cenex PAUA Suffolk County Council OXFORDSHIRE COUNTY COUNCIL

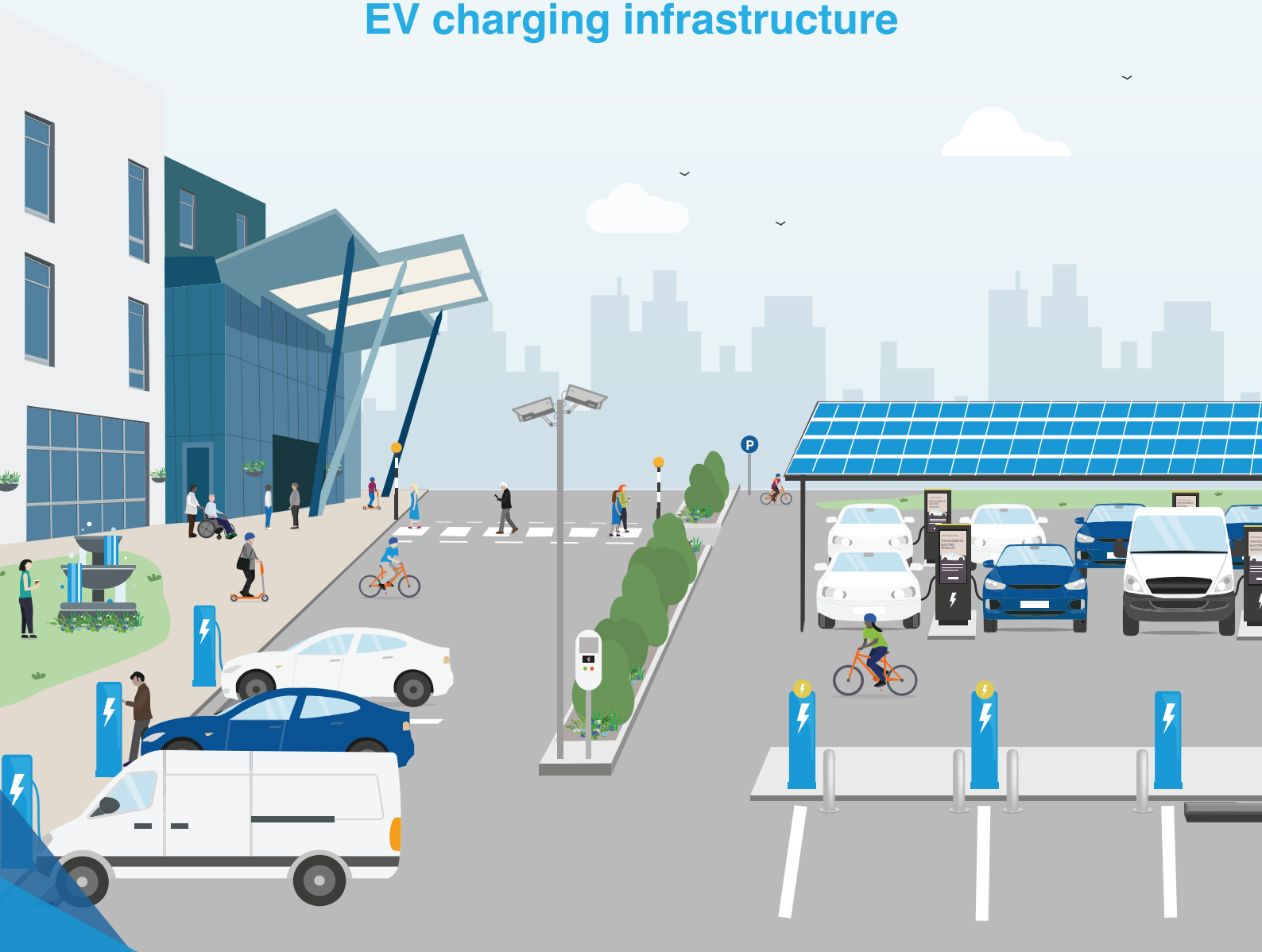
Transport

Energy Infrastructure

Knowledge & Enterprise

Paua PINS

A project funded by Innovate UK to understand the role of shared private EV charging infrastructure



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Executive Summary

Sharing charging infrastructure

The Paua PINS (Private Infrastructure Network Solution) project, funded by Innovate UK, demonstrated the role that a shared private infrastructure network can provide to support local authorities (LAs) and businesses as they electrify. There are fleets that are unable to complete their daily operations using electric vehicles (EVs), due to range concerns from particularly energy intensive duties, or due to being unable to charge at their own depots. For these vehicles, public charging can be an unacceptable option due to security, availability or cost concerns. Therefore, PINS could represent the optimum method for allowing the decarbonisation of specifically challenging to transition vehicles. The wide variety of depot types across organisations means that the specific challenges facing fleets can potentially be overcome by using another companies' infrastructure. This white paper presents the qualitative and quantitative implications of PINS.

Matchmaking

Fleets must understand what type of depot would be best for them to share with. To make this process easier Cenex has produced a **matchmaking tool.** The tool defines several depot archetypes to generalise UK depots and allow a fleet to determine the types of organisations to approach. It determines, based on answers to 9 questions, how good a match the fleet and depot archetype are. Based on the results of this tool, we determined three types of fleets that need PINS the most to fulfil their duty cycles, while they have good matching attributes with several host depot archetypes. These are utility, delivery/courier, and emergency fleets.

Qualitative analysis of PINS

Policy aspects

The UK is rapidly shifting to EVs and, while government incentives support EV adoption, they do not promote shared depot charging. LAs face monetary and planning challenges in leading shared infrastructure, so commercial fleets should take the lead with LAs supporting them. From the policy perspective, the PINS-related suggestions are to simplify chargepoint planning permissions, provide clear depot-sharing guidelines, support collaboration via platforms like **Paua Share**, and incentivise depot-sharing participation.

Social aspects

A successful implementation of PINS relies heavily on employee engagement and organisational culture. Concerns from drivers and depot/fleet managers can be mitigated by clear communication of PINS benefits, reassurance about addressing operational impacts, clear operational protocols, staff training, and tools like RACI (Responsible, Accountable, Consulted, Informed) to clarify roles.

A powerful tool to address behavioural change in the PINS context is the COM-B model (Capability, Opportunity, Motivation, Behaviour). An example of applying COM-B to PINS is included in this report.

Our key social recommendations include engaging staff to understand their concerns, communicating progress clearly, providing training on shared charging use and benefits, and monitoring feedback to continuously improve practices.

Technical aspects

Shared depot charging solutions need strong data interoperability between fleet, depot, and charging systems. Open standards like OCPI (Open Charge Point Interface) enable seamless integration and EV roaming, while controlled data access is key for security and efficiency. Some reliability concerns include chargepoint downtime (visitor fleets) and increased wear and maintenance (host depots). Regular inspections, preventative maintenance, and extra staffing may be needed, with costs offset through markup in the tariff charged by hosts.

Our key technical recommendations include integrating systems using open protocols, using real-time platforms like **Paua Share** for scheduling and availability, setting up clear payment, access, and security protocols, allocating dedicated visitor charging bays, and providing maintenance plans and troubleshooting guides.

Legal aspects

Some existing informal partnerships between LAs, fleets, and charging providers show promise but need formal legal frameworks to support large-scale depot sharing. A major concern is liability: hosts worry about damage, accidents, and disruptions caused by visiting fleets, especially in high-uptime operations like emergency, utility, and delivery services. To reduce risks, clear liability agreements are essential, defining responsibilities for hosts and visitors, as well as working with EMSPs (e-mobility service providers) and CPOs (chargepoint operators) that have agreements in place which clearly define the split of responsibilities amongst them. Data protection is also key, with organisations required to comply with GDPR (general data protection and regulation).

Our legal recommendations are to create formal liability agreements, partner with EMSPs/CPOs who operate under clear contracts, and ensure GDPR compliance for all shared data.

Quantitative modelling of PINS benefits

Economic case for PINS

We modelled the business case for PINS focussing on utility, delivery and emergency fleets, which are likely to charge at other organisations' sites due to lack of off-street parking at employee homes, duty cycle requirements, and/or lack of sufficient power supply to their own sites. The modelling included a sensitivity analysis, altering factors that can have an impact on the economic case.

Under normal/baseline conditions, fleets can save between £1.8 and £3.1 per vehicle and day (9-19% of charging costs) if they use PINS compared to using public chargepoints. Under favourable conditions of frequent PINS usage, low PINS charging prices and high public charging prices, these savings can even increase to between £5.4 and £9.7 per vehicle and day (26-50% of charging costs).

Some organisations may consider, instead of using PINS, upgrading the power supply to their own depots and installing additional charging infrastructure. However, our modelling shows that, from a chargepoint total cost of ownership (TCO) perspective, this only makes sense under very specific circumstances. For a delivery fleet, these are low depot electricity costs and high vehicle-to-charger ratios (high vehicle turnaround per connector). For an emergency fleet, these conditions are even more restrictive. Under most conditions, using chargepoint sharing solutions will make economic sense.

Economic modelling was also performed from the point of view of host organisations, which can generate extra revenue by sharing their infrastructure during downtime periods. Our modelling showed that there is also a compelling business case for host organisations, as they can achieve significant returns on investment (ROI) on their infrastructure after 10 years if their chargers are used for 1 hour/day by visiting organisations: 12-45% for slow and fast chargepoints, and 27-63% for rapid and ultra-rapid chargepoints.

Our modelling shows that there is a clear business case for fleets to seek charging at another organisation's sites, both from the host and visiting fleets' perspectives.

