# Warrington electric vehicle strategy

March 2021

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WARRINGTON
Borough Council

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## Executive summary

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# Warrington Electric Vehicle Strategy
# Executive Summary

**Warrington Borough Council**

# Why Develop an Electric Vehicle Strategy?

The UK is facing a climate emergency and is committed to reducing Greenhouse Gas emissions to net zero by 2050 in response to recommendations from the Committee on Climate Change (CCC). Warrington Borough Council (WBC) declared a Climate Emergency in June 2019 and this Electric Vehicles Strategy directly supports WBC's aim of reducing carbon emissions, and supports the ambitions outlined within the Warrington Local Transport Plan 4 Strategy.

Electric vehicles (EV) have zero tailpipe emissions and this strategy will also support WBC's aim to improve air quality as outlined in the Warrington Air Quality Action Plan (2017-2022). The UK Government's ultimate vision as set out in "The Road to Zero Strategy" published in July 2018 is that every new car and van sold in the UK should be zero emission by 2040, and that the entire UK road fleet should be effectively decarbonised by 2050. However, on 18th November 2020 the government brought the ban on new ICE car sales forward to 2030 which also prohibits the sale of new hybrid vehicles.

EV are an alternative to petrol and diesel vehicles which reduce emissions, particularly in congested urban areas where stopping and starting, idling and over-revving of petrol/diesel vehicles in queues produces high concentrations of emissions. EV use an electric drivetrain to provide power to the wheels rather than carbon-based fuels, so they generate zero exhaust emissions and less noise whilst driving. In spite of the increased electricity requirement, EV have a lower whole-life carbon footprint than petrol/diesel vehicles and given the UK's progress towards and remaining plans for greener electricity generation these benefits will increase further in the future. EV also produce less noise pollution and encourage a smoother driving style than petrol/diesel which increases driving efficiency by reducing the power required per km driven and causing lower particulate emissions from brake and tyre wear.

There are a range of actions that are needed to decarbonise transport such as increasing the numbers of people walking, cycling and using public transport as set out in WBC's Local Transport Plan 4, however transitioning to EV will also have an important role to play to complement this modal shift.

# Objectives of the Strategy

Through engagement with industry stakeholders and WBC officers, and review of relevant data, strategies and policies, the following objectives for the strategy have been set:

- Reduce carbon emissions in Warrington in line with WBC's declaration of a climate emergency;
- Improve air quality levels in line with the Air Quality Management Strategy;
- Align with the LTP4 ambition to reduce single occupancy journeys (particularly for shorter journeys) and move towards an integrated transport network.

The above objectives have been used to guide development of the strategy.

# The Current Situation

Buying and driving an EV can feel intimidating for many people and there is a general lack of awareness about the benefits and practicalities of driving an EV.

### Range of vehicles

One common perceived barrier to driving an EV is the real world range of vehicles before recharging is needed. Approximately 64% of the plug-in vehicle models available in UK have a battery capacity of less than 20 kWh which equates to less than 80 miles, however this includes plug-in hybrid vehicles that have predominately petrol engines to extend the vehicle range. However, all the new models announced to reach the market beyond 2020 are battery electric vehicles with capacities above 30 kWh equating to 120+ miles. This demonstrates the trend towards increasing battery capacity, intended to meet consumers' demand for increased range per charge and to tackle the continuing reports of range anxiety by potential adopters. New buyers of EV are experiencing much greater range than the early adopters upon which much research was based. Ranges have gone from less than 100miles to 200+miles. 250 miles electric range is more than adequate for the vast majority of UK drivers daily driving requirements which are below 20 miles per day, meaning they don't need to recharge every day. Even company car users whose annual mileage is quoted as 17,500 miles typically don't exceed 70 miles daily so electric range should be adequate for most daily mileage requirements.

### Choice of vehicles is expanding

In February 2020 there were 69 plug-in car models available on the UK market according to Electric Vehicle Database[1]: 32 plug-in hybrids (PHEV) and 37 full battery electric models (BEV). A further 18 models are announced for sale by the end of 2020, with an additional 18 models announced beyond then, all of which are BEV. There are commercially available models for buses, taxis and light goods vehicles, however choice is more limited at present.

**Price of vehicles** – plug-in vehicle prices generally remain high, although estimates provided by EV Database suggest a concentration of new full battery electric models coming by 2021 priced at under £40K with battery capacities up to 60 kW. The second-hand plug-in vehicle market is still small, making up less than 0.2% of auction sales in 2018[2] and most independent second-hand dealerships leave this limited market to franchised dealers. Second-hand dealers report the usual concerns about lack of recharging infrastructure alongside poor real range and value for money as reasons for this. However, the Go Ultra Low campaign supported by Energy Savings Trust and others seek to dispel these myths, but continuing regional awareness raising activities are required to get the correct messages out to consumers. Due to the falling price of batteries and increasing maturity of vehicle production techniques it is estimated that price parity between EV and petrol/diesel vehicles will occur in the mid-2020s.

### Charging of vehicles

One of the most often cited barriers is the lack of charging infrastructure. All plug-in vehicles require infrastructure to recharge their on-board batteries, by connecting the vehicle to an external electricity supply, most commonly the electrical grid or to an electrical storage facility. Currently, there is a range of charging infrastructure types and connectors which differ across vehicle manufacturers and models, however all manufactures (with the exception of Tesla) are working towards the Open Smart Charging Protocol meaning charging types and connectors will become standardised in the coming years.

[1] https://ev-database.uk/
[2] https://www.motortrader.com/surveys/market-report-electric-vehicles-used-market-10-10-2018

Plug-in vehicle charging technology is evolving rapidly. Prior to 2016 most technology charged at 3kW alternating current (called slow charging), which was adequate to fully recharge most batteries (typically up to 24kWh) overnight. With the development of vehicles came fast 7kW alternating current charging, and with the introduction of higher capacity batteries, direct current fast, rapid and ultra-rapid charging technology has since become available that (providing the vehicle is compatible) recharges vehicles much quicker.

Approximately 80% of vehicle charging is conducted at home locations where energy costs are lower, with top up charging taking place when required at destinations or on-route.

### Supply of vehicles

Consumers currently report significant waiting times for some plug-in vehicle purchases and there have been instances of models removed from sale in the UK due to an excess of demand over supply. These reports further reduce consumer confidence in this emerging market where many consumers still perceive plug-in vehicles to be inferior to petrol/diesel vehicles in terms of price and utility. They also hamper the effects of efforts to raise awareness of plug-in vehicles benefits, and press speculation and negativity further hinders the transition from petrol/diesel to lower emission vehicles. Vehicle manufacturers are increasing capacity to make EV however there is a big question mark regarding whether this increase will be sufficient to meet demand in the short to medium term.

## Current Numbers of EV in Warrington

Figures from the Department for Transport show that approximately 486 plug-in cars and vans were registered in Warrington by September 2019 equating to 0.4% of all cars and vans registered in the area, which is below the UK national average of 0.63%. Warrington is home to 0.33% of all cars and vans in the UK, but currently has only 0.2% of all plug-in vehicles registered in the UK. However, it should be noted that these figures do not include plug-in vehicles operating in Warrington that are registered outside the Borough, due to either in-commuting or lease vehicles being registered by the leasing company at their base location.

An increase of over 40,000 EVs would need to be registered in Warrington by 2030 to align with targets set by the UK Climate Change Committee which would require a significant acceleration in EV uptake above current growth rates.

As noted above, there is significant uncertainty about numerous aspects, not least the supply of electric vehicles. This strategy therefore considers how this uncertainty may play out and proposes a flexible approach to the provision of charging infrastructure and supporting measures. A minimum provision of charging infrastructure is proposed supporting residential, destination, on-route, taxi, and bus charging to support current demand and give people the confidence to transition to EV. Further to this it is recommended a pipeline of other sites is developed that can be deployed ahead of anticipated demand in a timely manner with analysis of usage informing the need to deliver further infrastructure.

# Current charging infrastructure in Warrington

Key to developing a forward-looking strategy for electric vehicles is understanding the current level of charging infrastructure in Warrington.

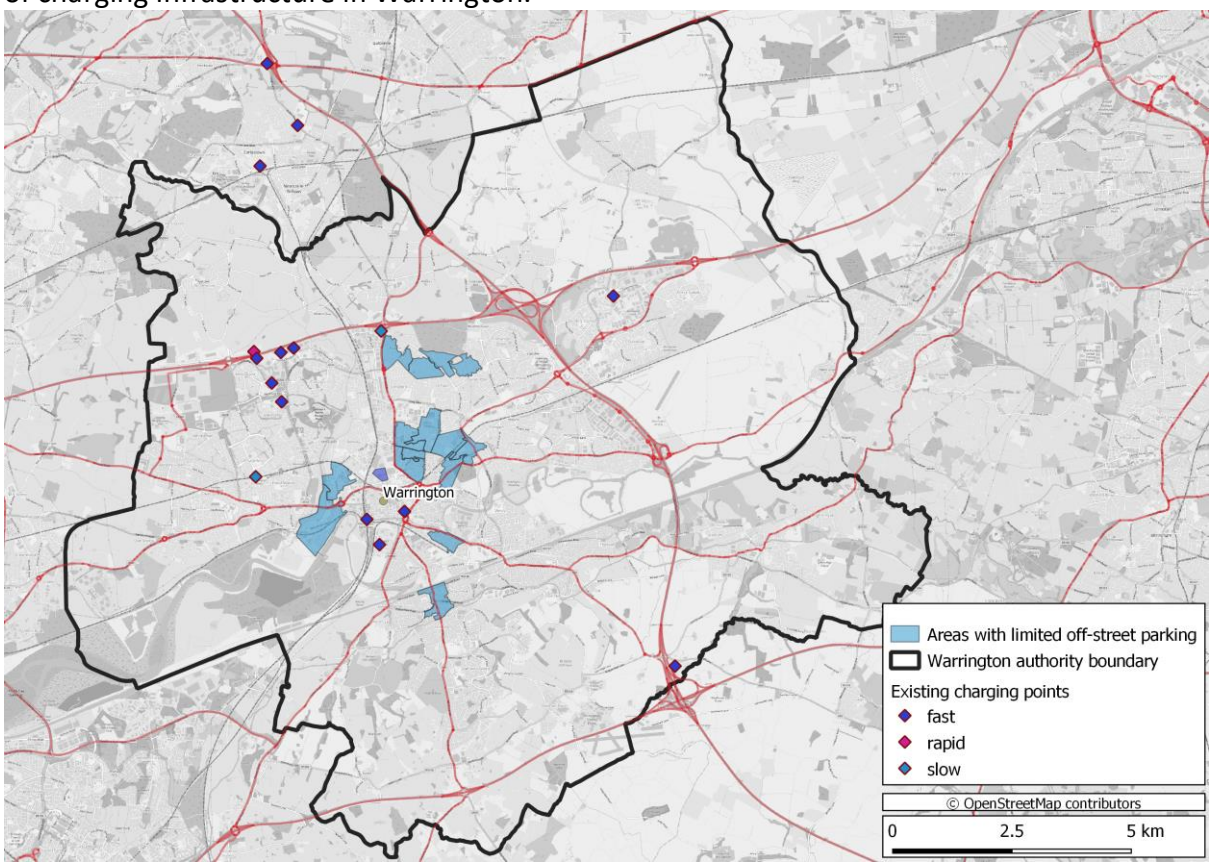


**Figure 1 - Publicly available existing charging infrastructure in Warrington**

Existing charging infrastructure is located in various destination areas such as the town centre (Times Square car park), around Warrington Bank Quay station, and retail areas such as Asda and IKEA. There are however large sections of the Borough that do not have any publicly accessible charge points.

Different charging points provide different levels of power which affects the charging time. Slow units are charging points between 3kW and 6kW, fast chargers offer a speed between 7kW and 22kW. Rapid chargers typically charge at 50 kW and ultra-rapid charge points charge at 100kW+ power. There is currently a lack of rapid charger provision in Warrington with a key gap in the town centre.

Analysis has also been conducted to understand areas of Warrington that have high concentrations of flats and terraced houses in which residents are unlikely to have the ability to recharge electric vehicles. There is a concentration of flats within Warrington town centre and concentrations of terraced housing to the north and on the outskirts of the town centre.

