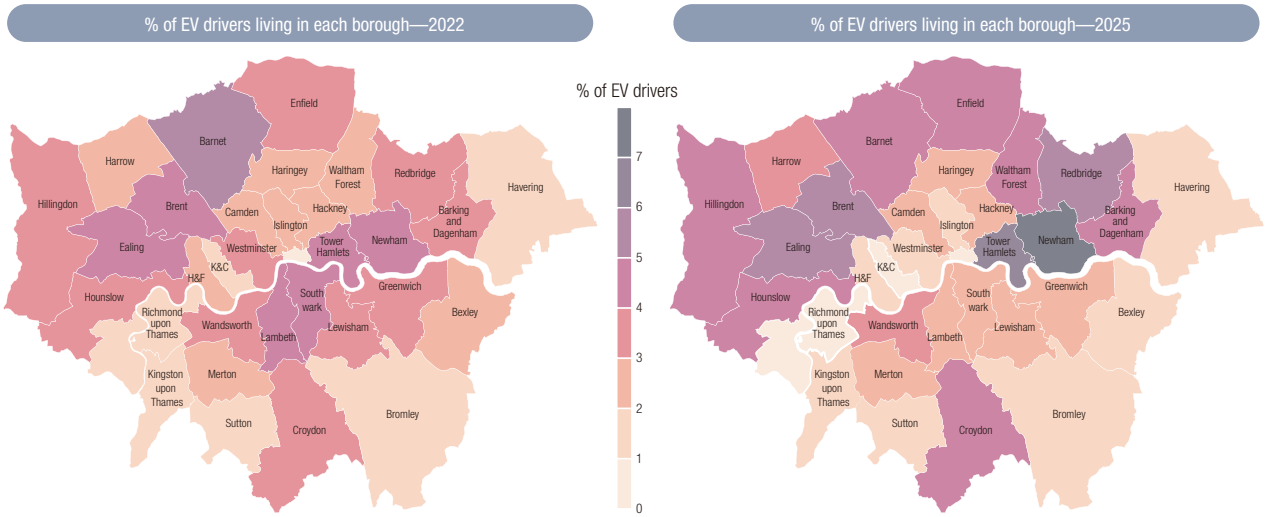


Figure 2 | Expected Change in Relative Demand for EV Chargers across London 2022–2025



EV: electric vehicle

identified as a key technology in managing the impact of electric vehicles. However, if all assets are following the same price signals to minimize cost, it may increase load peaks. Depending on local constraints this may create a greater problem for the distribution network and it is useful for a network operator to have a range of tools to influence load. Hitachi implemented charging control systems at nine Royal Mail depots across London to test several different methods of controlling and incentivizing smart charging (see Figure 3).

Flexibility services, where the network operator makes a payment to a customer in return for reducing load at peak times, are an established tool for network management, often utilized by companies with large industrial loads that can be controlled. Hitachi aggregated the predicted load from EVs charging at each depot and offered demand response services to the network operator. When an offer was accepted, the charging control system reduced the capacity available to EVs charging at the depot.

The same system was also able to manage load over a longer term by managing the EV demand in line with a new connection product called a 'profiled connection.' This allowed demand limits to vary every 30 minutes of the day and dynamically allocate capacity for EV charging in line with the available capacity on the network. This contrasts with a typical, fixed allocated capacity that can lead to underutilized network infrastructure.

Optimise Prime successfully proved the technical feasibility of both flexibility services and profiled connections.

Figure 3 | EVs Charging at Royal Mail's Mount Pleasant Mail Centre in Central London

However, the project also identified limitations that must be considered when designing solutions of this type. For example, the volume and timing of charging is much more difficult to predict at smaller depots, making the accurate provision of flexibility challenging. With profiled connections, the EV load must be sufficiently large to counter any variance in background load, and profiles may need to be updated periodically to account for seasonal variations.

Understanding the Views of Drivers and the Barriers Faced by Businesses

In addition to the technical trials, the project undertook analysis of financial and behavioral factors that may impact how quickly fleets electrify.

An understanding of the economics of fleet electrification is crucial for fleets, network operators, and other stakeholders, as the cost-benefit analysis impacts upon how quickly fleets will electrify. The project's financial models explore the costs faced by fleets, taking into account the impacts of recent changes, such as variations in electricity, fuel, and vehicle prices and the effects of government policies.

Financial motivators are not the only value consideration when fleet managers choose to switch their fleets to EV. Environmental and reputational benefits are a key consideration, as is ensuring that business can carry on as usual and that drivers are happy with their new working environment. Optimise Prime explored behavioral aspects of the transition to EV by collecting over 3,000 questionnaire responses from drivers and managers across 8 fleets. The surveys included questions on adoption, barriers and enablers, user experience and changes in their experience over time. While the results showed an overwhelmingly positive opinion of EVs, they highlighted pain points, including concerns over charger accessibility, which fleets should consider when planning infrastructure rollout and driver education.

The Impact of Optimise Prime

As a project that spans the domains of transport and energy, Optimise Prime has created a wide range of benefits for a breadth of stakeholders. The project's final event, held in London in January 2023, invited participants from throughout the fleet and energy industries to hear the project's results and participate in a panel discussion with Optimise Prime fleet managers (see Figure 4).

Optimise Prime set out to quantify and minimize the network impact of EVs while developing the value proposition and technical requirements for fleets and distribution network operators (DNOs). This has been achieved, with the project identifying significant potential savings for fleets that can be achieved by implementing smart charging and quantifying revenues available from flexibility services. The outcomes from Optimise Prime, including a substantial dataset, have been made public so that other organizations can benefit from the project's findings[4].

Hitachi's Solutions for Fleet Decarbonisation

Hitachi ZeroCarbon, a division of Hitachi Europe Limited, is responsible for developing solutions that help fleet operators electrify and reach net zero. Lessons learnt from Optimise Prime, and the technologies developed as part of the project are being implemented to help customers electrify their fleets economically. As an example of this, Hitachi has entered into a strategic partnership with First Bus, one of the largest bus operators in the UK, and has implemented smart charging software to control site demand, manage battery health, and offer the charging infrastructure at First's Glasgow depot to third-party fleets, creating new revenue streams. Hitachi is working across Europe to deliver charging and energy management

Figure 4 | **Panel Session at Project Close Down Event**

solutions, together with managed services and battery financing, which enable customers to meet their carbon reduction goals.

Conclusions

Optimise Prime has shown how the use of data and advanced charging control techniques can provide benefits to both electricity distribution networks and fleet customers, reducing costs of electrification. In turn, this reduction in costs can encourage companies to transition to EVs more rapidly, bringing substantial environmental benefits.

Hitachi ZeroCarbon is helping fleet managers benefit from the opportunities that EVs bring to reduce companies' impact on the environment. With the findings from Optimise Prime, and the technology developed as part of the trials, Hitachi offers end-to-end energy and mobility solutions that make that transition achievable and cost effective.

References

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