Environmental case for PINS

We also modelled the environmental performance of PINS, defined as the emissions savings enabled by switching additional vehicles from internal combustion engine vehicles (ICEVs) to EVs. We assumed that, enabled by charging at other organisations' sites, visiting fleets can electrify additional vehicles that they would not otherwise. This can unlock emission savings compared to ICEVs of 20-37% well-to-wheel (WTW) CO_2e, 28-46% NO_x and 26-46% $PM_{2.5}$ (particulate matter).

1. Introduction to the project

The Paua PINS (Private Infrastructure Network Solution) project, funded by Innovate UK, demonstrated the role that a shared private infrastructure network can provide to support local authorities (LAs) and businesses as they electrify. Currently this can only be implemented via private-bilateral agreements and has been deployed on a relatively small scale. However, the solution discussed within this project aims to scale up infrastructure sharing and to show how this can be extended to a wider variety of host depots, who own or operate the site where the chargepoints are located, and visitor fleets, who will drive into the site and use the chargepoints. The solution seeks to overcome the challenges associated with the sharing of private/restricted electric vehicle (EV) charging infrastructure through research and demonstration with key partners. The solution will enable the sharing of private host depots with visitor fleets to start the formation of a shared private network in partnership with Suffolk and Oxfordshire County Councils. This white paper presents the qualitative and quantitative implications of PINS.

2. Introduction to depot chargepoint sharing

Sharing charging infrastructure at a private depot location can present multiple benefits, and has in fact been deployed in the UK as per the case studies presented in this section.

2.1 Opportunities and motivations

There are several reasons why both host and visitor fleets would be driven to share their charging infrastructure.

2.1.1 For visitor fleets

- **Alleviating range concerns:** Some fleets, especially those with energy-intensive operations like emergency response and utilities vehicles, struggle to complete their daily EV duties on a single charge and often need top-up charging away from their base. Shared access to chargepoints at other organisations' depots (especially those located along typical routes) could be critical to making electrification feasible for these fleets. Utilities companies, with high mileage and high vehicle energy loads, face similar hurdles. Ultimately, the location of shared depots relative to vehicle routes is more important than simply having access to public chargers, as reducing non-productive "stem" travel to charging sites helps address range anxiety and operational efficiency.
- **Vehicles unable to charge at base depot:** Vehicles unable to charge at their own depot, such as those working remotely for multiple days (like utilities vehicles) are ideal candidates for using shared depot chargepoints, offering a more reliable and secure alternative to relying on public networks or costly mobile battery solutions. Additionally, some fleets operate from drivers' homes and may lack depot infrastructure entirely. With around 35%[1] of UK homes unsuitable for home chargepoint installation, many drivers must depend solely on public charging, which poses challenges, especially for larger vehicles. This issue is aggravated by the low numbers of public chargepoints dedicated to heavy goods vehicles (HGV).
- **Cost:** Charging at another organisation's depot is likely to offer significant cost savings compared to using the public network. Public charging rates are high, averaging 56 p/kWh for slow/fast chargers and 80 p/kWh for rapid chargers, while the average electricity price for medium-sized non-domestic users is just 29 p/kWh. Even with a profit margin included for the hosting depot, fleet operators can expect to pay considerably less per kWh than they would on the public network, making depot sharing a financially attractive option. In section 5 of this paper we have modelled several cost scenarios for both host and visiting fleets.
- **Convenience:** Sharing chargepoints with another organisation may offer fleets greater availability and convenience compared to the public network, improving fleet uptime. With the ability to arrange guaranteed access times or use booking systems, fleets can be confident that a chargepoint will be available when needed. This is crucial given the public network's average utilisation rate, meaning there's a significant chance a charger could be unavailable. For time-sensitive operations like emergency services or delivery (courier) fleets, such uncertainty could cause serious disruptions.

2.1.1 For host depots

- **Financial:** Depots with vehicles on set shift patterns often have predictable periods of chargepoint downtime, creating opportunities to share this unused capacity with other organisations. Doing so can generate additional income, likely at rates below public network prices, helping to offset and recover the initial investment in charging infrastructure more quickly. Moreover, due to the additional energy use, host depots could negotiate better bulk energy tariffs and benefit from off-peak charging rates.
- **Image:** Beyond financial gains, depot owners can also benefit from an enhanced public image by supporting sectors like emergency services or by promoting low emission transport.
- **Partnerships** with other organisations can foster valuable knowledge exchange, encouraging collaboration, innovation, and shared learning around EV charging and fleet management practices, as well as potentially creating new business opportunities.

2.2 Case studies

Several UK initiatives are advancing the concept of EV chargepoint sharing to support fleet electrification. First Bus, a major UK bus operator, has led the way by allowing companies like DPD, Police Scotland, and most recently Openreach to use its depot charging infrastructure during off-peak hours, with plans to expand partnerships further. In Cornwall, it has also opened chargepoints for public use. Meanwhile, Nottingham City Council, supported by Department for Transport funding, has developed a shared charging network across Nottinghamshire and Derbyshire for public sector fleets, with over 200 monthly uses from its 31 member organisations. Additionally, the Association of Fleet Professionals (AFP) launched a shared charging committee at the start of 2024 and in May 2025 introduced an online platform that allows AFP members with spare depot and office charger capacity to offer facilities to others within the organisation.

AFP's research showed strong interest (58%) among van fleets in sharing infrastructure with other organisations.

3. Matchmaking

When a visiting fleet has challenges with charging their EVs and when PINS is an attractive option to resolve this, they must first understand what type of depot would be best for them to share with. To make this process easier from a visiting fleet perspective, and to be able to quantify the likelihood and usefulness of a specific fleet to work with each depot type for chargepoint sharing, Cenex has produced a Microsoft Excel matchmaking tool. Its methodology and content are explained in this section.

3.1 Depot attributes

We first needed to define the attributes that characterise host depots in the context of chargepoint sharing. We did this by conducting a Cenex internal workshop and an external workshop with relevant fleet operators from LAs, public transport, delivery/courier services, utilities, and emergency services.

- **Location:** The depot must be in a place where it is needed.
- **Capacity:** The site must have adequate additional capacity to accommodate extra vehicles and people.
- **Availability:** There must be times when the chargepoints are available.
- **Opportunity:** The times when the chargepoints are available must coincide with times when other organisations want to use them.
- **Compatibility:** The chargepoints at the depot must be the right type, in terms of power and connector. Also, there must be enough parking space near the chargepoint for the type of vehicle looking to use the chargers.
- **Reliability and service levels:** The chargepoints need to be reliably functioning with regular servicing in order to meet the requirements of the other organisations.
- **Belief in success and consequences:** The visitor fleet must have confidence that, if they need the chargepoint, the right one will be free and accessible. If the chargepoint is unavailable, visitors will need to know how long they will have to wait, and if any measures can be taken to reward for the inconvenience.
- **Simplicity:** Access to the chargepoint needs to be a straightforward process with a clear agreement in place.
- **Motivation:** The depot owner and operator must both have motivation and desire to share with external parties.

3.2 Depot archetypes

The next step was to define depot archetypes based on their attributes. Archetypes help to generalise depots in the UK and therefore allow a fleet to determine what types of depots/organisations would be best to approach initially to start investigating the feasibility of a PINS partnership. The colours represent whether each characteristic is likely to aid or reduce the chance of depot sharing with another organisation.

Depot Type	Tiny Depot	Friendly Neighbourhood Depot	Open City Depot	Medium Enterprising Depot	Closed Complex Depot
Examples	Small local authority locations, small police stations in rural areas or outskirts	Local authority depot, some delivery organisations	Bus depots	Car rental locations, regional and local commercial businesses	Utilities, Emergency services
Location	Rural or outskirts	Varied across the country	Urban and city centre	Varied across the country	Varied across the country
Capacity	Limited	Busy and constrained	Significant space	Space constrained, mix of public & staff on site	Very busy with little capacity
Availability	Some but irregular	Irregular pattern	Consistent daytime working hours	Sometimes when chargers are free	Irregular pattern
Opportunity	Free when needed	Free when needed	Free when needed	Likely times when free	Most chargepoints utilised consistently
Compatibility	Unlikely and low power	Good variation available	High powered chargers available	Chargers not common, likely low power	Most high power, and some low power
Reliability	Few support staff	Staff available but complex operations	Staff on site, high standard of maintenance	Low staff, not urgent maintenance	High standard of maintenance
Belief in success	High	Low	High	Low	Low
Simplicity	Low security and lack of staff	Barrier access, cameras, may be closed overnight	Barrier access, cameras	Open with little security	High levels of security
Motivation	Low	Possible altruistic motivation	Business case	May see value in business diversification	Limited, but may have interest in partnership

3.3 Matchmaking tool

3.3.1 User inputs

Reflecting each of the attributes of a depot archetype, the **matchmaking tool** asks the user, who belongs to the visiting fleet, to input answers to 9 questions. These define their specific requirements if they were to engage in a PINS agreement with another organisation. The answers to these questions are purposefully constrained to specific answers, with between 2 and 4 options to choose from, such that they can be mapped against the depot archetype attributes.

- Where do you need charging?
- How many vehicles need charging?
- How vital is it that the chargepoints are available consistently at the same time?
- How often will you need to use the chargepoints?
- Do you need high power chargepoints?
- How critical is the reliability and maintenance of the chargepoints?
- How critical is your confidence in the host organisation implementing protocols and processes?
- What level of security would you require on site?
- How motivated do you believe host depots will be to specifically share with your fleet?

These questions are deliberately vague, and not asking for specific quantitative data, as this tool is expected to be useful at the very early stages of determining suitable matches for depots/fleets. It would be expected that once archetypes have been recommended, that the fleet would need to perform further research into specific depots within this archetype to understand further feasibility for sharing. It is also encouraged that they get in touch with Paua, who have produced a more refined matchmaking tool that can drill down into the detail and nuances of each fleet and can put them in touch with relevant fleets in the geographical area of interest.