# Measures proposed in this strategy

A number of measures are proposed in this strategy to support the transition to electric vehicles in Warrington as set out below.

| Potential Measure | Rationale |
|---|---|
| **Short Term (0-2 Years)** | |
| Development and roll out of an EV taxi strategy for the Borough including engagement with the Hackney Carriage (HC) and Private Hire (PH) trade umbrella organisations. | Measures to support the transition to EV of HC and PH are becoming increasingly common in the UK recognising the potential benefits of reducing carbon emissions and improving air quality from vehicles that are highly utilised in urban areas. Funding has been secured from Defra to develop an EV taxi strategy. Key to realising benefits from this measure will be early engagement with the taxi trade to co-develop measures. |
| Increase provision of rapid charging infrastructure for taxis in convenient locations. | A key early measure as part of the EV taxi strategy will be planning for and delivering rapid charging infrastructure for taxis to complement other measures brought forward. |
| Develop a business case and specific proposals for the transition of the local bus fleet to EVs. | Scoping of a business case for this measure was undertaken for the All-Electric Bus Town Expression of Interest. Although unsuccessful, this provides the basis for submissions future funding opportunities for electric buses. Passive provision for charging an electric fleet is included in the proposals for the new bus depot. |
| Provide charging infrastructure for buses. | Alongside development of the business case, planning for the provision of charging infrastructure at bus depots and for top up charging where necessary should be prioritised. In particular, early engagement with Scottish Power to scope out electricity supply capacity at the new depot will be crucial. |
| Provide charging points at key destinations (e.g. town centre, Warrington Bank Quay station, major retail parks, major employment areas). | Although there is uncertainty regarding the rate of EV uptake given the constraints noted, a minimum provision across each use case will be required to give people considering the transition to EV the confidence to purchase / lease an EV. |
| Investigate priority on-route charging points on the Major Road Network. | |
| Provide on-street or off-street charging points to support residents with limited access to parking provision and home charging. | |
| Myth busting campaigns and practical support for the general public. | To gain maximum value from early investments in charging infrastructure (including the charge points already provided in the Times Square car park), a proportionate roll out of this measure is recommended. |

| Potential Measure | Rationale |
|---|---|
| Work with local businesses to encourage transition to an EV fleet / grey fleet. | Due to the number of fleet vehicles held by businesses and organisations (or grey fleet consisting of personal vehicles used for business purposes) there is an opportunity to achieve significant benefits by transitioning these to EV.<br>Some businesses and organisations could achieve cost savings by switching to EV in addition to environmental benefits and the free service provided by the Energy Saving Trust can be promoted through existing business connections such as the Travel Choices work currently conducted by Warrington, economic development support services and the chamber of commerce. |
| Transition Council fleet and operational vehicles to EV. | Introducing EV amongst WBC fleet and operations vehicles could be viewed as the Council "leading the way" in future vehicles whilst also increasing visibility of EV across the Borough. There is scope to integrate this measure with the provision of an EV car club in the town centre, with WBC using the vehicles within business hours and then the general public using them outside business hours, increasing the financial sustainability of the measure. |
| Continuous engagement and joint working with Scottish Power through the "Charge" project. | Scottish Power are currently conducting the "Charge" project that merges electricity and transport planning to create an over-arching map of where EV charge points will be required and where they can be best accommodated by the electricity grid. The project will also determine where future upgrades to electricity supply capacity are required to futureproof the network and feed into future business cases to secure investment as part of broad network development. If these locations can be identified this will avoid costly investment later which hinders the business case for charging infrastructure. The project is in progress with an end date of December 2022 and there is an opportunity for WBC to use the recommendations in this strategy and subsequent detailed planning to position the Council at the forefront of EV infrastructure provision in the region. |
| Update Parking Standards (currently 2015) to further encourage EV uptake. | Parking Standards contain requirements which new developments need to meet, including the number of EV parking spaces or charging points. The policy review shows that since the current Parking Standards were developed significant developments have occurred in EV planning and technology and therefore updated guidance is needed to reflect the changes in the vision and commitment of the Council.<br>A particular emphasis in any review will be to move from current passive (EV ready) provision to actual physical installation of EV charging equipment in residential developments. |
| Encouragement through contract procurement. | As contracts begin to reach their end point, the Council can amend the scoring criteria for tenders to give a greater focus to environmental and sustainability considerations including specific requirements for EV where appropriate. |

| Potential Measure | Rationale |
|---|---|
| Support the development of a car club in Warrington giving flexible access to EVs. | This measure aligns well with other transport aims in the Local Transport Plan 4 and there appears to be significant potential to provide flexible access to EV for Council pool cars and residents living in or near the town centre without access to a car or who are limited in terms of purchasing an EV by the lack of off-street parking. |
| Increase use and roll out of electric cargo bikes / e-scooters. | E-cargo bikes can provide a solution to local deliveries and also as the first/last mile of longer journeys. There could be scope for the Travel Choices team and other communication channels engaging local businesses to promote these solutions. However, in the case of e-scooters, UK trials are ongoing and further evaluation is required. |
| **Medium Term (2-5 Years)** | |
| Amend existing licensing laws to support the increased uptake of EV taxis | Initial feasibility of these measures could be included within development of the EV Taxi Strategy however significant planning and assessment will be required before these measures can be rolled out. These measures would also be most effective once rapid charging infrastructure has been provided in the short term to support top up charging during shift patterns. |
| Encourage uptake by providing loans, leasing options or a scrappage scheme (in addition to the existing OLEV fund). | |
| Supporting the transition of LGVs to EVs. | Given there are limited commercially available models and relatively low distance ranges it is recommended this measure is kept under review, with outcomes from the initial trial in Leeds evaluated prior to proceeding. |
| **Medium to Long Term (5+ Years)** | |
| Supporting the transition of HGVs to EVs. | The technology for HGV EV is still under development and as such, this measure isn't deliverable in the current situation. Alternative solutions are recommended for consideration such as hydrogen. |
| Introduce charging hubs / forecourts. | Although clusters of charging infrastructure should be provided in the short term for each use case, due to significant uncertainty regarding the uptake of EV and how drivers will want to charge their vehicles, the development of larger charging hubs should be considered when there is more clarity on these issues. Given the high cost, a cautious approach is recommended regarding investing in this measure and understanding whether these solutions can be provided by the private sector. |

# Targets and monitoring

Most strategies set out proposed criteria by which they will be judged, and how success will be measured. In this case, because too many variables remain regarding EV uptake and the factors that influence this, it could be unwise to set a figure for how many new charging points are envisaged to be installed or figures for EV uptake as a result of this strategy, and in what timeframe.

It is recommended the uptake of EVs in Warrington is tracked against the UK Climate Change Commission projections for EV uptake (43,000 proportional PIVs for Warrington by 2030) and progress is tracked regarding the implementation of measures contained in this strategy.

# Warrington electric vehicle strategy

March 2021

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WARRINGTON
Borough Council

# Warrington Electric Vehicle Strategy

Document No. 2

22 December 2020

**Warrington Borough Council**

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| 1 | 10/11/2020 | Warrington EV Strategy – Final | JD | AC | AC | AC |
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## Contents

# Executive Summary

**Why develop an electric vehicle strategy for Warrington?**

The UK is facing a climate emergency and is committed to reducing Greenhouse Gas emissions to net zero by 2050 in response to recommendations from the Committee on Climate Change (CCC). Warrington Borough Council (WBC) declared a Climate Emergency in June 2019 and this Electric Vehicles Strategy directly supports WBC's aim of reducing carbon emissions, and supports the ambitions outlined within the Warrington Local Transport Plan 4 Strategy.

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**Objectives of the strategy**

Through engagement with industry stakeholders and WBC officers, and review of relevant data, strategies and policies, the following objectives for the strategy have been set:

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- Improve air quality levels in line with the Air Quality Management Strategy;
- Align with the LTP4 ambition to reduce single occupancy journeys (particularly for shorter journeys) and move towards an integrated transport network.

The above objectives have been used to guide development of the strategy.

**The current situation**

Buying and driving an EV can feel intimidating for many people and there is a general lack of awareness about the benefits and practicalities of driving an EV.

**Range of vehicles** – one common perceived barrier to driving an EV is the real world range of vehicles before recharging is needed. Approximately 64% of the plug-in vehicle models available in UK have a battery capacity of less than 20 kWh which equates to less than 80 miles, however this includes plug-in hybrid vehicles that have predominately petrol engines to extend the vehicle range. However, all the new models announced to reach the market beyond 2020 are battery electric vehicles with capacities above 30 kWh equating to 120+ miles. This

demonstrates the trend towards increasing battery capacity, intended to meet consumers' demand for increased range per charge and to tackle the continuing reports of range anxiety by potential adopters. New buyers of EV are experiencing much greater range than the early adopters upon which much research was based. Ranges have gone from less than 100miles to 200+miles. 250 miles electric range is more than adequate for the vast majority of UK drivers daily driving requirements which are below 20 miles per day, meaning they don't need to recharge every day. Even company car users whose annual mileage is quoted as 17,500 miles typically don't exceed 70 miles daily so electric range should be adequate for most daily mileage requirements.

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**Charging of vehicles** – one of the most often cited barriers is the lack of charging infrastructure. All plug-in vehicles require infrastructure to recharge their on-board batteries, by connecting the vehicle to an external electricity supply, most commonly the electrical grid or to an electrical storage facility. Currently, there is a range of charging infrastructure types and connectors which differ across vehicle manufacturers and models, however all manufactures (with the exception of Tesla) are working towards the Open Smart Charging Protocol meaning charging types and connectors will become standardised in the coming years.

Plug-in vehicle charging technology is evolving rapidly. Prior to 2016 most technology charged at 3kW alternating current (called slow charging), which was adequate to fully recharge most batteries (typically up to 24kWh) overnight. With the development of vehicles came fast 7kW alternating current charging, and with the introduction of higher capacity batteries, direct current fast, rapid and ultra-rapid charging technology has since become available that (providing the vehicle is compatible) recharges vehicles much quicker.

Approximately 80% of vehicle charging is conducted at home locations where energy costs are lower, with top up charging taking place when required at destinations or on-route.

**Supply of vehicles** – consumers currently report significant waiting times for some plug-in vehicle purchases and there have been instances of models removed from sale in the UK due to an excess of demand over supply. These reports further reduce consumer confidence in this emerging market where many consumers still perceive plug-in vehicles to be inferior to petrol/diesel vehicles in terms of price and utility. They also hamper the effects of efforts to raise awareness of plug-in vehicles benefits, and press speculation and negativity further hinders the transition from petrol/diesel to lower emission vehicles. Vehicle manufacturers are increasing capacity to make EV however there is a big question mark regarding whether this increase will be sufficient to meet demand in the short to medium term.

**Current numbers of EV in Warrington**

Figures form the Department for Transport show that approximately 486 plug-in cars and vans were registered in Warrington by September 2019 equating to 0.4% of all cars and vans registered in the area, which is below

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the UK national average of 0.63%. Warrington is home to 0.33% of all cars and vans in the UK, but currently has only 0.2% of all plug-in vehicles registered in the UK. However, it should be noted that these figures do not include plug-in vehicles operating in Warrington that are registered outside the Borough, due to either in-commuting or lease vehicles being registered by the leasing company at their base location.

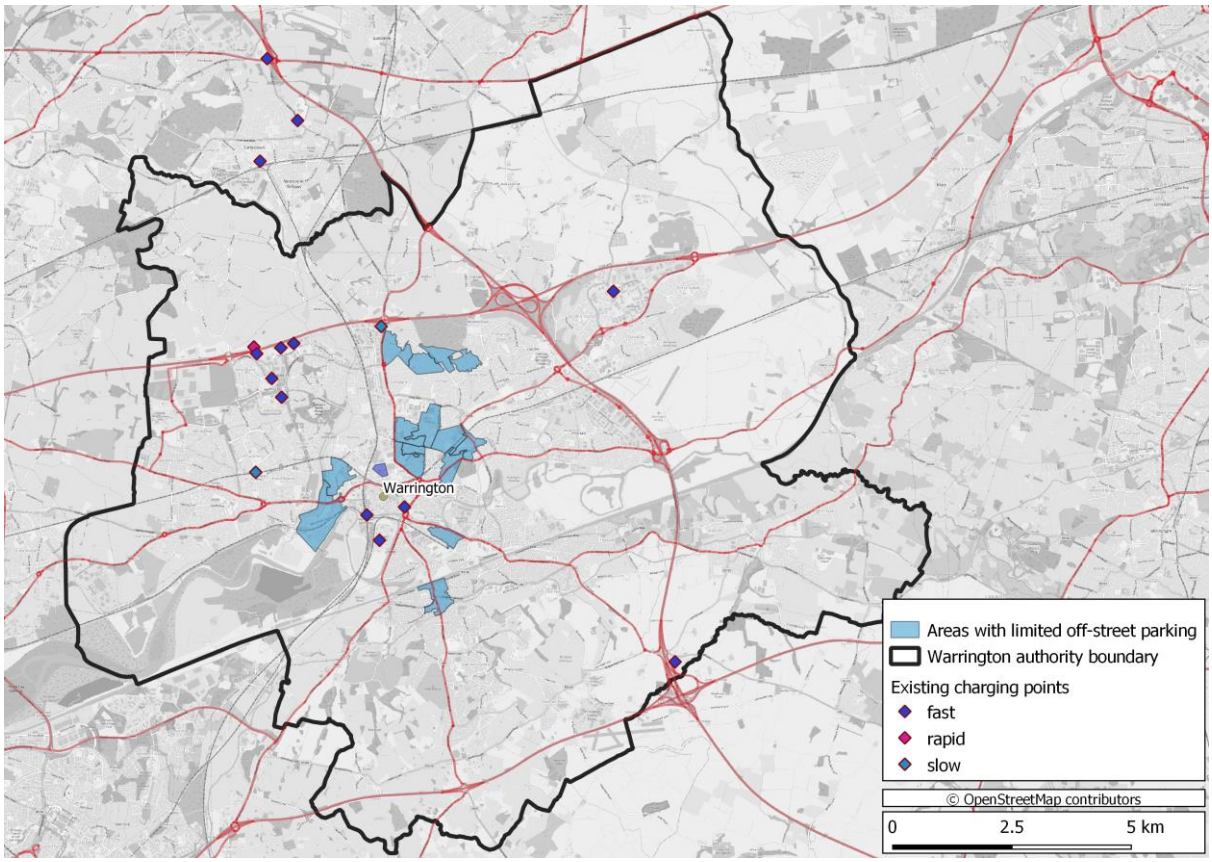
An increase of over 40,000 EVs would need to be registered in Warrington by 2030 to align with targets set by the UK Climate Change Committee which would require a significant acceleration in EV uptake above current growth rates.

As noted above, there is significant uncertainty about numerous aspects, not least the supply of electric vehicles. This strategy therefore considers how this uncertainty may play out and proposes a flexible approach to the provision of charging infrastructure and supporting measures. A minimum provision of charging infrastructure is proposed supporting residential, destination, on-route, taxi, and bus charging to support current demand and give people the confidence to transition to EV. Further to this it is recommended a pipeline of other sites is developed that can be deployed ahead of anticipated demand in a timely manner with analysis of usage informing the need to deliver further infrastructure.