3.3.2 Outputs

The tool then determines whether fleet and depot are a match in each of the attribute categories. Following this, the tool sums the number of matched attributes and uses this as a score for how good a match the depot archetype and fleet are. An example of how this works in practice is shown below. In this scenario, the closed complex depot is the best match, and in fact is a match across each of the attributes (based on the inputs from this example fleet).

Depot Type	Tiny Depot	Friendly Neighbourhood Depot	Open City Depot	Medium Enterprising Depot	Closed Complex Depot
Location	Y	Y	N	Y	Y
Capacity	Y	Y	Y	Y	Y
Availability	Y	Y	Y	Y	Y
Opportunity	Y	Y	Y	Y	Y
Compatibility	N	Y	Y	N	Y
Reliability	N	N	Y	N	Y
Belief in success	Y	Y	Y	Y	Y
Simplicity	N	N	N	N	Y
Motivation	N	Y	Y	Y	Y
Score (9 max)	**5**	**7**	**7**	**6**	**9**
Match?	**OK Match**	**Good Match**	**Good Match**	**Good Match**	**Perfect Match**

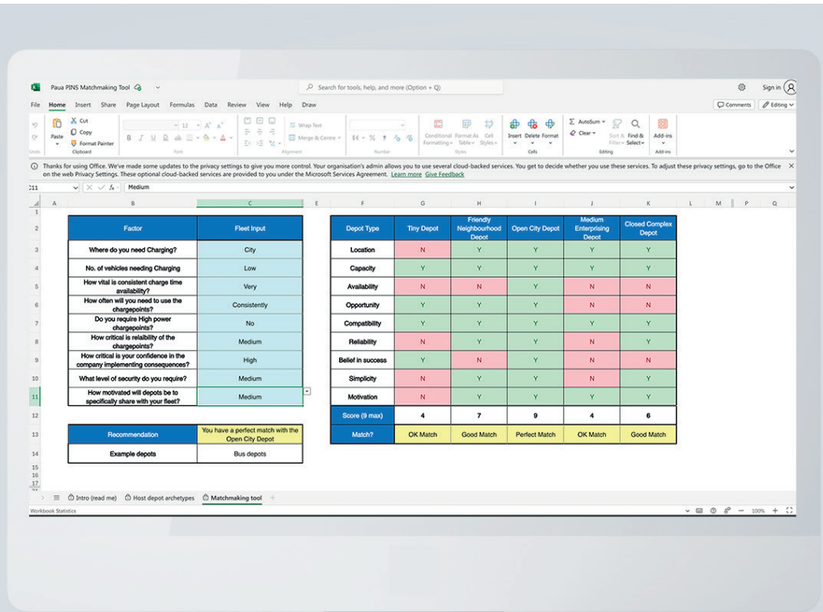
3.3.3 Matchmaking examples

Cenex then used this tool, and information gathered during the project, to determine which types of fleet would benefit from using shared infrastructure the most, and what depot archetypes they match with. The following matrix shows five different types of fleet with the following information:

- An example organisation within the fleet type.
- What charging requirements the organisation has to effectively electrify their fleet.
- How critical PINS is for their transition to zero emission vehicles.
- Red-amber-green rating describing how useful and likely a shared charging infrastructure agreement would be with each depot archetype.

This matrix shows how three fleet types need chargepoint sharing the most to fulfil their duty cycles, while they also have relatively good matching attributes with several host depots and organisations. Therefore, during the next sections of this white paper, we have mostly focussed on:

- Utilities fleets
- Delivery / courier fleets
- Emergency fleets



Usefulness and Likelihood of wanting to share

Fleet	Example	What do they need?	PINS Criticality for operations	Tiny Depot Small local authority locations, small police stations in rural areas or outskirts	Closed Complex Depot Utilities, Emergency Services	Medium Enterprising Depot Car rental locations, regional and local commercial businesses	Open City Depot Bus depots	Friendly Neighbourhood Depot Local authority depot, some delivery organisations
Delivery	Royal Mail	Require additional areas to charge their vehicles as depots are over-capacity. This can be fast daytime charging or slow charging overnight	High, depots often do not have the capacity to support all vehicles if they were to be transitioned to electric.	Potentially useful if in the right area and there is some spare capacity. However, would need agreements with multiple depots to cover all vehicles. Typical low power chargers would mean a time/day agreement would need to be in place as delivery company will have fixed routes and known power requirements. Additional motivation may be required for the depot to be inclined to sign up.	There will be difficulties with finding available times for chargepoint to be shared with the delivery fleet and there may be a lack of motivation to share. However, the reliability, types of chargepoints and depots could be a good match. Therefore business models may need to be developed collaboratively between the fleet and depot.	Similar to a tiny depot, where the locations and types of depot available could be suitable for a few additional vehicles. However, there is likely to be less opportunity to charge as these businesses often have more sporadic operations and would be less likely to be able to provide guaranteed chargepoint availability at specific times.	Very likely. High power chargers available in the day, allowing for delivery vehicles to top-up charge over breaks. In urban and city environments, where delivery depot charge constraints may be most common.	Unlikely, unless there are any unusual shifts within the depot or over-provision of chargers. Will typically be operating on a similar pattern to a delivery company and will rarely have space for a significant number of additional vehicles looking for a full re-charge. Alternatively, the high power chargepoints used for some HGVs may provide an option for top up charging the delivery vehicles.
Utilities	Scottish Water	Require re-charging during long distance drives to jobs, re-charging whilst away from depot for multiple days and to be used by home-based employees with no access to a chargepoint.	High, charging is often required away from depots, and many vehicles are home-based with high mileages required.	Could be useful, as generally low number of vehicles will be needing re-charging - spread out across country. Ideal if high-power chargepoints are available, however this is unlikely for this depot type.	Chargepoint types will be of the correct type, and will be good for dropping in for top-up charges, potentially in useful locations. However, availability of chargers is not guaranteed. In order to maximise the motivation to share, a like-for-like agreement with another utilities organisation with the same issues could work.	Many locations across the country will be useful. Generally have capacity to receive additional vehicles which are passing nearby. Often will not have high power chargers which could be an issue for top-ups. May be an opportunity for overnight charging where there is spare capacity but additional risk of poorly maintained infrastructure.	There should be high power chargepoints available at the times when Utilities fleet will need them. If depot has over-provision of low power chargers, fleet could use these overnight. Main challenge is potentially needing to have many agreements in place, as top-up charges could be needed at various locations across country.	High power chargepoints available when fleet requires use, secure area to park vans. Challenges will be relating to the location of depots, and whether multiple agreements will be required depending on location of work.
Emergency	Police	Require high-speed charging in order to limit downtime. These chargepoints must also have guaranteed availability and reliability because failure to re-charge when needed can have severe consequences. Also depots must have good levels of security and simplicity of access.	High, vehicles have intensive operations and often require top-up charging in order to make operations feasible.	Multiple smaller locations could be helpful with unpredictability of police routes. Low number of vehicles on site will be a benefit to police who will want quick and easy access. However, unlikely to have high-power chargepoints and these will be less well maintained than at major depots. Security of vehicles may also be a problem for small depots not run by an emergency services organisation.	High power, well maintained chargepoints and strong security measures on site would be very beneficial. Challenge will be agreeing prioritised use for the police, ensuring chargepoints are always available when needed. Depots with a lot of activity and busyness may also be problematic with police needing efficient access, with limited delay.	Would not be able to provide the guarantee of available, reliable chargepoints, is unlikely to have high-power and is a reasonably unsecure site.	High power chargepoints with good availability and good maintenance. Depots are typically have reasonable levels of security. Not many locations so will have to be convenient to typical police response routes.	Potential use of high-power HGV chargepoints at these depots could be advantageous during the day, but reliability would need to be guaranteed which can be unlikely for this type of depot. Security may also be a concern with a high number of different activities performed by various vehicle types at the depot.
Buses	First Bus	Consistent high-power charging at a single base that is returned to each day after a set route is completed.	Low, repeatable low-intensity operations means vehicles can generally be re-charged fully overnight at their own depot.	Small depots would not be sufficient for the large vehicles that First Bus operate.	Due to the constantly changing environment of this kind of depot, with inconsistency in the times the chargepoints are in use, it would be challenging for a bus operator to consistently use the chargepoints to complete their routes. If space could be guaranteed, it may still cause problems having multiple large buses driving around the already busy depot.	These depots are likely too small and have insufficient power chargepoints to be of any use.	The depot would be an ideal fit since it is of the same type as the fleet's home depot. However, another bus operators depot would once more, only make sense if there was an over-provision of chargepoints on the site, and that these could then be utilised by the fleet overnight. There would also be issues with potentially assisting a rival bus operator in the same area, with limited motivation to do so.	In the unlikely instance that a bus operator would be interested in using another organisations depot, a local authority depot could be an option. However, this would only be the case if there were ample high-power chargers that could be used overnight, which is when most vehicles based on these depots would also be charging. Therefore it would only be viable if the depot had an overprovision of high power chargers.
Councils/RCVs	Local Authority	Consistent high-power charging at a single base that is returned to each day after a set route is completed.	Medium, repeatable low-intensity operations means vehicles can generally be re-charged fully overnight at their own depot. Sometimes can have power-constraints at depots.	Same as above	Same as above	Same as above	Same as above	Same as above

4. Qualitative analysis of PINS

Using a combination of literature research, interviews with depot and fleet operators, and online surveys for fleet staff, we have analysed the main policy, social, technical and legal factors affecting chargepoint sharing.

4.1 The policy aspects

The UK's trajectory towards EV adoption is clear, with ambitious targets for EV uptake and a ban on new internal combustion engine vehicle (ICEV) sales by 2035. At the time of writing, Cenex modelling projects 28 million EVs on UK roads by 2040[2], a rapid transition with significant implications for fleets and depots. Even with potential target adjustments, manufacturers' commitment to phasing out ICEVs will inevitably increase demand for charging infrastructure, creating both opportunities and challenges for depot sharing.

However, while government incentives (such as grants and tax breaks) can reduce the expenditures associated with EV charging infrastructure, their direct impact on promoting shared depot charging models is unknown. Current government interventions, while accelerating the transition to EVs, do not directly incentivise or facilitate collaborative charging solutions. These incentives encourage fleets to establish individual charging infrastructure, potentially undermining the cost-saving and resource-sharing benefits of collaborative approaches. The lack of policy focus on chargepoint sharing means fleets are not being actively encouraged to explore the economic and environmental efficiencies that can be gained from joint infrastructure development.

On the public realm, LAs usually implement diverse policies across different regions, and they often struggle with budget constraints and planning complexities. This poses a challenge to a coordinated development of shared EV infrastructure, and therefore it is unlikely that local authorities will lead PINS-like solutions in the near future. Therefore, the private sector such as commercial fleets should kick off the process with support from their local authorities, which in turn can provide a wide variety of depots suitable for chargepoint sharing.

Policy-related recommendations

In summary, effective policy interventions are needed to enable the potential of depot sharing:Scheduling systems and routing systems.

- **Streamlining planning permissions:** Simplifying the process for obtaining planning permission for charging infrastructure.
- **Developing clear guidelines:** Providing clear guidelines and best practices for depot sharing arrangements, including data sharing protocols, liability considerations, and access control procedures.
- **Facilitating collaboration:** Fostering and funding collaboration between LAs, businesses, and other stakeholders through the development of shared platforms for information exchange and matchmaking, such as Paua Share.
- **Incentivising participation:** Offering incentives for organizations that participate in depot sharing arrangements, such as reduced parking and electricity fees.

4.2 The social aspects

Within visitor fleets

Employee engagement is a crucial, yet often overlooked, element in the successful implementation of any innovation; with shared depot charging being no different. Drivers are at the forefront of any operational change and their concerns must be addressed proactively. Interviews with drivers across delivery, utility, and emergency services highlighted anxieties about potential disruptions to daily schedules, security risks associated with sharing facilities, and the impact on vehicle availability. For instance, a delivery driver commented:

> *"I'm worried about having to queue for a chargepoint at another company's depot. What if it holds me up and I miss my delivery slots?"*

To mitigate these concerns, clear communication about the benefits of depot sharing is essential. For example, emphasizing how reduced charging costs can translate into lower operating expenses, or how access to shared charging can improve route planning and reduce reliance on public charging infrastructure can resonate with drivers.

Within charging host organisations

Host depot managers also expressed some concerns. One manager from a utility company commented:

> *"Increased traffic flow and the potential for congestion within the depot yard."*

Another, from an emergency services depot, highlighted the importance of maintaining operational readiness, stating:

> *"We need to ensure that our emergency vehicles always have priority access to charging points."*

To address these concerns, interviews with potential depot-hosting organisations highlighted the importance of proactive communication, training, and clear operational protocols as vital factors to ensure buy-in from all levels of staff, covering the impact on daily operations, safety protocols, and access procedures. Interviews also highlighted a common issue: over the years, responsibility for charging infrastructure may have shifted between different individuals within an organization, leading to confusion and a lack of clear ownership. A RACI chart can be a valuable tool for clarifying roles and responsibilities, defining who is Responsible for a task, who is Accountable for the overall outcome, who needs to be Consulted for their input, and who needs to be Informed of the progress and decisions.

Organisational culture

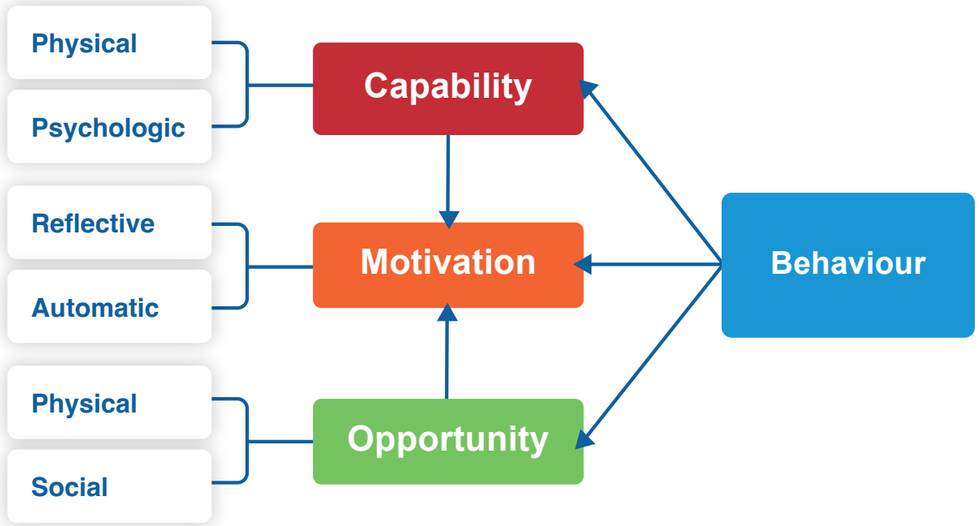
A positive organisational culture is a strong predictor of successful shared charging implementation. Key cultural elements include:

- **Collaboration:** "Collaboration is key" emphasised a representative from a major delivery fleet, highlighting the need for "communication and cooperation between different businesses and organisations to create a network of shared charging depots." This sentiment was echoed throughout the interviews, as well as fostering a culture of respectful use of shared resources among all users.
- **Sustainability:** Organisations with a genuine commitment to sustainability are more likely to embrace shared charging initiatives as a tangible step towards their environmental goals.
- **Innovation and risk tolerance:** Our surveys indicated that organisations with a history of successful innovation were more receptive to the concept of shared charging. A willingness to explore new approaches and accept a degree of calculated risk is crucial for overcoming initial hurdles and reaping the long-term benefits of shared charging.
- **Addressing employee concerns** through clear communication, training programs, and regular feedback mechanisms is crucial to gain buy-in from your staff and contractors. One depot manager from a utility company emphasised the importance of this, stating:

> *"we have implemented a system where depot staff are briefed on any upcoming visits from other fleets, and they are aware of any potential disruptions to their usual routines."*

The COM-B toolkit

To incentivise shared depot charging between visitor fleets and depot hosts, organisations can leverage the COM-B (Capability, Opportunity, Motivation, Behaviour) model. This model highlights that understanding and changing behaviour (B) occurs as an interaction between these three necessary COM conditions. For a person or organisation to change their behaviour, they must be able to do it (capability), have the chance to do it (opportunity), and want or need to do it (motivation). By focusing on these three components, organisations can influence the behaviour of visitor fleets and depot hosts, promoting the adoption of shared depot charging.



Condition	Aspect	Visitor Fleet	Host Depot
Capability: are they able to do it?	Physical	Having access to clear operational guidelines and compatible charging standards.	Having reliable charging infrastructure and clear safety protocols.
	Psychological	Feeling confident in the reliability and security of the shared charging system.	Feeling confident in their ability to manage shared access without disrupting their own operations.
Opportunity: do they have the chance to do it?	Physical	Availability of strategically located depot chargers, flexible charging schedules and user-friendly booking systems.	Having systems to manage bookings, scheduling, payments, and access control.
	Social	Positive interactions with depot staff, clear communication channels, and established trust between fleets.	Clear service level agreements, established communication protocols, and a collaborative approach with visitor fleets.
Motivation: do they want to do it?	Reflective (deliberate)	Recognising cost savings, operational efficiency, and reduced downtime compared to public charging.	Recognising revenue generation and optimised infrastructure utilisation.
	Automatic (impulsive)	Integrating depot charging into their routine operations and processes to achieve seamless charging.	Establishing efficient and automatic processes for managing shared charging.

Recommendations from a social perspective

- Conduct **employee engagement** activities within both visitor fleets and depot-hosting organisations to understand employees' perspectives, concerns, and potential barriers to depot sharing.
- Develop clear **communication** strategies to keep employees informed about the progress of depot sharing initiatives.
- Implement comprehensive **training programs** to educate employees on the benefits of EVs, the procedures for using shared charging facilities, and the importance of collaboration.
- Regularly monitor and evaluate **employee feedback** to identify areas for improvement and make necessary adjustments to depot sharing operations.

4.3 The technical aspects

Data interoperability

Our interviews and surveys highlighted a significant need for interoperability of different charging networks and seamless integration of charging data between fleet management systems, charging infrastructure providers, and depot management systems. This would involve open data standards and secure data exchange protocols. One fleet manager, when discussing potential challenges, stated:

> *"We need a system where all the data talks to each other. Right now, it feels like everyone's on their own island."*

Our engagement indicated an appetite for advanced telematics and fleet management systems, which optimise various aspects of fleet operations, including route planning, charging schedules, and energy consumption. By integrating these systems with depot sharing platforms, fleet operators can gain real-time access to critical data, such as vehicle locations and state of charge, empowering them to minimise operational disruptions.

A key tool that can enable PINS is the Open Charge Point Interface (OCPI), which is a protocol that ensures interoperability across the EV charging ecosystem, streamlining integration and communication between charging networks, mobility service providers, and EV drivers. In particular, it enables roaming across EV charging networks. The UK government has proposed OCPI as a standard protocol to ensure reliable and accessible EV charging, and actively promotes it for EV roaming.

The ability to control access and data visibility within a depot sharing network is a key factor for many fleet operators, particularly for large depots, who expressed a strong interest in chargepoint availability being visible on a shared platform, but only to selected users. This selective visibility allows for controlled access and ensures that sensitive information remains protected.

Chargepoint maintenance and reliability

Visitor fleets expressed concerns about the reliability and availability of private charging infrastructure, e.g. chargepoint downtime or slow charging speeds. Interviews highlighted the need for robust and reliable charging infrastructure with sufficient capacity to accommodate the needs of multiple fleets.