**Current charging infrastructure in Warrington**

Key to developing a forward-looking strategy for electric vehicles is understanding the current level of charging infrastructure in Warrington.

Figure - Publicly available existing charging infrastructure in Warrington




Existing charging infrastructure is located in various destination areas such as the town centre (Times Square car park), around Warrington Bank Quay station, and retail areas such as Asda and IKEA. There are however large sections of the Borough that do not have any publicly accessible charge points.

Different charging points provide different levels of power which affects the charging time. Slow units are charging points between 3kW and 6kW, fast chargers offer a speed between 7kW and 22kW. Rapid chargers

typically charge at 50 kW and ultra-rapid charge points charge at 100kW+ power. There is currently a lack of rapid charger provision in Warrington with a key gap in the town centre.

Analysis has also been conducted to understand areas of Warrington that have high concentrations of flats and terraced houses in which residents are unlikely to have the ability to recharge electric vehicles. There is a concentration of flats within Warrington town centre and concentrations of terraced housing to the north and on the outskirts of the town centre.

**Measures proposed in this strategy**

A number of measures are proposed in this strategy to support the transition to electric vehicles in Warrington as set out below.

| Potential Measure | Rationale |
|---|---|
| **Short Term (0-2 Years)** | |
| Development and roll out of an EV taxi strategy for the Borough including engagement with the Hackney Carriage (HC) and Private Hire (PH) trade umbrella organisations. | Measures to support the transition to EV of HC and PH are becoming increasingly common in the UK recognising the potential benefits of reducing carbon emissions and improving air quality from vehicles that are highly utilised in urban areas. Funding has been secured from Defra to develop an EV taxi strategy. Key to realising benefits from this measure will be early engagement with the taxi trade to co-develop measures. |
| Increase provision of rapid charging infrastructure for taxis in convenient locations. | A key early measure as part of the EV taxi strategy will be planning for and delivering rapid charging infrastructure for taxis to complement other measures brought forward. |
| Develop a business case and specific proposals for the transition of the local bus fleet to EVs. | Scoping of a business case for this measure has already begun and there is potential government funding to support this from the DfT Electric Bus Towns fund. |
| Provide charging infrastructure for buses. | Alongside development of the business case, planning for the provision of charging infrastructure at bus depots and for top up charging where necessary should be prioritised. In particular, early engagement with Scottish Power to scope out electricity supply capacity at the new depot will be crucial. |
| Provide charging points at key destinations (e.g. town centre, Warrington Bank Quay station, major retail parks, major employment areas). | Although there is uncertainty regarding the rate of EV uptake given the constraints noted, a minimum provision across each use case will be required to give people considering the transition to EV the confidence to purchase / lease an EV. |
| On-route charging points on the Major Road Network. | |
| Provide on-street or off-street charging points to support residents with limited access to parking provision and home charging. | |
| Myth busting campaigns and practical support for the general public. | To gain maximum value from early investments in charging infrastructure (including the charge points already provided in the Times Square car park), a proportionate roll out of this measure is recommended. |
| Work with local businesses to encourage transition to an EV fleet / grey fleet. | Due to the number of fleet vehicles held by businesses and organisations (or grey fleet consisting of personal vehicles used for business purposes) there is an opportunity to achieve significant benefits by transitioning these to EV.<br>Some businesses and organisations could achieve cost savings by switching to EV in addition to environmental benefits and the free service provided by the Energy Saving Trust can be promoted through existing business connections such as the Travel Choices work currently |

| | |
|---|---|
| | conducted by Warrington, economic development support services and the chamber of commerce. |
| Transition Council fleet and operational vehicles to EV. | Introducing EV amongst WBC fleet and operations vehicles could be viewed as the Council "leading the way" in future vehicles whilst also increasing visibility of EV across the Borough. There is scope to integrate this measure with the provision of an EV car club in the town centre, with WBC using the vehicles within business hours and then the general public using them outside business hours, increasing the financial sustainability of the measure. |
| Continuous engagement and joint working with Scottish Power through the "Charge" project. | Scottish Power are currently conducting the "Charge" project that merges electricity and transport planning to create an over-arching map of where EV charge points will be required and where they can be best accommodated by the electricity grid. The project will also determine where future upgrades to electricity supply capacity are required to futureproof the network and feed into future business cases to secure investment as part of broad network development. If these locations can be identified this will avoid costly investment later which hinders the business case for charging infrastructure. The project is in progress with an end date of December 2022 and there is an opportunity for WBC to use the recommendations in this strategy and subsequent detailed planning to position the Council at the forefront of EV infrastructure provision in the region. |
| Update Parking Standards (currently 2015) to further encourage EV uptake. | Parking Standards contain requirements which new developments need to meet, including the number of EV parking spaces or charging points. The policy review shows that since the current Parking Standards were developed significant developments have occurred in EV planning and technology and therefore an update is required to reflect the changes in the vision and commitment of the Council. |
| Encouragement through contract procurement. | As contracts begin to reach their end point, the Council can amend the scoring criteria for tenders to give a greater focus to environmental and sustainability considerations including specific requirements for EV where appropriate. |
| Support the development of a car club in Warrington giving flexible access to EVs. | This measure aligns well with other transport aims in the Local Transport Plan 4 and there appears to be significant potential to provide flexible access to EV for Council pool cars and residents living in or near the town centre without access to a car or who are limited in terms of purchasing an EV by the lack of off-street parking. |
| Increase use and roll out of electric cargo bikes / e-scooters. | E-cargo bikes can provide a solution to local deliveries and also as the first/last mile of longer journeys. There could be scope for the Travel Choices team and other communication channels engaging local businesses to promote these solutions. However, in the case of e-scooters, UK trials are ongoing and further evaluation is required. |
| Conduct study into allowing EVs to utilise bus lanes. | Consideration would be needed as to whether this measure would negatively impact on bus journey times and reliability, with stakeholder engagement with bus operators recommended. |
| **Medium Term (2-5 Years)** | |
| Amend existing licensing laws to support the increased uptake of EV taxis | Initial feasibility of these measures could be included within development of the EV Taxi Strategy however significant planning and assessment will be required before these measures can be rolled out. These measures would also be most effective once rapid charging infrastructure has been provided in the short term to support top up charging during shift patterns. |
| Encourage uptake by providing loans, leasing options or a scrappage scheme (in addition to the existing OLEV fund). | |
| Supporting the transition of LGVs to EVs. | Given there are limited commercially available models and relatively low distance ranges it is recommended this measure is kept under |

| | |
|---|---|
| | review, with outcomes from the initial trial in Leeds evaluated prior to proceeding. |
| **Medium to Long Term (5+ Years)** | |
| Supporting the transition of HGVs to EVs. | The technology for HGV EV is still under development and as such, this measure isn't deliverable in the current situation. Alternative solutions are recommended for consideration such as hydrogen. |
| Introduce charging hubs / forecourts. | Although clusters of charging infrastructure should be provided in the short term for each use case, due to significant uncertainty regarding the uptake of EV and how drivers will want to charge their vehicles, the development of larger charging hubs should be considered when there is more clarity on these issues. Given the high cost, a cautious approach is recommended regarding investing in this measure and understanding whether these solutions can be provided by the private sector. |

**Targets and monitoring**

Most strategies set out proposed criteria by which they will be judged, and how success will be measured. In this case, because too many variables remain regarding EV uptake and the factors that influence this, it could be unwise to set a figure for how many new charging points are envisaged to be installed or figures for EV uptake as a result of this strategy, and in what timeframe.

It is recommended the uptake of EVs in Warrington is tracked against the UK Climate Change Commission projections for EV uptake (43,000 proportional PIVs for Warrington by 2030) and progress is tracked regarding the implementation of measures contained in this strategy.

# 1. Introduction

Warrington Borough Council (WBC) have commissioned Jacobs and Zero Carbon Futures (ZCF) to develop a strategy to accelerate the transition to Electric Vehicles (EV) across the Borough.

The Strategy will support the Council's aim to reduce carbon emissions and improve air quality as outlined in the Warrington Air Quality Action Plan (2017-2022). WBC declared a Climate Emergency in June 2019 and this EV Strategy directly supports WBC's aim of reducing carbon emissions, and supports the ambitions outlined within the Warrington Local Transport Plan 4 Strategy.

## 1.1 Structure

- **Chapter 2: Policy and Strategy Review.** This involves a review of current national, regional, sub-regional and local policy and legislation and how this relates to the objectives of the overall strategy.

- **Chapter 3: Evidence Base and Analysis.** This includes a review of background data regarding of EV, including key trends and future likely developments. This also examines demographic data and summarises engagement which has been undertaken with stakeholders.

- **Chapter 4: Charging Infrastructure Mapping:** This section outlines potential charging locations which could be considered based upon outline analysis against different use cases, such as destinations, residential, taxis and on-route.

- **Chapter 5: Potential Measures.** This outlines the potential future measures which could be developed as part of the strategy which have been informed by the policy review and evidence base analysis. This also includes details regarding how future uncertainties could impact the development of the potential measures identified and how the strategy can be structured to be robust across these different scenarios.

- **Chapter 6: Appraisal and Sequencing.** This section displays the outputs of the Red Amber Green ratings assessments for impact and deliverability of the measures, alongside the recommended timescales for development and delivery of the measures.

- **Chapter 7: EV Commercial Models.** This section details potential options for how charging infrastructure can be delivered and maintained, alongside analysis underpinning these options.

- **Chapter 8: Summary Programme of Work.** This section outlines a high-level timeline of recommended measures and key strategic actions to be taken.

# 2. Strategy and Policy Review

There is a wide range of policies and strategies at national, regional, sub-regional and local levels that are creating an increasingly supportive framework for the transition to EV as outlined in the following sections. Selected key examples are summarised below to provide context and inform this strategy with further detail provided in relevant section within following chapters.

## 2.1 National Strategy / Policy

- *Committee on Climate Change (2019)* – in June 2019, the Government passed new laws to support a target of net zero emissions by 2050 in response to recommendations from the Committee on Climate Change (CCC).

- *OLEV Road to Zero Strategy (2018)* – outlines the ambition that every new car and van sold in the UK should be zero emission by 2040, and that the entire UK road fleet should be effectively decarbonised by 2050. However, on 18th November 2020 the government brought the ban on new ICE car sales forward to 2030 which also prohibits the sale of new hybrid vehicles.

- *DfT Future of Mobility: Urban Strategy (2018*) – this strategy sets out the approach that Government will take to seize the opportunities from the changes happening in urban transport. It sets out the benefits which the Government aims for mobility innovation to deliver and the principles that will help to achieve this.

- *DEFRA Clean Air Strategy (2019)* – sets out the Government's plan to tackle all sources of air pollution, making our air healthier to breathe, protecting nature and boosting the economy.

- *Future Mobility Zones* – outlines the Government's commitment to fostering experimentation and trialling through launching four Future Mobility Zones with £90 million of funding. The zones aim to demonstrate a range of new mobility services, modes and models. They focus on significantly improving mobility for consumers and providing an exportable template to allow successful initiatives to be replicated in other areas.

- *Decarbonising Transport: Setting the Challenge (2020)*- sets out in detail what Government, business and society will need to do to deliver the significant emissions reduction needed across all modes of transport, creating a pathway to achieving carbon budgets and net zero emissions across all modes of transport by 2050.

- *Emerging DfT Buses Strategy and Electric Bus Towns Fund* – the DfT is at the time of writing inviting expressions of interest from local authorities to receive significant capital funding to transition local bus fleets to EVs. Further information is provided in Section 3.8.1.

- *UK Industrial Strategy: Building a Britain fit for the future* - sets out how the Government plan to build a Britain fit for the future through helping businesses create better, higher-paying jobs with investment in the skills, industries and infrastructure of the future. A key 'grand challenge' is decarbonising the economy to enable clean growth and capitalising on the opportunities to develop world leading skills and businesses in the field of future mobility.

- *Highways England Road Investment Strategy 2&3 (2020)* – documents present the long-term vision for what the Strategic Road Network should look like in 2050, and the steps to help realise this alongside an investment plan. The document notes that the rise of electric vehicles is essential

to achieving the target of net-zero carbon emissions by 2050, but also has the potential to encourage increased travel on our road network as the costs of driving fall.

## 2.2 Regional Strategy / Policy

- *Scottish Power Charge Project* – a project to merge transport and the electricity network to create an over-arching map of where EV charging points will be required and where they can best be accommodated by the electric grid.

- *TfN West and Wales Strategic Development Corridor* – significant economic and population growth is forecast within this corridor which will increase demand on transport infrastructure. The work on this corridor is looking at improving connections for people and businesses and exploring the options for improving road and rail capacity.

- *TfN Strategic Transport Plan (2019)* – outlines the need for investment in transport across the North and identifies the priority areas for improved connectivity. The Plan notes that the transport network must be decarbonised to support a shift to a low carbon economy.

## 2.3 Sub Regional Strategy / Policy

- *Cheshire & Warrington Draft Transport Strategy* – improved accessibility will be essential for the unlocking of strategic and wider development sites for housing and employment as well as relieving the many congested areas of our local and strategic transport networks. The Strategy notes that working with partners to explore technical and digital innovations will assist with the management of the existing network, with an increased uptake in EV supporting this aspect of the strategy.

- *Cheshire & Warrington Energy and Clean Growth Strategy* – sets out the energy challenges facing the sub-region and how, in collaboration with industry and key public-sector partners, the challenge of delivering 'affordable energy and clean growth' can be met. The Strategy notes that the LEP has a role in promoting low carbon technologies as a key factor in making new development sustainable, such as providing EV charging infrastructure.

- *Cheshire and Warrington Local Industrial Strategy* – outlines what evidence suggests are the strengths, weaknesses, threats and opportunities for the Cheshire and Warrington economy and how the UK's Industrial Strategy can be implemented within the sub-region.

## 2.4 Local Strategy / Policy

- *Warrington Air Quality Action Plan (2017-2022)* – outlines the actions that WBC will deliver between 2017 and 2022 in order to reduce concentrations of nitrogen dioxide within the two designated Air Quality Management Areas (AQMAs). Further information is outlined in Chapter 3.

- *Declared Climate Emergency (2019)* – the Council declared a climate emergency in June 2019 and resolved that by 2030 it would be carbon neutral in its operation and activities. The Council also approved their Green Energy Strategy in September 2019. An increased uptake in EVs supports carbon targets through reducing the level of emissions generated by car travel.

- *Warrington Last Mile Study (2020)* – aims to provide high quality and fit for purpose transport infrastructure to make walking, cycling and public transport the obvious way to get to, from, and through Warrington town centre. This EV Strategy needs to provide complementary measures to

the Last Mile Study to maximise the uptake of sustainable modes of travel and reduce car usage where possible.

- *Warrington Local Transport Plan 4 (2019)* – the current Local Transport Plan for Warrington identifies EVs as an area to develop during the period of the plan as part of an integrated and sustainable transport network.

- *Warrington Central 6 Wards Masterplan (2020-2040)* – a 25 year plan for the Central 6 area to give a strategic vision for change to create a place that enables all people to live as full a life as they are able and be part of the wider Warrington community. A transition to EVs would support the Masterplan through providing a mode of travel to access opportunities, such as through the use of car clubs.

- *Warrington Means Business Strategy (2017)* – Warrington's economic growth and regeneration programme with the aim to achieve inclusive growth where local people can enjoy and participate in the benefits growth will bring. The Strategy outlines areas for economic growth and redevelopment which creates opportunities for introducing EV charging within new developments.

- *Emerging Warrington Local Plan (2019)* – following consultation on the Draft Local Plan in 2019, the Plan is being updated to reflect the feedback received. The Plan aims to support Warrington's projected growth through delivering the necessary social, health, transport and green infrastructure to support Warrington's projected growth. As new developments come forward, this presents an opportunity for EV charging infrastructure to be integrated in new developments.

- *Standards for Parking in New Developments (2015)* – Supplementary Planning Document (SPD) expands on the policies within Warrington's Development Plan and relevant national guidance in relation to development proposals for Parking in New Development. The current standards require 5% of parking spaces of new developments to provide an electric charging point or passive provision for a charging point. These standards are to be reviewed, and this EV Strategy will inform that review.

## 2.5 Legislation

- *Automated and Electric Vehicles Act (2018)* – Promotes the development and deployment of autonomous and electric vehicles, through large-scale investment in electric charging points and new rules ensuring vehicle compatibility, payment standardisation and guaranteeing reliability.

- The Government consulted in 2019 on regulations for EV charge point smart technology and the provision of EV charge points in residential and non-residential buildings. A recent consultation in 2020 also sought comments on whether e-scooters should be legalised in certain contexts and other future mobility solutions.

- The Environment Bill (2019-2021) is currently making its way through parliament. The bill sets out how the government plans to protect and improve the natural environment in the UK by setting out a new framework for environmental governance including a commitment to set ambitious targets for reducing air borne pollutants such as nitrogen dioxide and fine particulate matter.

## 2.6 Summary

The review has shown that there is support for the transition to EV at all spatial levels and an increasingly supportive policy and legislative framework is being developed. Specific aspects of the

above policies and strategies have also informed later chapters of this document covering the evidence base and option development.

# 3. Evidence Base and Analysis

## 3.1 Electric Vehicle Trends

The UK is facing a climate emergency and consequently is committed to reducing Greenhouse Gas (GHG) emissions by at least 80% of 1990 levels by 2050 through its Climate Change Act 20083. However, in June 2019 the government passed new laws4 tightening this target to net zero by 2050 in response to recommendations from the Committee on Climate Change (CCC). Currently there is a major industry/purchasing shift from diesel to petrol engines as diesel are categorised as 'dirty'. Both have environmental impacts and deleting both options (in combination with uptake of other sustainable options such as active travel and public transport) will improve both air quality and gas emissions.

Diesel engines emit less CO2 and greenhouse gases than petrol engines. This happens because of the particular type of fuel and the internal efficiency of the diesel engine. More specifically, the fuel used in diesel engines has a higher compression ratio than petrol and it also performs better than petrol engines. As a result, less fuel is used to travel the same distance, allowing to save more CO2. Most estimations indicate that diesel engines emit about 10% less than the petrol engines of the same category. If we look at other sources of pollution, such as fine particles (like PM10, PM2.5, NO2 or NOx) petrol results in less emissions then diesel.

Carbon dioxide (CO2) is the main component of GHG, which traps heat in the atmosphere causing global climate change. The transport sector currently generates the highest proportion of CO2 emissions in the UK, due to the increasing miles driven by Internal Combustion Engine (ICE) vehicles which burn carbon-based fuels and consequently emit CO2 from their exhausts. The transport sector has made the lowest contribution to UK GHG emissions reduction of only 3% from 1990 to 20185, making it a prime target for future regulation.

Nitrous Oxide (N2O) is also a contributor (as is methane) but CO2 is the largest contributor which is why legislation has focused on its impact. Nitrous oxide is released naturally from soils and water bodies as part of microbial processes. The two major man-made sources are from agriculture and manufacturing. It is also released from power stations and road transport.

An important note is that fine particle emissions (PM 2.5) also originate from brakes and tyres. EV have the benefit of regenerative breaking but tyre wear will be similar which is why reducing vehicles numbers long term is the best option for clean air.

The UK Government's ultimate vision as set out in "The Road to Zero Strategy" published in July 2018[6] is that every new car and van sold in the UK should be zero emission by 2040, and that the entire UK road fleet should be effectively decarbonised by 2050. However, on 18th November 2020 the government brought the ban on new ICE car sales forward to 2030 which also prohibits the sale of new hybrid vehicles.

EVs are an alternative to ICE vehicles using an electric drivetrain to power the wheels rather than carbon-based fuels, so they generate zero exhaust emissions whilst driving. EV uptake in the UK is still at the early adopter stage with affluent, environmentally conscious buyers who are keen to adopt new

[3] Available at https://www.legislation.gov.uk/ukpga/2008/27/contents
[4] https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law
[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790626/2018-provisional-emissions-statistics-report.pdf
[6] Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf

technologies. Research shows that EV consumers prefer to charge at home overnight or at work during the day, which suggests a low current demand for public recharging services. Most early EV adopters have off-street parking enabling them to charge at home overnight, although this capability is greatly curtailed in some residential areas. However, vehicle consumers generally value "refuelling" convenience very highly, so a failure to roll-out sufficient public recharging facilities may curtail future mass-market EV uptake. Indeed, surveys of both EV and non-EV drivers still identify the need for greater availability of public charging facilities as a key requirement for growing EV adoption. The government reflects this need for charging provision in its "Road to Zero Strategy" and can now legislate to require its provision using the "Automated and Electric Vehicles Act" (AEV Act)7. A caveat to prevailing thought is that early purchases were to people with an identified charging provision. New buyers of EV are experiencing much greater range than the early adopters upon which much research was based. Ranges have gone from less than 100miles to 200+miles. A new situation has arisen where large scale private finance is going into rapid charge hubs to maintain the current behaviour of going to a fixed point to 'fill up'. With such a low national population of battery electric vehicles projected to be circa 162,000 by the end of 2020 (SMMT) which is 0.46% of the UK car population, the normalising of driver behaviour is some way off. What is known is that there will have to be a mix of provision, however, the ratios of the type of chargers and charger numbers are yet to be established. Currently there is provision for a national network but no published strategy to achieve one.

## 3.2 Electric Vehicle Technologies

This section summarises the EV technologies currently available in the UK.

EV are an alternative to ICE vehicles which reduce emissions, particularly in congested urban areas where stopping and starting, idling and over-revving of ICE vehicles in queues produces high concentrations of emissions. EV use an electric drivetrain to provide power to the wheels rather than carbon-based fuels, so they generate zero exhaust emissions and less noise whilst driving. In spite of the increased electricity requirement, EV have a lower whole-life carbon footprint than ICE vehicles and given the UK's progress towards and remaining plans for greener electricity generation these benefits will increase further in the future. EV also produce less noise pollution and encourage a smoother driving style than ICE which increases driving efficiency by reducing the power required per km driven and causing lower particulate emissions from brake and tyre wear.

## 3.3 EV Terminology

There are many acronyms used to refer to electrically propelled low emission vehicles:

**Electric vehicles (EV)**

EV is the term most recognised by the general public, but it is a generic term used to refer to any vehicle driven by an electric motor powered by a battery, which range from hybrids through full electric and onto fuel-cell models. Their emissions depend upon the method of propulsion used to drive the wheels at any point in time.

**Ultra-Low Emission Vehicles (ULEV)**

The government's "Road to Zero" strategy takes a technology-neutral approach to reducing transport emissions, using the term Ultra Low Emission Vehicle (ULEV) currently referring to any vehicle emitting less than 75g$CO_2$ per km driven. Based on this definition the ULEV category includes both full electric and some hybrid vehicles. However, recognising advances in technology we expect the ULEV definition to be modified over time and the UK Vehicle Certification Agency reports an expected change to less

[7] http://www.legislation.gov.uk/ukpga/2018/18/contents/enacted

than 50g/km $CO_2$ by 2021. Most, but not all, ULEV need to be plugged in to an external electricity supply to recharge their batteries.

**Battery Electric Vehicles (BEV)**

Full battery electric BEV have no combustion engine and always use an electric motor for propulsion, so they produce ZERO exhaust emissions.

**Hybrid vehicles**

Hybrids use more than one form of on-board energy for propulsion, usually a petrol or diesel engine plus electric motors and a battery. Some hybrids simply use the electric motor to make more efficient use of petroleum fuel so the motor cannot power the vehicle alone, whilst others can operate using petrol/diesel OR electric power alone, although usually only for short distances due to the size, weight and cost of the two powertrains required. All hybrids produce some exhaust emissions.

**Plug-in hybrid electric vehicles (PHEV)**

PHEV are a subset of hybrid vehicles, combining a plug-in battery and an electric motor with an ICE, EITHER of which can be used to drive the wheels. The method of propulsion used at any time dictates the amount of tailpipe emissions produced.

**Plug-in vehicles (PIV)**

PIV is a collective term covering all vehicles which can be plugged in to an external electrical outlet to recharge their battery, including both BEV and PHEV. All PIV require recharging infrastructure to recharge their batteries in suitable locations, at appropriate times of day/night and for a suitable duration, using charging infrastructure. Therefore, PIV provide the demand for charging facilities.

**Fuel Cell Electric Vehicles (FCEV)**

FCEV use a fuel cell instead of or in combination with a battery to power the electric motor. The fuel cells generate electricity to power the motor, generally using oxygen from the air and compressed hydrogen. Hydrogen must be stored and transported from its production site to a refuelling station making it a costly infrastructure solution. Few FCEVs are currently available in the UK.

## 3.4 EV technology roadmaps

This section provides information on UK technology trajectories for all modes of road transport. The UK Automotive Council has developed long-term technology roadmaps[8] for passenger car, bus and commercial vehicle technology which represent the vision of vehicle manufacturers to 2040. They show electric drivetrain technology as a focus area for passenger cars and light vans to 2050 given the move towards reducing emissions.

### *3.4.1* Cars

The passenger car technology roadmap applies to private consumer's vehicles, taxi and private hire fleets, car share, individual business and pool cars. Many ULEV are now available to support these use cases with many more models scheduled for release by manufacturers in the coming years. However, this increasing choice must be widely promoted to encourage consumers to consider adoption. Caution should be taken when manufacturers make a model launch as it is the manufacturing capacity which is the control factor for supply. With regard to Fuel Cell Electric Vehicles (Hydrogen) take up has been minimal and no EU based car companies have declared any intent to produce these cars.

[8] https://www.automotivecouncil.co.uk/technology-group-2/automotive-technology-roadmaps/

### 3.4.2 Light Vans

Light vans (up to 3.5 tonnes) can also make use of EV and hybrid technologies, providing an important opportunity to reduce urban emissions from local delivery, servicing and wider business vehicles. New light van sales have an average fleet-wide emissions target of 147g $CO_2$/km from 2020 and must achieve a further 15% reduction by 2025 reaching 31% by 2030 under EU regulations. Relatively few EV van models are currently available in the UK. More models are appearing however as with cars it is the supply which is the constraint.

### *3.4.3* Heavy Duty Commercial Vehicles

Heavy duty commercial vehicles remain a challenge for EV technology primarily due to their weight, payload and range requirements and technology has concentrated on achieving Euro VI emissions to date. Several companies are now investing in alternative technology solutions to reduce emissions from heavy freight, some focussing on creating all-electric powertrains, while others add self-driving features and new fleet logistics systems to standard rigs to improve efficiencies and emissions. As a local example, CNG Fuels have opened one of Europe's largest biomethane compressed natural gas (Bio-CNG) refuelling stations in Warrington for HGVs.