On the other hand, depot-hosting organisations were concerned about the potential for increased wear and tear on charging infrastructure due to shared use, highlighting the need for careful consideration of the increased maintenance burden and potential for damage when sharing charging infrastructure.

These concerns underscore the need for robust maintenance and security protocols to safeguard the shared charging infrastructure and ensure its long-term reliability and performance. The potential increase in maintenance costs can be covered by the margin applied to their electricity tariffs by the host organisations.

Regular visual inspections, electrical safety checks, preventative maintenance and data-driven maintenance all need to be considered to provide a reliable chargepoint sharing service, as the usage of infrastructure increases over time. For the organisation hosting the chargepoints, all this may involve deploying additional human resources as sharing becomes more frequent, and it will help identify early any signs of physical damage, environmental damage caused by weather or corrosion, safety hazards, maintenance or usability issues (e.g. slow charging speeds, connectivity loss, poor accessibility).

Recommendations from a technical perspective

- Ensuring **data interoperability** between fleet management systems, charging infrastructure providers, and depot management systems.
- Communicating charging schedules, availability, and any time restrictions clearly through a **digital platform** (such as Paua Share) that provides real-time updates and management, potentially allowing chargepoint booking.
- Establishing clear **payment and billing** processes between hosts and visitors.
- Consider the additional **maintenance** requirements due to an increased chargepoint use from sharing with external organisations. Regular visual inspections, electrical safety checks, preventative maintenance and data-driven maintenance all need to be considered.
- Clearly defined **access protocols**, such as a process for visitor fleets to register their drivers and vehicles with the depot management, clear guidelines on entry and exit procedures for visitor vehicles, or electronic access control systems to manage and authenticate authorized visitor fleet access.
- Allocating specific, clearly **marked parking bays** exclusively for visitor fleet charging, physically separated from depot fleet parking to prevent conflicts and confusion.
- **Troubleshooting information**, such as a quick guide for staff for common problems, contact information for technical support, or a plan for what to do in emergency situations.

4.4 The legal aspects

Several interviewees mentioned informal agreements between local authorities, fleet operators, and charging infrastructure providers, showcasing the strength of such partnerships. While these informal agreements often involve shared responsibilities for maintenance, data sharing, and dispute resolution, there is a growing need for formalized legal frameworks to support larger-scale depot sharing initiatives. A key theme is the concern about the potential impact of increased demand on their existing infrastructure, with one fleet manager emphasising:

> *"We need to ensure that our infrastructure is protected and that we are not liable for any damage caused by other users."*

Liability and risk mitigation

A key concern highlighted in interviews was the potential for increased liability for depot-hosting organizations when sharing charging infrastructure with other fleets. This includes a range of potential risks, such as accidents involving vehicles while charging or manoeuvring within the shared depot areas. These could potentially cause injuries to personnel from visiting or host organisations, as well as damage to vehicles, charging infrastructure or depot property. These risks may increase in likelihood due to an increased traffic flow and chargepoint usage within the depot because of chargepoint sharing.

As explained in a previous section, emergency, utility and delivery fleets need chargepoint sharing the most and score high in our matchmaking tool, meaning they are compatible with several host depot archetypes. These fleets will probably also act as charging host organisations if they enter bilateral agreements with other fleets. However, they are at the same time liable for critical operations. Emergency fleets need to quickly respond to 999 calls and hence need very high vehicle uptime. Utility fleets may also be required to respond quickly to emergencies such as power outages or gas leaks. Delivery fleets, albeit running less critical operations, usually have time-sensitive deadlines.

Representatives from the three fleet types highlighted the importance of ensuring that shared charging arrangements do not disrupt their operations. An emergency fleet representative highlighted the need for clear protocols and procedures to ensure safe and efficient access to vehicles during emergencies. A utility fleet representative raised concerns about potential liabilities arising from damage to sensitive equipment or disruption to critical services. Finally, a delivery fleet representative said that disruptions to their charging infrastructure could significantly impact their ability to meet delivery deadlines and could potentially lead to customer dissatisfaction and financial losses.

To mitigate the aforementioned liability risks, clear liability agreements must be developed between participating organisations. These agreements should explicitly outline the responsibilities of both the charging hosts and visiting organisations, which should at least include:

- **Host depot responsibilities:** maintaining a secure environment within the depot, ensuring compliance with all relevant safety regulations, providing clear instructions and guidance on safe charging practices, and maintaining adequate insurance coverage for potential liabilities.
- **Visitor fleet responsibilities:** adhering to all safety guidelines and operating procedures within the depot, ensuring their drivers are properly trained and instructed on safe charging practices, and being responsible for any damage caused by their vehicles or personnel.

For both hosts and visitors, it is important to work with e-mobility service providers (EMSPs) and chargepoint operators (CPOs, who can often be the hosts themselves) that have agreements in place which clearly define the split of responsibilities amongst them. EMSPs offer EV charging services to drivers, primarily through digital platforms or apps, acting as intermediaries and connecting drivers with chargepoints managed by CPOs. CPOs own, manage, and operate EV chargepoints, including installation and maintenance. The agreements between the two should cover:

- charging services provided by the EMSP,
- technical framework to enable communication between EMSP and CPO,
- CPO obligations, e.g. safety and compliance with standards,
- EMSP obligations, e.g. log authorised users, invoices and payments, maintain IT security measures to prevent fraud,
- term and termination conditions,
- intellectual property and
- confidentiality.

Data privacy and security

Protecting sensitive data related to vehicle usage, charging patterns, and driver information is paramount for successful depot sharing. This includes personal data, vehicle identification data, and charging transaction data. Ensuring compliance with relevant data protection regulations, such as the UK General Data Protection Regulation (GDPR), is crucial. This includes:

- Obtaining necessary data subject **consent** by clearly informing individuals about how their data will be collected, used, and shared.
- Implementing appropriate **security** measures, such as data encryption, access controls, and regular security audits and penetration testing.
- Maintaining accurate and up-to-date **data records**.

Recommendations from a legal perspective

- Develop clear **liability agreements** between participating organisations, explicitly outlining the responsibilities of both the charging hosts and visiting organisations.
- Work with **EMSPs and CPOs** that have agreements in place which clearly define the split of responsibilities amongst them.
- Protect **sensitive data** related to vehicle usage, charging patterns, and driver information by adhering to GDPR.

5. Quantitative modelling of PINS benefits

After capturing the qualitative insights from many stakeholders via surveys and interviews, we created a model to evaluate the potential quantitative benefits of PINS from the economic and the environmental points of view.

As previously noted, due to their necessity to use PINS and their high score in our matchmaking matrix, we modelled these three fleets with the following assumptions:

- **Utility fleet:** Vehicles do not spend a long time at depots and are usually parked overnight at employees' homes. However, 35% of homes in the UK do not have off-street parking[1], so approximately this % of vehicles were assumed to require PINS or public charging. The remaining 65% charge at employees' homes, but with an assumed typical domestic charging power of 7kW and overnight dwell time of 12 hours, not all the charging necessities can be met. Therefore, the remaining charging necessities need to be met by PINS or public charging. Overall, our modelling indicates that around 50% of the utility vehicles will require PINS or public charging, of which half of them are large vans.

- **Delivery and emergency fleets:** Vehicles are parked at fleet sites during inactive periods. However, one of the main barriers to electrify both types of fleet is the constraint on power supply to the sites. Therefore, there would currently be a requirement for PINS or public charging for around 90%[3] of the vehicles in these fleets.

Moreover, for all fleets we used historic anonymised data[4] to build profiles of fleet composition (% of vehicles per vehicle type), annual mileage (mean and standard deviation per vehicle type), dwell times suitable for charging, and energy consumption per mile.

5.1 Business case from visitor fleets' perspective

When thinking about chargepoint sharing, potential visitor fleets may ask themselves three main questions:

a. How much could we be saving by charging at other organisations' depots compared to standard public charging?

b. What would be the business case like if we decided to invest in our charging infrastructure and rely minimally on out-of-depot charging?

c. What are the main sensitivities impacting the above?

To answer this last question, we selected three candidate variables that could have a significant impact on the business case:

1. **Charging price:** We created four different scenarios to account for the volatility in public charging prices and the possible variability in the markup that host organisations may charge (while implicitly accounting for the variability in the price they pay for their base electricity). All prices in the table below **include VAT**.

Scenario	Base electricity price at depot[5] (p/kWh)	Host's markup[6] (p/kWh)	PINS price[7] (p/kWh)	Public charging price[8] (p/kWh)
Worst case	35	50%	52	60
Scenario 1	35	35%	47	65
Scenario 2 (baseline)	**35**	**20%**	**42**	**70**
Best case	35	10%	38	80

2. **Ratio of PINS to public charging:** To recognise that not all out-of-depot (or out-of-home in the case of the utility fleet) charging may happen at another organisation's depot and that some public charging will usually be required, increments of 25% were assumed. For example, one of the scenarios considers 25% of out-of-depot/home happens at public chargers and 75% via PINS charging (i.e. at another organisation's depot).

3. **Annual mileage:** To recognise that our data will not represent all archetypical fleets, a +/- 10% value was applied to our source data.

! The central or baseline scenario was assumed to be scenario 2 of charging prices (35, 42 and 70 p/kWh inc. VAT for depot, PINS and public charging respectively), a 50/50 split between PINS and public charging for charging that happens out-of-depot/home, and the annual mileage from our data.

5.1.1 Charging cost comparison between PINS and public charging

We must note that, depending on the host depot sites, public charging sites may have a higher charging power than PINS sites, and this must be considered in the comparison. This is partly acknowledged by the charging price scenarios, with the public charging being 8 to 42 p/kWh more expensive than PINS charging. The impact of charging power on vehicle downtime and convenience is out of the scope of our modelling.

The following table shows, for the baseline scenario, the daily savings per vehicle in charging costs from performing the out-of-depot/home charging at a 50/50 mix of PINS and public sites, compared to performing all out-of-depot/home charging at public sites. The percentage savings represent the proportion of charging costs that were saved, using as a reference (denominator) the total charging costs (incl. depot/home charging) if all out-of-depot/home charging was performed at public sites.

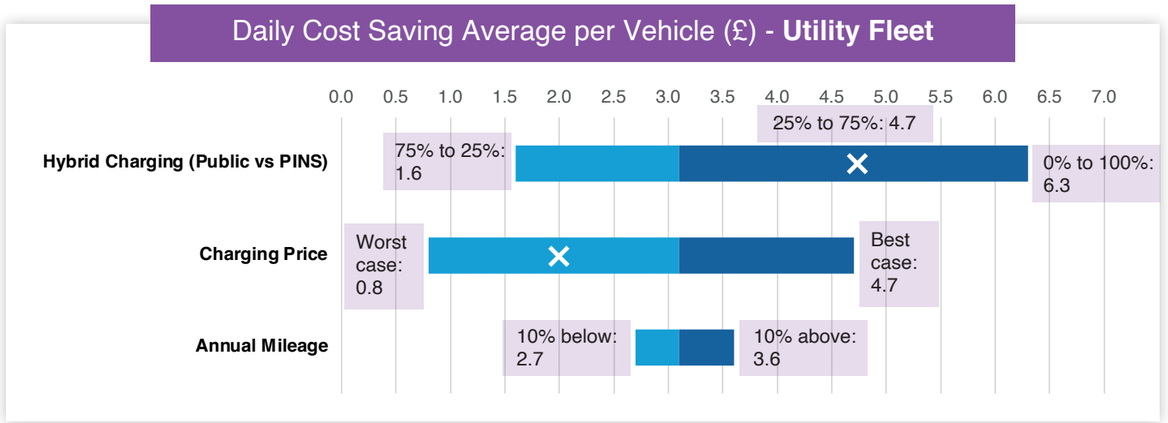
Fleet archetype	Daily charging costs saving per vehicle (baseline scenario)	Charging cost savings (baseline scenario)
Utility	£3.1	12%
Delivery	£1.8	19%
Emergency	£2.7	9%

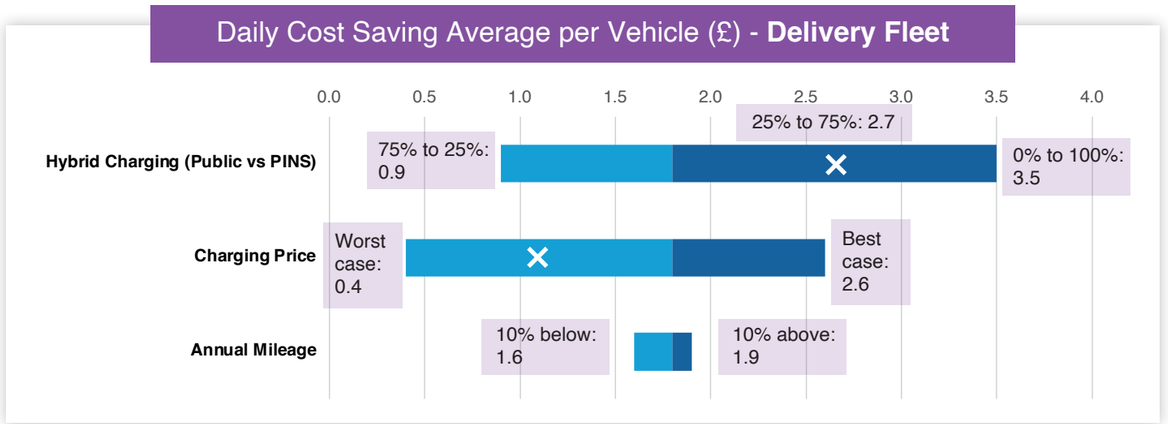
The difference in absolute savings between the three fleets is caused by the difference in daily requirements of energy to be charged out-of-depot/home, which is 23, 13 and 19 kWh per vehicle for the utility, delivery and emergency fleets respectively. These energy requirements are determined by several factors including fleet composition, annual mileage, energy consumption and dwell times. It makes sense that the more energy needs to be recharged out-of-depot/home, the more potential for PINS savings there is.

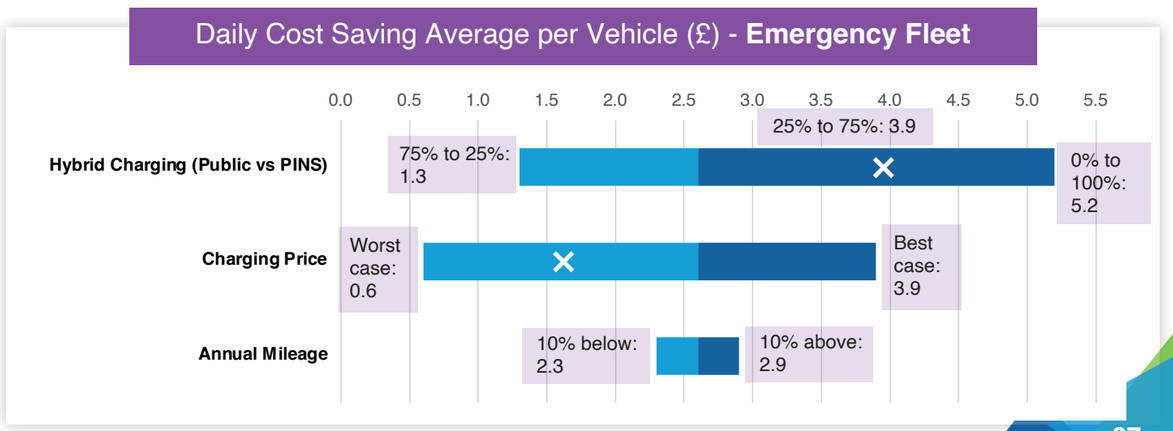
The delivery fleet has a higher relative percentage of savings than the other two fleets because its proportion of energy required to charge out-of-depot was higher: 90% compared to 39% for the utility fleet and 27% for the emergency fleet.

Sensitivity analysis

To isolate the effects of each of the sensitivity variables and see their true impact, we have fixed two of the three variables at their central or baseline values and changed the remaining variable across several values. We have then repeated the process with the other two variables to produce the graphs below. The central value of the savings (where the bars meet) represent the savings from the previous table, where the variables take their baseline scenario values.







If we measure impact by the range of values that the savings can take, the variable with the largest impact is the charging price, closely followed by the out-of-depot/home hybrid charging proportion. Daily savings of over £5/vehicle are achievable under the right circumstances, proving there can be a business case for fleets to use PINS to complement public and their own depot charging.

In relative terms, the charging cost savings percentages are shown in the table below for the extreme cases (annual mileage was omitted in this case due to its low impact). In absolute terms, the table below translates to daily savings between £5.4 and £9.7 per vehicle in the most optimistic case.

Scenario	Utility	Delivery	Emergency
75/25% public vs PINS charging, worst case charging price	2%	3%	1%
Baseline scenario (50/50% public vs PINS charging, 70 and 42 p/kWh public and PINS charging)	12%	19%	9%
100% PINS charging, best case charging price	34%	50%	26%

Under the right conditions, there are significant charging cost savings available across a variety of fleet types, showing **there is a compelling business case for fleets to seek charging at another organisation's sites** if the right agreement can be reached (considering the non-economic factors described in previous sections).

5.1.2 Total cost of ownership (TCO) comparison between self-depot and out-of-depot charging

While there is potential for a compelling business case to use PINS for charging that cannot be performed at a fleet's own depot, some fleets may instead be considering upgrading the power supply to their own depots and installing additional charging infrastructure. Please note that this section is only applicable to delivery and emergency fleets, which regularly charge at depots and are usually constrained by power supply to their depots, as opposed to utility fleets, which were assumed to regularly charge at employee homes.

To perform a chargepoint TCO analysis, we need to consider the typical capital and operating costs of chargepoints, which were averaged across multiple anonymised quotes obtained by Cenex. This includes the previously mentioned costs to upgrade the power supply to depots, referred to as "connection costs" [9].

Type [10]	AC	AC	DC	DC
Power	**7.4 kW**	**22 kW**	**50 kW**	**150 kW**
Connection cost	£1,500	£1,500	£3,800	£12,500
Equipment	£2,400	£3,500	£23,000	£50,000
Installation	£3,300	£3,300	£3,300	£3,300
Contestable DNO Costs	£1,600	£1,600	£1,600	£1,600
Warranty	£1,300	£1,300	£3,500	£3,500
Total Capital Cost	**£10,100**	**£11,200**	**£35,200**	**£70,900**
Back Office (annual)	£120	£120	£100	£100
4G Connection (annual)	£90	£90	£100	£100
Maintenance (annual)	£100	£100	£100	£100
Total Annual Operating Cost	**£310**	**£310**	**£300**	**£300**

The energy required to be charged out-of-depot calculated for the previous section was used to calculate the annual cost of out-of-depot charging if this was performed at the fleet's own depot. When charging at their own depot, fleets usually move vehicles around within their site once they have reached the desired state of charge, to ensure a higher chargepoint utilisation. We have assumed a 2:1 vehicle-to-charger ratio as the baseline scenario value. The charging cost savings from charging at a fleet's own depot are displayed in the table below for the **baseline scenario:** 50/50% public vs PINS charging; 35, 42 and 70 p/kWh inc. VAT for depot, PINS and public charging respectively; 2:1 vehicle-to-charger ratio.