### 3.4.4 Buses

A variety of low emission technologies are already used on buses, including hybrid, plug-in hybrid, electric, hydrogen fuel cell and biomethane models, enabling operators to choose appropriate technology solutions to meet their operational needs. The UK Government has provided funding towards the deployment of low emission buses through the DfT's Low Emission Bus schemes and Clean Bus Technology fund, and most recently advertised the opportunity to become the UK's first all-electric bus town[9]. There are two main types of electric bus: those which take power continuously from a source outside of the bus (e.g. overhead wires) whilst travelling; and those which use energy stored on-board usually in batteries. Hybrid electric buses use a combination of ICE and electric propulsion systems to reduce emissions. Future technology developments are targeting the use of fuel cells as the primary propulsion method as well as to extend range. Further information on electric bus applications is provided in the next section. During the period of writing this report no indicators have been published or observed which give a clear direction to the vehicle manufacturer's technology direction. Some UK cities e.g. Manchester are trialling BEV buses and others e.g. Aberdeen are trialling FCEV buses. The consequences for infrastructure for FCEV are substantial.

## 3.5 PIV car availability

This chapter reports on the Plug-in car models available and announced for the UK separated into BEV and PHEV (by 4th February 2020), summarises their battery capacity and charging capabilities and provides some context behind their availability and supply constraints. It is important to appreciate these circumstances when assessing likely demand for recharging facilities.

In February 2020 there were 69 plug-in car models available on the UK market according to Electric Vehicle Database[10]: 32 plug-in hybrids (PHEV) and 37 full battery electric models (BEV) as shown in Figure 3-1. A further 18 models are announced for sale by the end of 2020, with an additional 18 models announced beyond then, all of which were BEV. Many PHEV previously available in the UK are no longer for sale and no new PHEV show in the pipeline, highlighting the manufacturers' continuing shift from PHEV to BEV focus in line with tightening EU new car sales emissions targets. The UK's recent announcement to include PHEV in the ban on non-EV sales which has been pulled forward to 2030 should continue to reinforce this focus.

[9] https://www.gov.uk/government/news/britains-first-all-electric-bus-town-to-pave-the-way-for-green-communities-of-the-future
[10] https://ev-database.uk/

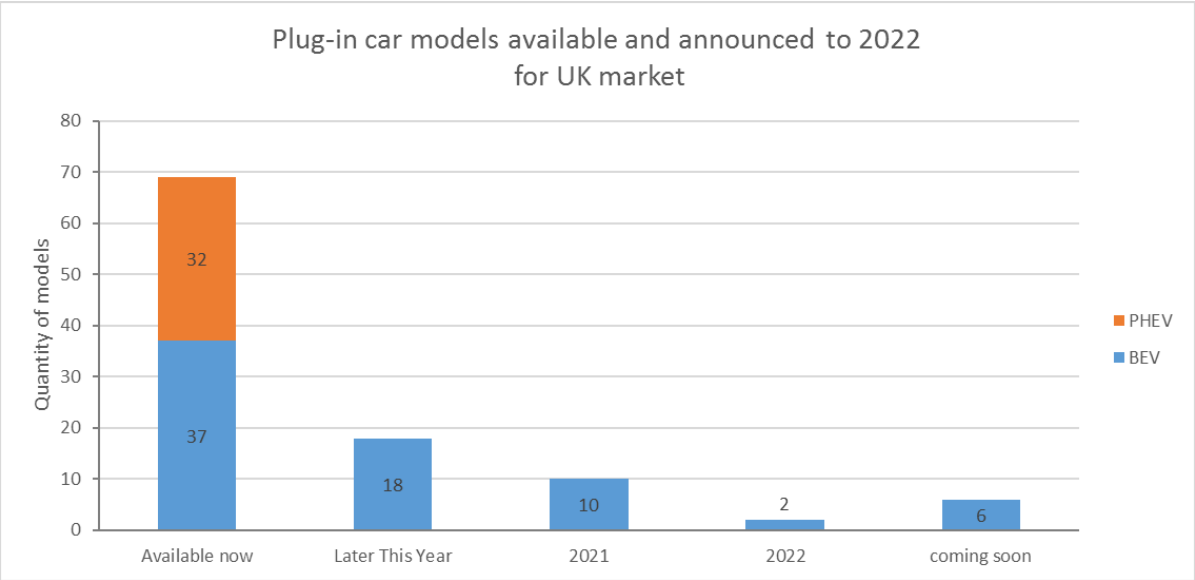



Figure 3-1 PIV models announced for the UK market

In contrast to the future BEV focus, the majority (64%) of PIV sales in the UK by the end of 2019 were PHEV according to the European Alternative Fuels Observatory (EAFO)[11], as shown in Figure 3-2. The UK's PHEV experience is similar to most European countries however, some such as Norway have the opposite situation due to their more favourable BEV incentive schemes. It will be interesting to see how the UK's BEV v PHEV split changes in the future following the 2018 changes to vehicle incentives in favour of BEV, changes to the ban on non-EV new car sales from 2030 and the associated lack of new PHEV models coming to market. This PHEV fleet will continue to need charging facilities going forward.

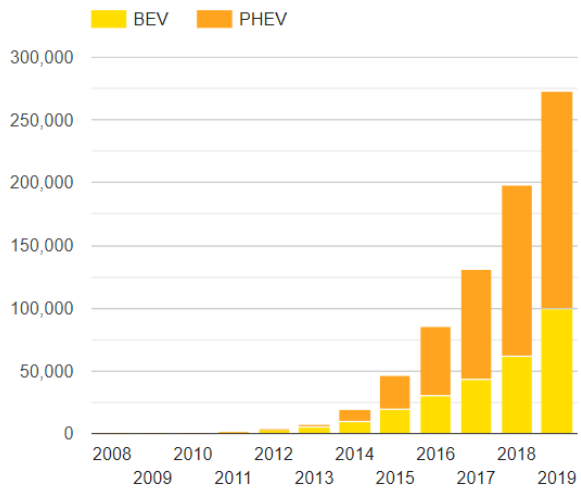



Figure 3-2 - Total PIV registrations in UK, split by BEV and PHEV

PIV model prices generally remain high as summarised in Figure 3-3, although estimates provided by EV Database suggest a concentration of new BEV models coming by 2021 priced at under £40K with battery capacities up to 60 kW. The second-hand PIV market is still small, making up less than 0.2% of auction sales in 2018[12] and most independent second-hand dealerships leave this limited market to

[11] https://www.eafo.eu/
[12] https://www.motortrader.com/surveys/market-report-electric-vehicles-used-market-10-10-2018

franchised dealers. Second-hand dealers report the usual concerns about lack of recharging infrastructure alongside poor real range and value for money as reasons for this. However, the Go Ultra Low campaign supported by Energy Savings Trust and others seek to dispel these myths, but continuing regional awareness raising activities are required to get the correct messages out to consumers.

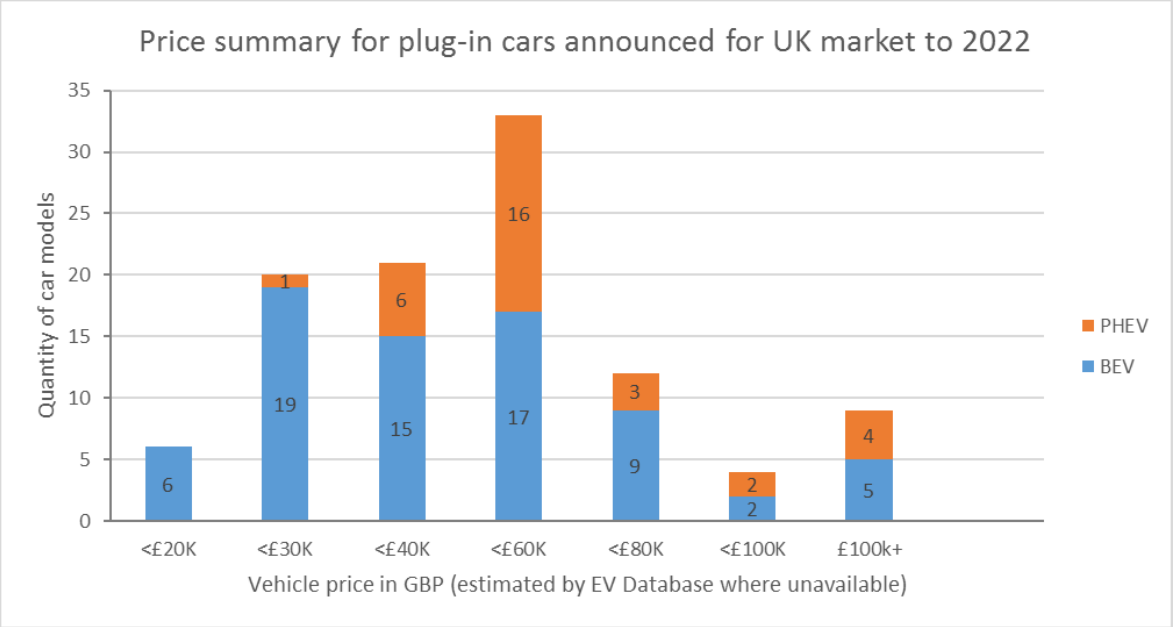



Figure 3-3 - PIV model prices announced for UK

### 3.5.1 Battery capacity

64% of the PIV models currently available in UK (at Feb 2020) have a battery capacity of less than 20 kWh as shown in Figure 3-4, since all the PHEV models sit in this category. However, all the new models announced to reach the market beyond 2020 are BEV with battery capacities above 30 kWh. This demonstrates the trend towards increasing battery capacity, intended to meet consumers' demand for increased range per charge and to tackle the continuing reports of range anxiety by potential adopters.

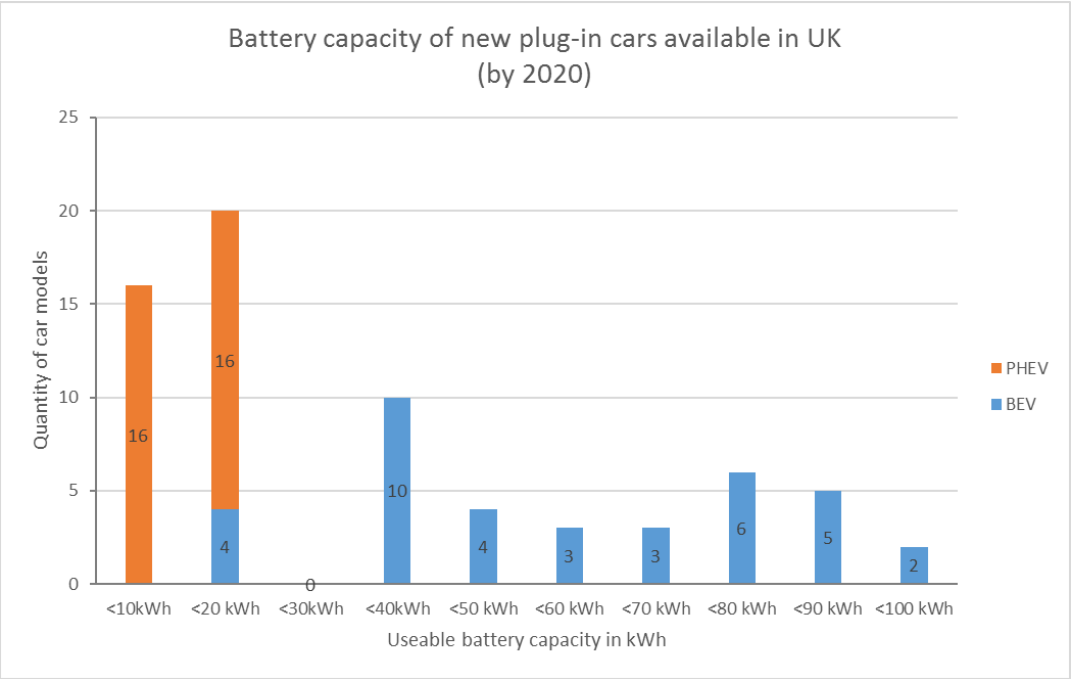



Figure 3-4 - Battery capacity of PIV models available in UK 2020

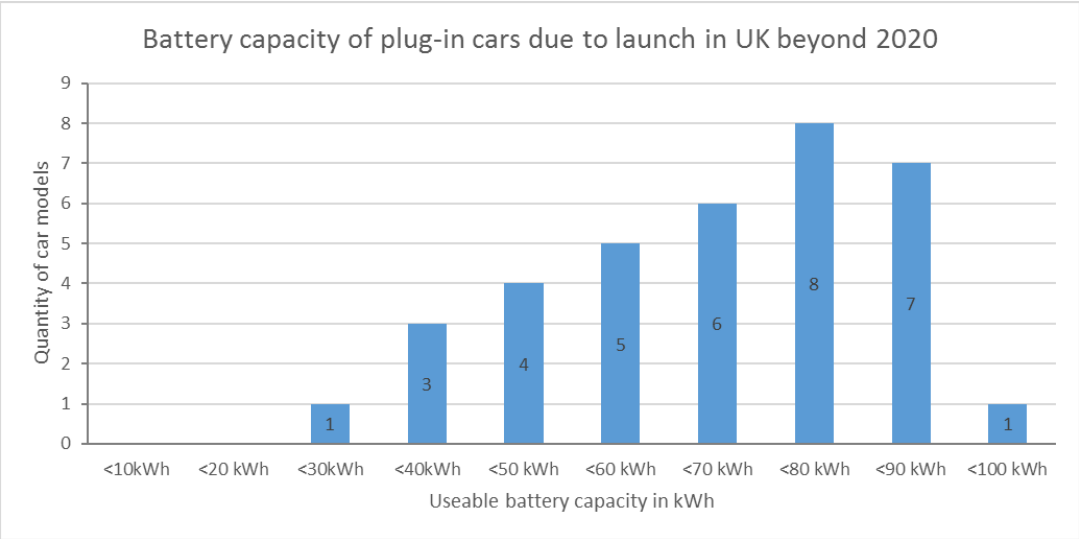



Figure 3-5 - Battery capacity of PIV models announced for UK beyond 2020

### 3.5.2 Electric range

Figure 3-6 shows the manufacturer's quoted electric range of PIV announced for the UK, clearly illustrating PHEV's low electric range per charge, and the concentration of BEV models with around 250 miles electric range. 250 miles electric range is more than adequate for the vast majority of UK drivers daily driving requirements which are below 20 miles per day, meaning they don't need to recharge every day. Even company car users whose annual mileage is quoted as 17,500 miles[13] typically don't exceed 70 miles daily so electric range should be adequate for most of their daily mileage requirements.