All results given per vehicle, baseline scenario	Delivery	Emergency
Annual energy required out of depot (kWh)	3721	7560
Annual Cost of PINS	£777	£1,578
Annual Cost of public charging	£1,302	£2,646
Total annual cost out of depot	**£2,079**	**£4,224**
Annual Cost of own depot charging	**£1,295**	**£2,631**
Annual charging cost savings	**£784**	**£1,594**
Daily charging cost savings	£3.0	£4.4
Charging cost savings (%)	38%	38%

The savings available from charging costs alone are significant and may seem compelling, but the TCO needs to be considered. To address this, we have selected the payback period as an appropriate measure of the business case. This reflects how many years it would take to recuperate the initial chargepoint investment via the savings obtained from a cheaper self-depot charging tariff. The payback periods for the **baseline scenario** are:

Payback (years), baseline scenario	AC 7.4 kW	AC 22 kW	DC 50 kW	DC 150 kW
Delivery fleet	**8.0**	**8.9**	28.0	56.4
Emergency fleet	3.5	3.9	**12.2**	**24.7**

The results for AC and DC charging have been highlighted for the delivery and emergency fleets respectively because of their typical operating patterns. Delivery / courier fleets usually have relatively lower daily energy requirements and higher dwell times suitable for charging, while emergency fleets have higher energy requirements and need to maintain a reasonable state of charge to be able to respond to emergencies immediately.

The payback is lower for the AC chargers due to their significantly lower capital costs. The only reasonable payback periods (e.g. less than 4 years) for this baseline scenario are available for AC chargepoints for an emergency fleet, which is unlikely due to the operating patterns of emergency fleets. However, if an emergency fleet is considering installing AC chargers, doing so within their premises is likely to have a better business case than charging at other organisations' sites.

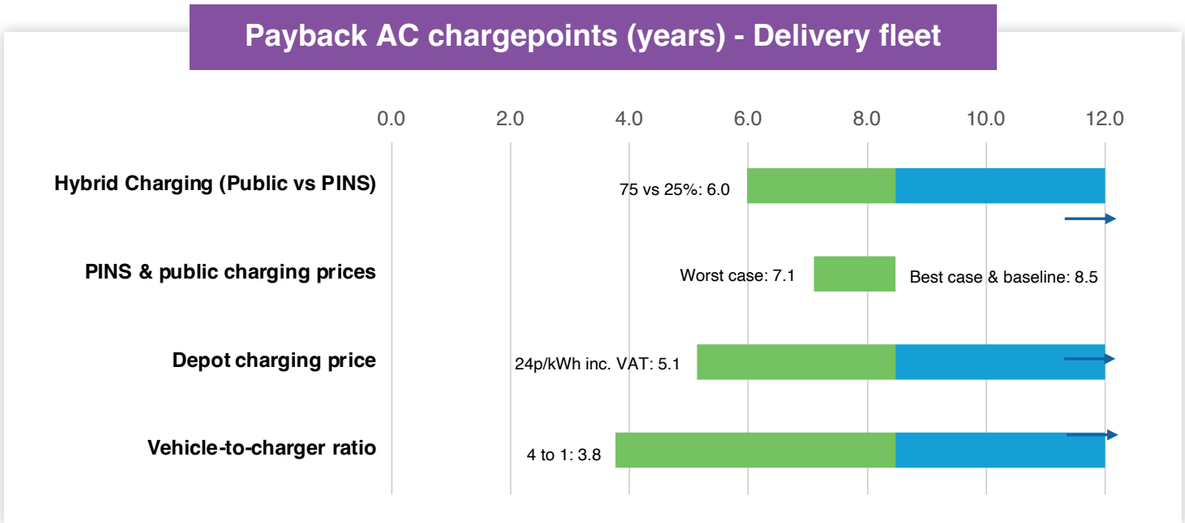
Sensitivity analysis

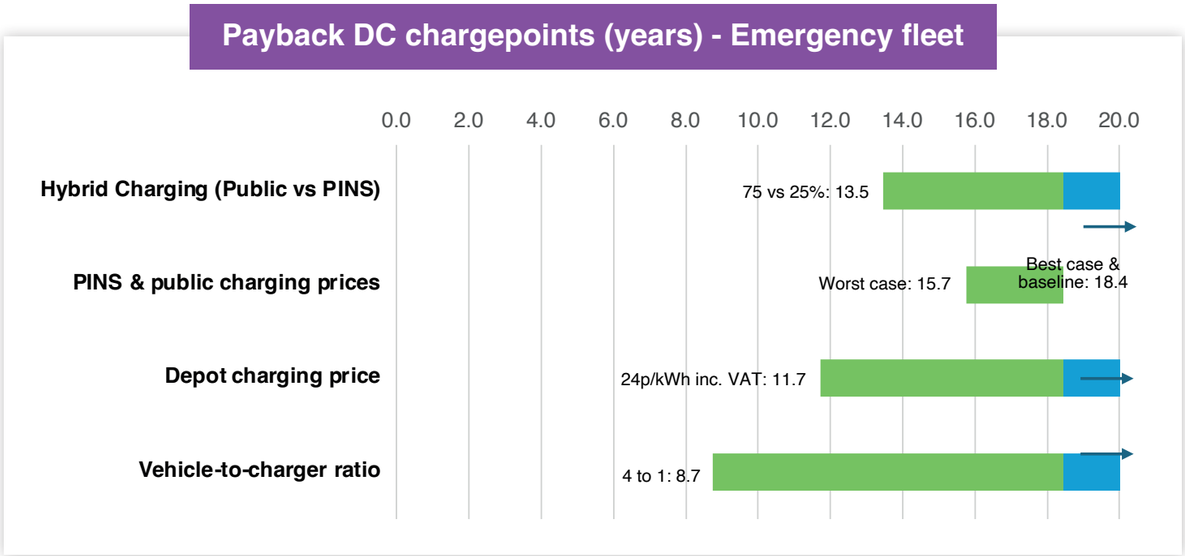
On top of the public vs PINS charging ratio and the public and PINS charging prices, we removed the annual mileage sensitivity variable due to its low impact observed previously, and added two more variables in this case:

1. **Depot charging price:** some fleets may access off-peak charging tariffs or special/ bulk agreements with electricity suppliers. Low, baseline and high values: £0.24, £0.35 and £0.48/kWh inc. VAT.

2. **Vehicle-to-charger ratio:** some fleets may be more proactive with their site management and be able to rotate charging slots quicker. Low, baseline and high values: 1:1, 2:1 and 4:1.

We have then displayed the payback period in the same way as the sensitivity analysis in the previous section. To simplify the results, we have averaged the payback periods for both AC chargepoint powers (7.4 and 22 kW) for the delivery fleet and for both DC chargepoint powers (50 and 150 kW) for the emergency fleet, due to each fleet's typical operating patters as previously explained. Where an arrow is displayed, it means that the payback period is too high to be even relevant.





The only cases in which payback periods are reasonable for the delivery fleet would be with low depot electricity costs or high vehicle-to-charger ratios. For the emergency fleet, there are no sensible payback periods even under those conditions.

If we push variables simultaneously to their extreme values to find the lowest possible payback periods, then we would need to have a 25/75% PINS vs public charging ratio, a low depot charging price of 24p/kWh inc. VAT, a 'best case scenario' for PINS and public charging prices (i.e. low PINS price and high public price), and a high vehicle-to-charger ratio of 4:1. If all this conditions are met, the payback period of the charging infrastructure would be 1.6 years for the delivery fleet (average of 7.4 and 22 kW AC chargepoints) and 3.9 years for the emergency fleet (average of 50 and 150 kW DC chargepoints). It must be noted that, under those highly favourable conditions, the payback for the emergency fleet using AC chargepoints would be less than 1 year, although emergency fleets would not normally use this type of slower chargepoints.

Our analysis shows that only under very specific circumstances will there be a case for emergency fleets to install their own DC chargepoints in order to charge their vehicles solely at their own premises, as opposed to using PINS. Installing AC chargepoints to charge solely at their own sites will pay back quicker than DC chargepoints for both delivery and emergency fleets, although emergency fleets are less likely to install AC chargepoints.

5.2 Business case from host organisations' perspective

Now that we have shown that there is a business case for PINS for visiting fleets, we will analyse the business case from the point of view of the organisations hosting the chargers. As mentioned previously, depots with vehicles operating on fixed schedules often have predictable periods when their chargepoints are unused. This downtime presents an opportunity to share charging capacity with other organisations and generate extra revenue, helping to accelerate the return on their initial infrastructure investment.

We have modelled the host organisations' business case by assuming the **baseline scenario:** 50/50% public vs PINS charging for visiting fleets; 35, 42 and 70 p/kWh inc. VAT for depot, PINS and public charging respectively (i.e. 20% PINS markup). This results in the following revenue and profit for the host organisation depending on the visiting fleet archetype. The results are shown per each visiting vehicle from external organisations and assume that each visiting vehicle charges once per day at the host depot.

Fleet archetype	Annual PINS revenue per visiting vehicle	Annual profit per visiting vehicle
Utility	£2,548	£437
Delivery	£777	£133
Emergency	£1,578	£271

While the order of magnitude of these profits seems compelling, we need to analyse again the chargepoint TCO to get the full picture. A reasonable lifetime for most chargepoints is around 10 years, hence we analysed how frequently they would need to be used by visiting fleets to pay back their capital and operating costs in that period by the use of visiting fleets alone. Based on the profits in the previous table, in order to reach a payback period of 10 years for each chargepoint, the table below shows how many times each chargepoint would need to be used daily by external organisations. We used the capital and operating costs for chargepoints displayed previously, except for the connection costs, as it was assumed that hosting other fleets would not justify in itself an upgrade in grid power supply.

Daily visits required per chargepoint to pay back in 10 years	AC	AC	DC	DC
Visiting fleet archetype	**7.4 kW**	**22 kW**	**50 kW**	**150 kW**
Utility	3	3	8	14
Delivery	9	10	26	46
Emergency	4	5	13	23

We deem that anything higher than 5 daily external fleet visits per chargepoint is unrealistic, so in most cases it would be **unlikely that the chargers would pay for themselves purely based on external organisations' visits.** However, external fleet visits can still help recover a percentage of the charging infrastructure costs. If each chargepoint is used for 1 hour per day by an external organisation, the table below shows the return on investment (ROI) after 10 years. Utility and delivery fleets show the same results because they are both assumed to have a 5 day/week utilisation, while emergency fleets usually have a 7 day/week utilisation.

Chargepoint ROI after 10 years if each chargepoint is used for 1h/day by external fleets	AC	AC	DC	DC
Fleet archetype	**7.4 kW**	**22 kW**	**50 kW**	**150 kW**
Utility or Delivery	12%	32%	27%	45%
Emergency	16%	45%	38%	63%

Significant proportions of chargepoint costs can be recovered by host organisations, specially at the higher end of charging powers. If the visiting fleets have duty cycles and operating patterns like those of emergency fleets, the business case is slightly more attractive compared to utility or delivery fleets.

We have shown how **there can be a compelling PINS business case not only for visiting fleets, but also for host organisations**, assuming that the right agreement can be reached (considering the non-economic factors described in previous sections).

5.3 Environmental case for PINS

To support the economic modelling, we calculated the environmental performance of PINS, defined as the emissions savings enabled by switching additional vehicles from ICEV to EV. We assumed that, enabled by charging at other organisations' sites, visiting fleets can electrify additional vehicles that they would not otherwise.

In the case of the utility fleet, these are usually vehicles that cannot be charged at employee homes because of the lack of off-street parking or enough time to recharge the daily energy requirements at 7 kW AC charging. As previously mentioned, our modelling indicates that around 50% of the utility vehicles will require PINS or public charging. In the case of delivery and emergency fleets, these are usually vehicles that cannot be charged at their depots because of power supply constraints, which our modelling indicates are around 90% of the vehicles.

We used per mile consumption and emission factors from petrol, diesel and electricity that were reflective of typical UK industry practice[11] to calculate the savings from electrifying the additional vehicles due to PINS compared to ICEV. The **baseline scenario** was assumed, hence only 50% of the charging happening out of depot/home was attributed to PINS with the rest assigned to public charging, so only the equivalent emission savings were considered.

The table below shows the emissions savings due to PINS, normalised per vehicle and compared to an ICEV. Relevant ICEV comparators were chosen for each fleet to ensure a like-for-like comparison.

Fleet archetype	WTW[12] CO2e savings (t)	WTW CO2e savings (%)	NOx savings (kg)	NOx savings (%)	PM2.5[13] savings (g)	PM2.5 savings (%)
Utility	1.9	20%	2.7	28%	10.0	26%
Delivery	0.7	30%	1.5	45%	4.7	45%
Emergency	9.7	37%	7.4	46%	24.2	46%

We have shown how **not only is there a business case for PINS, but also a significant environmental case with emissions savings ranging from 20 to 46% compared to petrol/diesel.**

6. Conclusions and recommendations

Our qualitative analysis via stakeholder workshops and interviews prompted the following recommendations and guidance for best practice:

Recommendations

Policy

- Streamline and simplify planning permissions to install charging infrastructure at private sites.
- Develop official guidelines and best practices for depot sharing arrangements backed by government and industry.
- Fund collaboration between LAs, businesses, and other stakeholders to develop chargepoint sharing platforms.
- Offer incentives for organizations that participate in depot sharing arrangements.

Social

- Conduct employee engagement activities within both visitor fleets and hosts to understand their concerns.
- Develop clear communication strategies to keep employees informed.
- Implement training programs to educate employees on the benefits from and procedures for using shared charging facilities.
- Monitor and evaluate employee feedback.

Technical

- Ensure data interoperability between fleet/depot management systems and EMSPs/CPOs.
- Communicating charging schedules, live availability, and time restrictions through a digital platform, potentially allowing for chargepoint booking.
- Establishing clear payment and billing processes between hosts and visitors.
- Clearly defined access protocols for visitor fleets, such as simple registration, entry/exit procedures, and automatic authentication of visitors.
- Allocating specific, clearly marked parking bays.
- Creating troubleshooting information: quick guides, contact information, technical support, plan for emergencies.

Legal

- Develop clear liability agreements explicitly outlining the responsibilities between participating organisations.
- Work with EMSPs and CPOs that have agreements in place which clearly define the split of responsibilities amongst them.
- Protect sensitive data related to vehicle usage, charging patterns, and driver information by adhering to GDPR.

We drew the following conclusions from our quantitative modelling of depot chargepoint sharing:

Conclusions

Economic

- There is a compelling business case for utility, delivery and emergency fleets to seek charging at another organisation's sites: charging cost savings of 9-19% are available under baseline conditions and 26-50% under more optimistic conditions.
- If delivery fleets, instead of using PINS, chose to upgrade the power supply to their depot and install additional AC chargepoints, then the only conditions under which those chargepoints can pay back in a reasonable time (< 5 years) compared to PINS would be with low depot charging costs (24p/kWh inc. VAT) or high vehicle-to-charger ratios (4:1).
- For emergency fleets and DC chargepoints, both of these conditions would need to be met, as well as low PINS prices, high public charging prices, and 75% of the out-of-depot charging using public infrastructure. It is unlikely that all these conditions would be met simultaneously, so emergency fleets should consider performing some of their charging at other organisations' sites.
- There is also a compelling business case for host organisations, as they can achieve significant ROIs after 10 years if their chargers are used for 1 hour/day by visiting organisations: 12-45% for AC and 27-63% for DC.

Environmental

- PINS can enable the electrification of additional vehicles that would otherwise remain as ICEVs.
- This can unlock emission savings compared to petrol/diesel vehicles of 20-37% WTW CO_2e, 28-46% NOx and 26-46% PM2.5.
- Not only is there a business case for PINS, but also an environmental case with significant emissions savings.

About

To find out more about this report, contact info@cenex.co.uk

To find out more about chargepoint sharing solutions, contact info@pauatech.com

Cenex

Cenex lowers emissions through innovation in transport and the associated energy infrastructure. We operate as an independent, not-for-profit research and technology organisation (RTO) and consultancy, specialising in the project delivery, innovation support and market development. As trusted advisors with expert knowledge, Cenex are the go-to source of guidance and support for public and private sector organisations along their transition to a zero-carbon future and will always provide you with the insights and solutions that reduce pollution, increase efficiency and lower costs.

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Paua

Paua is committed to simplifying charging and payment for businesses with electric vehicles. With Paua you can:

- Manage your EV charging costs across public, home and workplace
- Pay for electric vehicle charging nationwide
- Fairly compensate for charging at home

Their offering is based on a number of tools to simplify fleets' transition to electric:

- Driver app: Enabling drivers to easily find chargers, navigate and monitor their realtime charging on their phone.
- EV charge card: The magic Paua EV charge card for drivers that can start 60,000+ EV connectors nationwide. Simply tap and charge.
- Fleet dashboard: for managers to view and report on all charging sessions in a few clicks
- APIs: for managers to connect to Paua data in real time and automate reporting and processes.

Paua's products are Paua Access, providing access to UK's largest public network of EV connectors, and Paua Reimburse, to fairly reimburse your employees for charging anywhere.

Paua Share adds third party private depots to the growing list of locations businesses can charge, keeping fleets moving at lowest possible cost and reducing the need for detours to charge while also helping EV infrastructure hosts shorten the payback time of their EV charger installations. Win Win!

Paua will ultimately reduce administration and help your business electrify faster, while keeping your colleagues happy with easy-to-use tools and dependable support.

Email: info@pauatech.com | Website: www.paua.com

References

- [1] RAC Foundation, GB average proportion of households with off-street parking or parking potential
- [2] Home - National EV Insight & Support | Delivered by Cenex
- [3] For delivery fleets, this is based on anecdotal evidence by one of the interviewed stakeholders. For emergency fleets, this is based on Cenex modelling of multiple sites within an emergency fleet using vehicle telemetry and site power capacity data kindly provided by one of the interviewed stakeholders. For emergency fleets, we assumed that the number of vehicles requiring out-of-depot charging was those that would need to charge at least 10% of their sessions out of their own sites due to power supply limitations.
- [4] Based on a mix of historic Cenex projects and data kindly provided by stakeholder group.
- [5] Average of last 12 months from UK Government statistics (table 341) on non-domestic electricity prices for medium sized users (2-20 GWh annual consumption) including Climate Change Levy (CCL).
- [6] This range covers the expected markup in the future based on conversations with the stakeholder group.
- [7] Host markup applied to the base electricity price at depot.
- [8] AA monthly Recharge Report on public charging prices, with the sensitivity covering the range of flat, off-peak and peak charging rates from rapid and ultra-rapid chargepoints.
- [9] National Grid Energy Distribution's indicative DNO connection costs for a medium size connection (200-1000 kVA) are £75,000, which would cover either 50 fast, 20 rapid or 6 ultra-rapid chargers (link)
- [10] Costs assume that AC units typically have two connectors while DC units have a single connector.
- [11] Consumption figures from Cenex consultation with industry and based on past project experience. Greenhouse gas (GHG) emission factors from Department for Energy Security and Net Zero (DESNZ). Air quality emission factors from National Atmospheric Emissions Inventory (NAEI), based on COPERT 5. ICEV baselines assumed to be Euro 6d (RDE 1.43).
- [12] Well-to-wheel emissions represent the total GHG emissions associated with a fuel's entire lifecycle: production, processing, distribution, and use.
- [13] PM2.5 emissions, or fine particulate matter, are a type of air pollution that poses significant health risks due to their size: smaller than 2.5 micrometres.