[13] https://www.gov.uk/government/statistical-data-sets/nts09-vehicle-mileage-and-occupancy

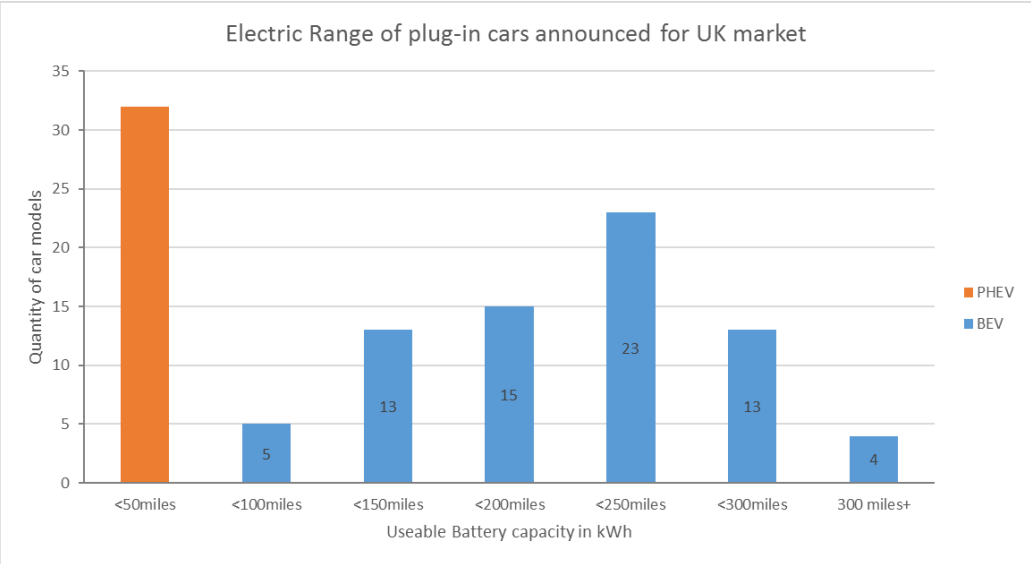



Figure 3-6 - Quoted range of PIV announced for UK

All vehicles currently on the market (except Tesla which uses a variant) are using a Li Ion battery technology. As a result there is a basic correlation of battery capacity to range of 4 miles to 1 kWh which reflects in the list of vehicles below. The battery price is a commodity with a market price per kWh but the vehicle is priced as now in terms of accessory specification and brand desirability. The quoted range on a full battery charge varies by PIV model and in practise also varies with driving style and conditions such as ambient temperature.

The following examples provide some context regarding range of announced UK PIV vehicles.

| | | |
|---|---|---|
| Nissan Leaf | - 38 kWh battery | - range = 140 miles |
| MG ZS EV | - 44.5 kWh battery | - range = 140 miles |
| BMW i3 120 Ah | - 37.9 kWh battery | - range = 145 miles |
| Renault Zoe R110 ZE40 | - 41 kWh battery | - range = 160 miles |
| VW ID.3 Std range | - 45 kWh battery | - range = 170 miles |
| Tesla Model 3 Std range | - 50 kWh battery | - range = 210 miles |
| Nissan Leaf e+ | - 60 kWh battery | - range = 215 miles |
| Renault Zoe Gen2 | - 60 kWh battery | - range = 225 miles |
| Kia Soul EV | - 64 kWh battery | - range = 230 miles |
| Kia e-Niro | - 64 kWh battery | - range = 230 miles |
| Hyundai Kona | - 64 kWh battery | - range = 245 miles |

### 3.5.3 Charging capabilities

There is currently a momentum to install the most powerful charger to achieve comparable charging times to a conventional car. The current charger range is 3kW to 350kW for cars and light vans. How does power relate to time on a charger? First, alternating current (AC) which is delivered in a linear or constant manner so a 30kWh car on a 3kW charger will take 10 hrs, and a 7kW charger just over 4 hours from empty to full. 7kW is the current volume maximum acceptance. Direct current (DC) or rapid charging is very different and the amount of power is determined by the car and not the charger. An example being the Nissan 30kWh Leaf which has a maximum acceptance of 50kW even if it is on a

350kW charger. The time spent on a DC charger is a function of the power acceptance curve which unlike the AC system is not linear and unique for each model and how much the customer wishes to take which is a function of need and price. As such there is no general answer to how long a car needs to charge on a rapid charger. Car makers are still trying to agree a standard message such as 0 to 100 miles from empty in 'x' minutes. Unfortunately most drivers never arrive empty and the time in northern Sweden in the winter will be different to Spain in the winter. There is no system currently available or likely to be available for several years to match EV fill time with a conventional vehicle fill time however the infrastructure installed now will still be compatible with any advances in battery chemistry.

The cost of charging is generally determined on a price per kWh basis with a connection fee in some cases. The price for AC charging is similar to a domestic tariff of circa £0.15 per kWh and DC is in the range of £0.30/£0.36 if a connection charge is applied it is normally in the range of a £1.00 connection charge. Note: With the utility companies entering the market there are trials and conversations to link domestic tariffs with EV charging to retain customers or gain customers.

The cost of installation is dependent upon associated civil and electrical works however as a guide a 7kW charger to purchase and install is circa £5-7,000 and for a 50kW DC rapid £18-25,000.

PIV charging technology is evolving rapidly. Prior to 2016 most PIV charged at 3kW AC (called slow charging), which was adequate to fully recharge most batteries (typically up to 24kWh) overnight. With the development of vehicles with 7kW on-board chargers came fast 7kW AC charging, and with the introduction of higher capacity batteries the 11kW and 22kW AC fast charging technology has since come to market. Figure 3-7 illustrates the AC recharging capabilities of the PIV models announced for the UK to 2022. This demonstrates the low power charging capabilities of PHEVs and when combined with the fact that PHEVs also have lower capacity batteries and the lack of new PHEV models, this highlights the limited demand they present for public charging facilities.

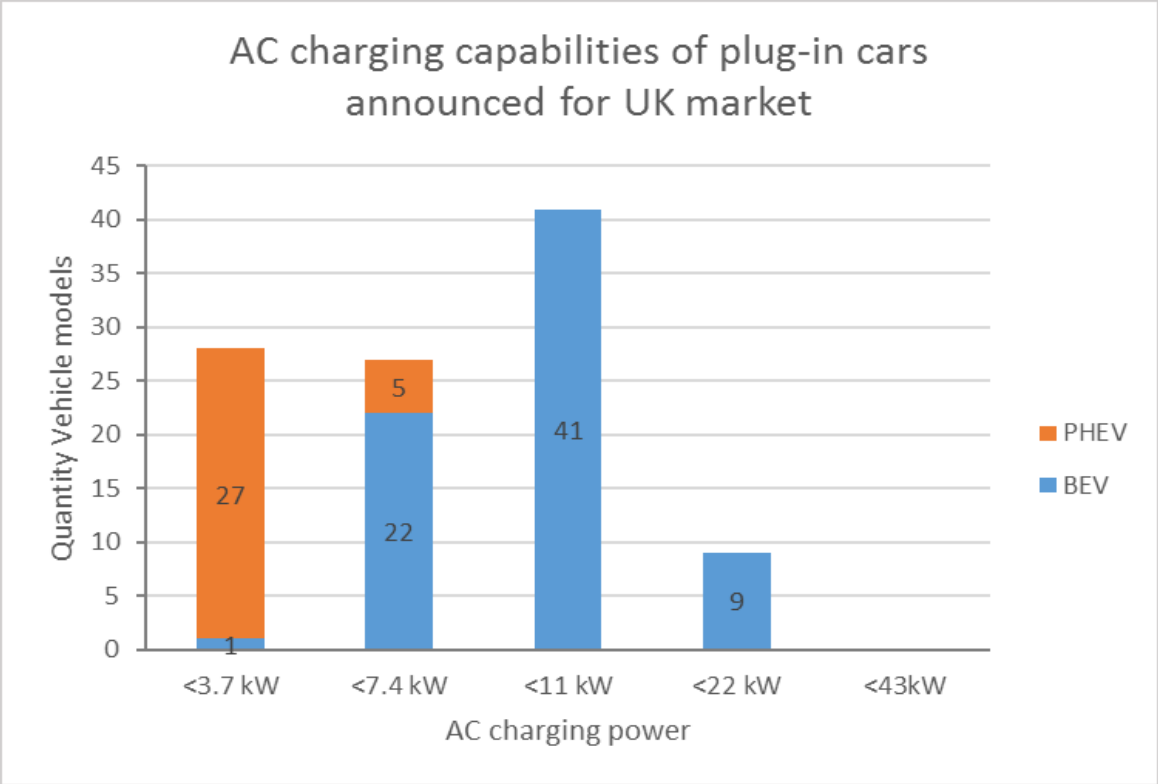


Figure 3-7 - AC charging capabilities of PIV announced for UK

Rapid charging DC technology developed in parallel provides consumers with a faster method to recharge, although only some PIV models were equipped with this capability prior to 2016. However, all new PIV models due to be available in UK to 2022 are rapid charge capable. Most vehicle manufacturers now use the CCS or CHAdeMO DC socket/plug for rapid charging. Only legacy Renault Zoe cars use the 43kW AC rapid charging system, and Renault has recently changed to CCS DC rapid charging for future PIV models.

In parallel, Tesla developed its own Supercharger technology, connectors and sockets to suit their bespoke battery solution which had much higher energy capacity than most early PIV (from 60 – 100 kWh), consequently charging their vehicles at 120kW power. Tesla superchargers were the first examples of high-power chargers to appear in the UK, but they can only be used by Tesla vehicles.

The latest technology development introduces charging at powers between 100kW and 350kW DC called high-power charging, but few PIV capable of using this charge power are currently available in the UK, most of which are high-priced executive cars. The majority of high-power charging solutions use the CCS DC connector/plug however a few have maintained the CHAdeMO standard. The roll-out of high-power chargers at 150kW+ for public use is now beginning in the UK, and most are designed so they can also deliver 50kW DC charges to rapid chargeable vehicles to combat the current lack of high-power charging demand.

Figure 3-8 illustrates the rapid recharging power capabilities associated with the PIV models announced for UK to 2022. This shows the trend towards increasing rapid charging powers to provide acceptable recharging times for higher capacity batteries, addressing consumers' concerns about the comparative convenience between recharging and refuelling.

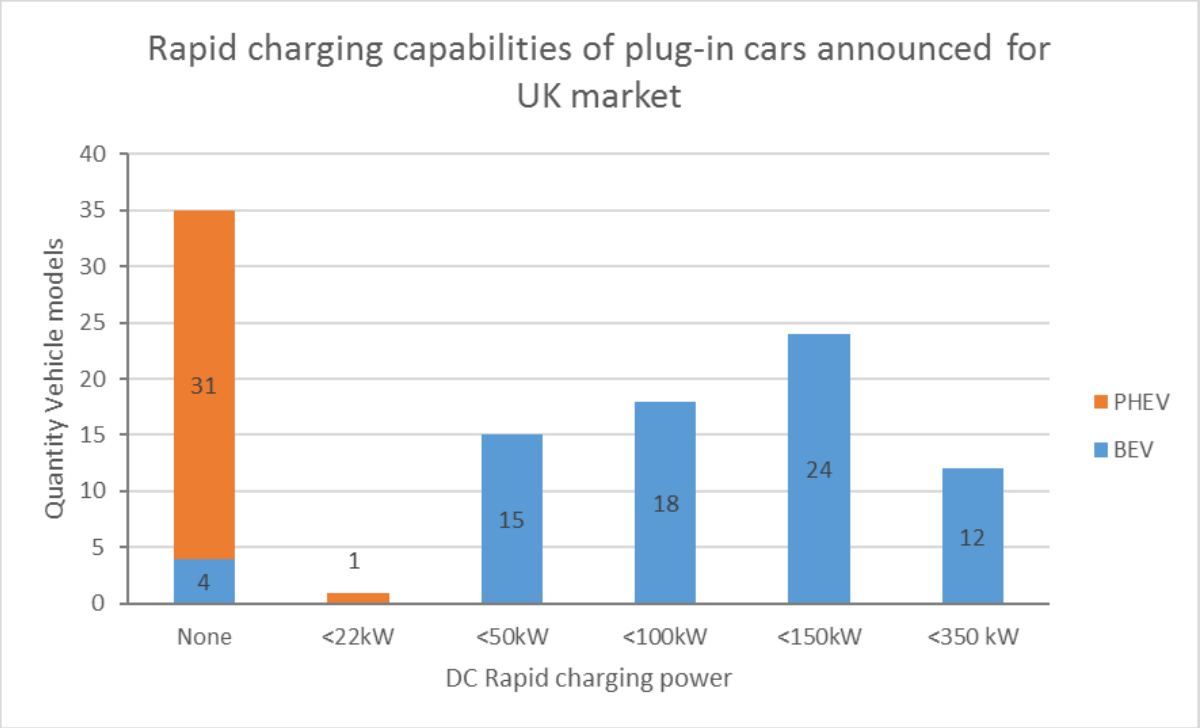


Figure 3-8 - Rapid charging capabilities of announced PIV for UK

Figure 3-9 shows the rapid charging connectors, illustrating the future prominence of the DC CCS connector for rapid charging which falls in line with the minimum rapid public charging requirements set out in the EU's Alternative Fuels Directive (2014)[14].

However, it is important to note that only 55% of all PIVs sold in the UK to date can be rapid charged, so slow and fast AC charging solutions will continue to be required to support existing PIVs' recharging needs. Of those rapid chargeable PIV currently on UK roads, approximately 70% require the CHAdeMO connector so it recommended that new rapid chargers installed over the next 5-10 years will require both DC CCS and CHAdeMO connectors to support both categories of demand. However, the rapid 43 kW AC connector will have very low and declining demand going forward.

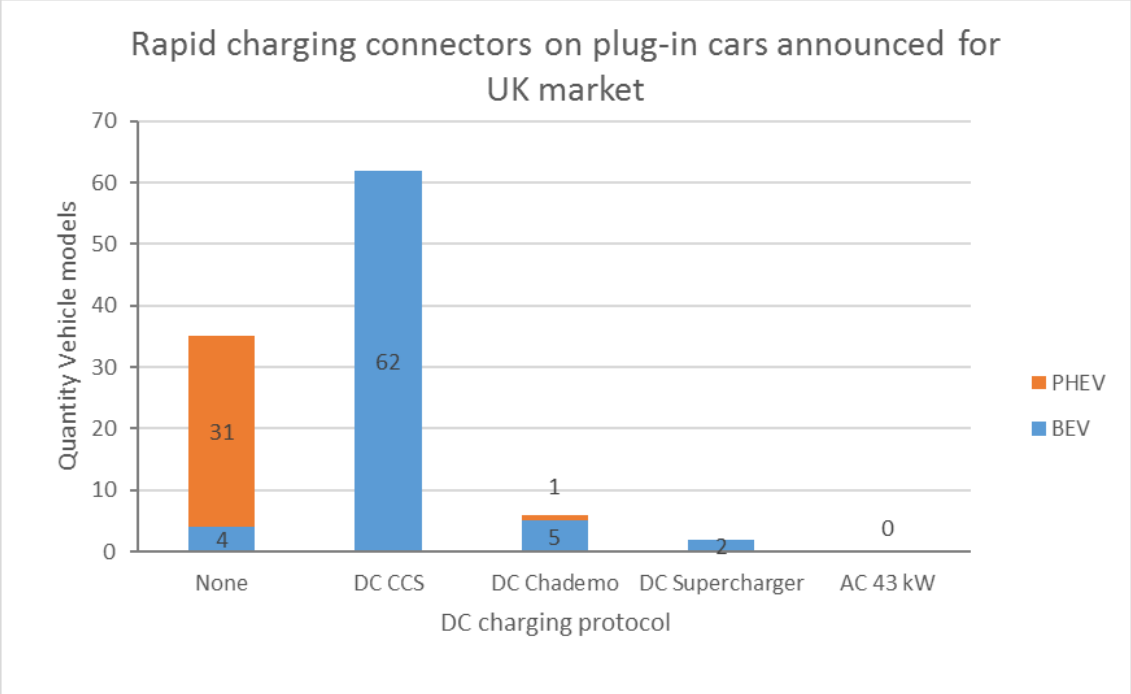



Figure 3-9 - Rapid charging connectors used by announced UK PIV models

### 3.5.4 PIV supply constraints

Consumers currently report long waiting times for PIV purchases and there have been instances of models removed from sale in the UK due to an excess of demand over supply. These unconfirmed reports further reduce consumer confidence in this nascent market where many consumers still perceive PIV to be inferior to ICE vehicles in terms of price and utility. They also hamper the effects of efforts to raise awareness of PIV benefits, and press speculation and negativity further hinders the transition from ICE to lower emission vehicles.

The lack of production capacity is a global issue, originating in vehicle production plants and the battery production facilities across the world. Vehicle manufacturers are in unprecedented territory, facing a demand for product transition at global government level based on emission reduction requirements. Indeed, the EU has set increasingly stringent regulations and associated fines to drive vehicle manufacturers to reduce the emissions of new car and van sales in Europe. However, the technology trajectory is still uncertain, the associated costs and plant changeover timelines are high, and both battery technology and supply are a key determinant. This presents major financial and

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0094&from=en

reputational risks for vehicle manufacturers since one of the key constraints (batteries) is out of their control.

The UK Government is also concerned about the strength of the automotive industry as it is an important contributor to UK employment, exports and GDP. Nissan introduced the Leaf in 2011, manufacturing all European volumes of battery and vehicle at its UK plant. The first model had a limited 24 kWh battery, which could have been seen as a risk with the limited charging infrastructure available at that time. However, this model led the way in Europe and was soon followed by Renault, Mitsubishi, BMW, VW and Tesla, and higher battery capacities are now becoming the norm. These market leaders are beginning to increase PIV model range but have yet to make significant volumes to satisfy the potential demand across the whole of Europe. Many vehicle manufacturers have made little or no significant impact on PIV availability to date, although there is much talk in the press about new models to come with little evidence of significant production volumes for the UK.

The current lack of PIV production volume is posing a problem for both legislators and supporting businesses. The UK government has responded by offering purchase incentives since 2011 however, these have been reduced over the last 3 years and now apply only to the cleanest PIV available, excluding PHEV models. More favourable incentives in countries such as Norway have driven PIV demand to such an extent that vehicle manufacturers could be confident to redirect large percentages of European PIV production volumes there. Norwegian vehicle incentives include exemptions from the country's 25% VAT on vehicle purchase, free parking and ferry use, as well as use of bus lanes. These incentives were complemented by the introduction of municipal charging facilities and a national network of rapid chargers. The UK does not at present hold such an incentive-based allure for the limited PIV supply, even though it is the second largest vehicle market in Europe.

The availability and cost of Lithium-ion (Li-ion) batteries appears to be the key limiting factor in PIV component supply. Consequently, vehicle manufacturers are considering whether to make or buy. Tesla has chosen to manufacture its own batteries and has launched associated energy business opportunities, and Nissan set up its own European battery manufacturing facility to guarantee early supply for its vehicle production but this has recently been sold. Most PIV manufacturers chose to rely on battery suppliers however European battery manufacturing capacity represents only a small proportion of global volume, and Chinese companies own the majority. Li-ion technology is also limited in terms of the opportunity to increase energy capacity and reduce cost, so new technologies are required to achieve the volume, capacity and cost requirements of the future PIV market. Appropriate volume-ready technologies are not forecast to reach the PIV market until 2025 to 2030, and many new battery manufacturing plants will then be required to supply the PIV volumes required to meet European targets, requiring significant investment and long-range planning. Therefore, this is considered to be the major risk to transport emission reduction targets in the UK.

Once the low battery volumes assigned to European PIV are split between European countries based on likely PIV sales, and then further by region, this leaves very low supply volumes likely for each LA until production capacity increases significantly. Regions and LAs have little or no control over vehicle manufacturers' PIV allocations. However, meaningful incentives such as grants supported by public charging facilities and financial dis-incentives such as Low Emission Zones have been shown to increase demand in some countries, leading to PIV manufacturers e.g. Nissan and Tesla directing greater proportions of limited production volumes there.

These supply constraints coupled with low UK PIV uptake to date questions the validity and usefulness of the CCC's targets to guide regions towards quantifiable charging infrastructure provision as a means of increasing PIV adoption. They do not appear to be affecting PIV manufacturers' allocation of vehicles to the UK.

## 3.6 PIV Charging technologies

This section explains the need for recharging infrastructure, and summarises the technologies used in the UK.

### 3.6.1 The need for recharging infrastructure

All Plug-in Vehicles (PIV) require infrastructure to recharge their on-board batteries, by connecting the vehicle to an external electricity supply most commonly the electrical grid (the electricity transmission network) or to an electrical storage facility. Electric Vehicle Supply Equipment (EVSE) is the collective term referring to all equipment used to deliver energy from the grid to PIV, including plugs, sockets, conductors, power outlets and devices which allow communication between recharging equipment and the vehicle.

All PIV require some form of EVSE to recharge their batteries, situated at suitable locations, over a suitable duration and at appropriate times of day or night which meet users' requirements. However, the vehicle dictates how power is drawn from the grid and therefore controls the speed of recharge, not the EVSE equipment. Consumer preferences and habits also have a role to play in recharging behaviour, and many consumers still consider current recharging durations as a limitation of PIV. However, different recharging equipment types are available to suit different use cases.

There is much debate about who should provide recharging infrastructure and several different solutions have now been implemented by public and private organisations in the UK and across Europe. There are many stakeholders interested in recharging infrastructure, for many different reasons, making it a complicated marketplace with often conflicting objectives. Once it became clear that EV were going to become mainstream the prevailing logic of electricity companies sell electricity, oil companies sell petroleum products and car makers sell cars was being challenged within themselves and by outside players entering the market. While this consolidation will continue it should not impact on the user. Feedback from the customer is seeing the introduction of contactless payment become standard which then makes the decision on operator based on price and convenience. The following sections set out the current different standards however; the recent announcement of Nissan to abandon the Chademo charger protocol to adopt the CCS charger and Tesla to make its cars compatible means that going forward to current confusing situation will end. The result will be that the user can use any charger with a standard AC and DC plug and pay contactless.

### 3.6.2 Charge points

The most well-known element of EVSE is the charge point – also called a charging post, charging point and charging station. The UK Electric Vehicle Supply Equipment Association (UK EVSE)[15] promotes the following terminology to avoid confusion:

- **EV charge point/charging unit** – a single upstand or wall-mounted structure offering one or more socket outlets or tethered plugs suitable for recharging EV.
- **EV charging station –** a physical site with at least one charge point installed suitable for recharging at least two EV. A station sometimes has other physical structures such as feeder pillar, weather shelter, signage, protection barriers etc.

Charge points can typically be mounted onto a wall or as free-standing units installed in the ground. Most ground mounted charge points can be installed with retention sockets to ease swap out for future maintenance, repair or replacement.

[15] http://ukevse.org.uk/uk-evse/

EV charging methods are split into two categories: AC and DC charging. EV batteries require DC current but the UK's energy grid supplies only AC current so power electronics are required to convert AC to DC current either in the vehicle or in the charger. If located in the vehicle the equipment is usually less powerful for space and weight reasons, and if in the charger this increases infrastructure cost with power.

Charge point specifications differentiate by power output, communication protocol, connector type and number of charging outlets. The charging power dictates the rate of recharge providing slow, fast and rapid charging solutions for different use-cases, with a range of dwell-times therefore appropriate to different types of location where users wish to recharge. A range of charging solutions are now available, designed to suit different vehicle use cases, summarised in Table 3-1. All vehicles on the market can AC charge from any public AC charger. The DC Chademo connectors are basically unique to Nissan and Mitsubishi and will be phased out with the next model introduction.

Table 3-1 Electric Vehicle Charging Methods

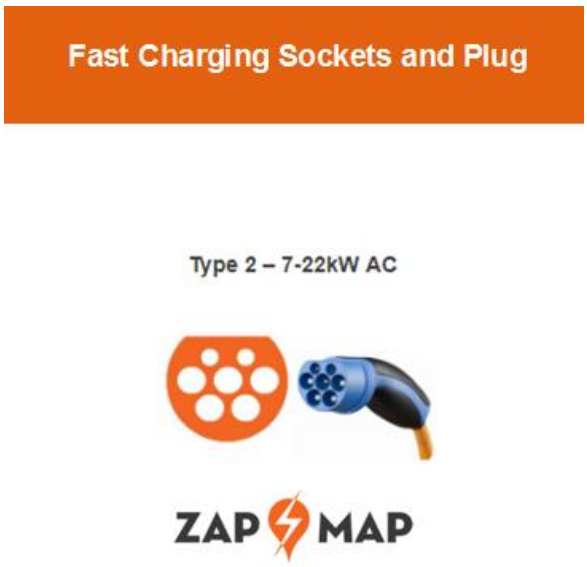
| Charger type | Power output | Supply type | Socket/ plug | Charging locations | Vehicle uses |
|---|---|---|---|---|---|
| Slow | < 7 kW | AC | Type 2 | Residential areas, Destinations | cars and light vans |
| Fast | 7.7 - 22kW | AC | Type 2 | Destinations, Depots | cars & small commercial vehs |
| Rapid | 23 - 50kW | AC | Type 2 | En-Route | cars & small commercial vehs |
| | | DC | Chademo | En-Route | cars & small commercial vehs |
| | | DC | CCS | En-Route | cars & small commercial vehs |
| High-Power | < 100kW | DC | Chademo | En-Route, Depots | cars & small commercial vehs |
| | < 350kW | DC | CCS | En-Route, Depots | cars & small commercial vehs |
| Ultra-Rapid | < 600kW | DC | Pantograph | En-Route | HGV's & buses |

### 3.6.3 Charging connectors

The international IEC standard 62196 specifies the plugs, sockets and outlets required for conductive recharging, covering charging modes, connection configurations and safety requirements for the operation of EV and recharging facilities. EV recharging connectors are specialised for automotive use.

PIV cars and light vans are supplied with a charging cable used to connect the vehicle to slow or fast charge points. This cable has a plug specific to the vehicle on one end, and a suitable plug on the other end to connect to slow/fast charge points in the UK. Some vehicles have separate charging sockets for slow/fast and rapid charging solutions, whilst some manufacturers have standardised on one vehicle-side socket for all charging solutions. Figure 3-10 and Figure 3-11, taken from the Zap Map website[16], show the variety of charging connectors (plugs) and sockets used for the different types of PIV in UK.

[16] https://www.zap-map.com/




Charging cables are typically supplied with a Type 2 plug to connect to slow and fast charge points in the UK.

Charging cables are also available fitted with standard UK 3-pin plugs intended for infrequent use where Type 2 charging solutions are not available, incorporating power protection limiting delivery to 3kW due to the risk of 3-pin plugs overheating when delivering power over prolonged periods.

Figure 3-10 – Type 2 socket and plug for slow and fast charging in UK

Rapid and high-power chargers do not use the cable supplied with the vehicle. Instead, these chargers are fitted with tethered cables and connectors which plug directly into the vehicle due to the high power being delivered. There are 4 socket/plug formats used for rapid and high-power charging in the UK, as shown in Figure 3-11.


Most vehicle manufacturers use the CHAdeMO or CCS DC socket/plug for rapid and high-power charging. Only Renault retains the 43 kW AC system.

Tesla's 120 kW supercharger socket/plug was designed to suit their bespoke battery solution. Tesla provides superchargers for public use.

Figure 3-11 - Sockets and plugs for rapid and high-power charging in UK

### 3.6.4 Charging protocols

The charging protocol governs how the vehicle communicates with the recharging equipment, and potentially through the charge point with a wider network of equipment and services such as payment systems, energy, communications and other services. The use of the Open Charge Point Protocol (OCPP) is promoted as the best way to enable the functionality required for widely available and accessible

recharging networks of the future. All vehicle and charging manufacturers will adopt the same communications protocol to allow the global recharging network will become accessible by all PIV drivers, flexible to address the needs of various stakeholders and cost less to run as new developments are shared easily and quickly. The use of a common protocol can enable communication between any recharging equipment and any wider system in the future. Most PIV and charger manufacturers now use the OCPP protocol however one still uses proprietary communication protocols e.g. Tesla. It is a matter of discussion as to when Tesla also falls in line.

The latest version available is OCPP 2.0 however version 1.6 is most commonly specified in procurement exercises in the UK currently and has been adopted across most of Europe, USA and Asia. Most slow and fast chargers intended for public use in the UK are now OCPP compatible however some old charge point models are not upgradeable, and therefore risk becoming obsolete. This highlights the need to consider future proofing in recharging infrastructure deployment plans.

A further development, the Open Smart Charging Protocol (OSCP), could enable direct communication between the electrical grid operator and the charge point. This potential functionality is highly valued by grid operators who need to monitor and control peak loading and timing implications for peak demand management, in order to maintain electricity provision for all.

### 3.6.5 Smart charging

Electric mobility will become an integral part of the UK's smart energy environment because the electrification of transport is key to decarbonising the economy. So smart charging solutions are a key enabler of a sustainable recharging market in the UK. Smart charging could benefit both consumers and electricity networks by incentivising consumers to shift recharging demand to periods when there is plentiful clean, renewable electricity available, in turn reducing the need for expensive electricity network reinforcement.

With regular (non-smart) charging as soon as the PIV is plugged-in it starts charging, drawing the maximum amount of power available from the supply until the battery is fully charged. For large fleets this could overload the available power supply causing practical power outages on-site and financial penalties from the energy supplier. Alternatively, smart charging allows the monitoring and management of the charging session enabling remote control over when, for how long and how fast the PIV recharges. Smart charging uses the OCPP charging protocol (v1.6 and beyond) to maximise charging flexibility and to mitigate the need for high-cost power supply upgrades. Although smart charging increases recharging infrastructure cost somewhat, it can provide multiple benefits:

- **Power peak reduction:** schedule and automatically control each vehicles' charging cycle to avoid peak power demand times and avoid exceeding maximum power supply capacity.
- **Reduce investment costs:** make optimal use of the existing power supply by controlling the charging speed of each charge point to prioritise specific vehicles and balance the available power across chargers to ensure each vehicle is fully charged ready for the next shift's activity.
- **Energy cost reduction:** cost-effectively schedule charging times to take advantage of time-of-use energy tariffs which could reduce operating costs.
- **Increase flexibility:** use prioritised load balancing to deliver only the energy required to suit each vehicles' next shift requirement, and allow for e.g. extended shifts, increased range, late start/finish times.
- **Demand response:** respond instantly to dynamic energy pricing and accelerate or reduce the energy consumption of your fleet accordingly to reduce operating costs.
- **Integration of batteries and renewable energy sources:** use stationary batteries as energy stores, charging them from renewable generation sources and/or when energy cost is low and subsequently use that stored energy to recharge vehicles when energy costs are high.

- **Reduce manual labour:** removes the time-consuming and error-prone need to manually plug/un-plug vehicles at specific times.
- **Improve PIV battery health:** smart charging results in slower charging over the battery's life-cycle, preserving its state of health and reducing long-term operating costs.

There are currently three levels of smart charging available:

- Basic load balancing distributes the available power capacity equally between all charge points to prevent overloading and high energy costs at peak times.
- Scheduled/static load balancing can also optimise charging schedules to take financial benefit from time of use energy tariffs.
- Dynamic load balancing can combine both static and dynamic data such as bus routes, next day plans and dynamic energy pricing to ensure the entire fleet is charged in time for individual departure at the lowest cost.

### 3.6.6 Recharging technology innovation

Since both EV technology and users' charging behaviour are still developing in this nascent market, so are recharging technologies which may disrupt the recharging market in the future.

#### 3.6.6.1 Innovative charging solutions

**Induction charging** is being trialled as a way to improve the ease of recharging without the need to plug-in. Electricity is transferred through an air gap from a magnetic coil in a charging pad mounted into the ground, to a second magnetic coil fitted onto the EV. Most EV manufacturers don't currently supply vehicles with induction charging equipment fitted although high-end manufacturers are beginning to consider it as a high-value optional extra (e.g. BMW 530e). A few companies offer induction charging systems for after-market retrofit, although this may invalidate vehicle and battery warranties at the present time. These early-market induction charging systems currently support static charging, i.e. whilst the car is parked, but the ultimate convenience would be dynamic charging whilst the car is in motion over chargers embedded in the road surface. Induction technology is still in development and costs for infrastructure are very high. A guide to vehicle manufacturers offering induction charging comes from the vehicle platform development to allow for equipment under the vehicle. If a new car is launched without the technology then it can reasonably be assumed any introduction will be via a platform change and that will be minimum of 6 years from product launch. No vehicle manufacturers have announced induction charging as standard on any new EV product coming to market.

**The battery swap process** involves the use of an automatic system to exchange a depleted PIV battery with a fully charged one, providing a "refuelling" time equivalent to that of an ICE. Chinese companies are pursuing this technology although there is little activity in the US or Europe currently. The system was first trialled by BetterPlace in 2010 but eventually failed due to the high investment costs and limited demand.

#### 3.6.6.2 Battery Energy Storage Systems (BESS)

Using PIV batteries in a second-life capacity outside of the vehicle in stand-alone Battery Energy Storage Systems can offer even more services to fleet and grid operators. When PIV batteries are no longer suitable for use in a vehicle (at around 70-80% of their original capacity) they can be removed and re-used in other applications, changing their primary use from transport to an energy solution. However, multiple second-life batteries are required to create an economic large energy storage facility which can provide a number of storage system services. Co-locating BESS with local renewable energy generation facilities maximises the commercial opportunity available to a landowner.

#### 3.6.6.3 Vehicle to grid (V2G) services

V2G services use the PIV battery in the vehicle to store energy and then supply it back to the grid at another time via the charging equipment. However, only PIVs using the Chademo charging protocol can currently deliver V2G services e.g. Nissan LEAF and Mitsubishi Outlander. V2G roll-out is also currently curtailed by battery degradation fears, hardware costs and limited energy revenue opportunities. In the future, this facility could offer EV owners, whether individuals or businesses, a value stream to earn revenue from the electricity grid operator or energy supplier. However, this financial opportunity is limited by the PIV's battery's energy storage capacity and the competing demand and priority for use of that battery as a means of transport.

The V2G facility operates both as a charge point AND enables energy stored in the battery to be fed back into the electricity grid to help supply energy elsewhere at times of peak demand or when renewable energy is unavailable. In this way the PIV battery provides services to the grid such as demand shifting, peak shaving and energy arbitrage, and enable the use of localised renewable generation resources such as PV and wind turbines to reduce electricity costs. At a fleet scale V2G will provide contractual opportunities with energy providers to generate revenue in addition to the benefits of converting to PIV.

V2G requires more complex bi-directional charging technology because the vehicle and charging equipment must be capable of controlling power in both directions between the grid and PIV, adding hardware and software and so increasing basic charging costs. The development of V2G compatible PIV has been slowed by a lack of communication standards for bi-directional charging but emerging standards are expected to greatly impact scale and cost reduction in the near future. Consequently, the financial business case for V2G and its variants vehicle-to-home and vehicle-to-business is still unclear, because neither capable vehicles nor charging equipment are widely available.

In national policy terms, V2G technology is offered as an important contributor to Demand Side Response (DSR) which aims to ensure a secure, sustainable and affordable UK electricity system. DSR's ultimate goal is to rebalance energy needs by changing how we produce and consume energy, to minimise the requirement to upgrade or install hardware on the national electricity supply network (grid). For businesses and consumers DSR can reduce total energy costs and reduce carbon footprint[17] either by reducing demand or taking advantage of on-site energy generation. To the individual car owner no viable case currently exists to pay back the investment required

#### 3.6.6.4 V2G case studies

In 2018 Innovate UK awarded £30 million of government funding to 21 V2G projects[18] led by EV manufacturers and energy businesses, in line with the UK Industrial Strategy, seeking to make the UK a world leader in low carbon vehicles and smart energy systems.

In late 2018 a report commissioned jointly by UK Power Networks and Innovate UK "V2G Global Roadtrip: Around the world in 50 projects"[19] showed that over half of global V2G projects were being undertaken in Europe but only one was in the UK. The report noted that Renault Nissan were dominant in V2G projects and that DC power was the main feature. The UK project is being delivered by grid operator Northern Powergrid in Newcastle investigating the use of 19 x 10kW DC MagnumCap10 V2G chargers with its fleet of Nissan LEAF cars and ENV200 vans. The complexity and time challenges of the G59 and G83 interconnection process including network impact assessments were identified as interim lessons. The V2G Hub[20] website currently identifies 65 V2G projects in 15 countries involving

[17] https://www.nationalgrideso.com/balancing-services/demand-side-response-dsr
[18] https://www.gov.uk/government/news/30-million-investment-in-revolutionary-v2g-technologies
[19] https://everoze.com/v2g-global-roadtrip/
[20] https://www.v2g-hub.com/

thousands of PIV and chargers, demonstrating V2G's increasing importance and interest to stakeholders.

Figure 3-12 shows a V2G facility developed by Nissan with multinational energy provider Enel, where 8 V2G chargers are being used by employees at Nissan's European R&D facility in Cranfield. The chargers provide an intelligent energy management system to recharge PIV and enable them to give stored energy from their batteries back to the grid to help stabilise demand.


Figure 3-12 - Nissan powers up UK-based European R&D hub with V2G technology

## 3.7 PIV adoption

This strategy focuses on Plug-in Vehicle (PIV) adoption rather than ULEV adoption because the volume of PIVs registered (including both BEV and PHEV) drives the demand for recharging services. Published ULEV adoption figures include some hybrid vehicles which do not plug-in. It is also important to understand the local areas' circumstances when devising a charging strategy such as vehicle ownership, propensity to buy PIV, housing stock and therefore the ability to recharge at home.

### 3.7.1 PIV uptake in Warrington

The latest published DfT vehicle statistics[21] were used to investigate total vehicle registrations and the uptake of PIV to Q3 September 2019. This historical PIV registration data was then used to forecast possible increases in PIV adoption in the area to 2030. A caveat is that some vehicles will be registered outside of Warrington due to lease arrangements however due to the cross reference of the domestic charge point grant scheme most private owners are correctly allocated.

Table 3-2 shows that 486 plug-in cars and vans were registered in Warrington by September 2019 equating to 0.4% of all cars and vans registered in the area, which is below the UK national average of 0.63%. Warrington is home to 0.33% of all cars and vans in the UK, but currently has only 0.2% of all PIV registered in the UK. It should be noted that these figures do not include PIVs operating in Warrington that are registered outside the Borough, due to either in-commuting or lease vehicles being registered by the leasing company at their base location. Data provided by WBC in April 2020 shows WBC employees lease 25 PIVs (4 BEVs and 21 PHEVs), with 25 PIVs on order (24 BEVs and 1 PHEV) through a company based in north east England.

[21] https://www.gov.uk/government/collections/vehicles-statistics

Table 3-2 Plug-In Vehicles registered

| Area | Population Density | Total Cars & vans registered | PIV Q3 2019 | % PIV (ranked) |
|---|---|---|---|---|
| Wokingham | 939 | 106,081 | 781 | 0.74% |
| Aberdeen City | 1,225 | 103,147 | 454 | 0.44% |
| **Warrington** | **1,160** | **120,267** | **486** | **0.40%** |
| Rochdale | 1,391 | 98,862 | 323 | 0.33% |
| Thurrock | 1,055 | 92,944 | 283 | 0.30% |
| Newport | 805 | 79,648 | 202 | 0.25% |
| North East Lincolnshire | 833 | 79,496 | 188 | 0.24% |
| Stockton-on-Tees | 962 | 100,351 | 225 | 0.22% |

Gross Disposable Household Income[22] (GDHI) and percentage of dwellings without off-street parking data[23] is also useful for interpreting PIV adoption, and to assess the need for public charging facilities. Table 3-3 presents the population, income and vehicle density figures for Warrington. Lack of off-street parking spaces in residential areas presents a particular problem, limiting the ability of PIV drivers to recharge their vehicles at home and suggesting the need for more public charging facilities in areas with a high percentage of homes without off-street parking. Warrington's terraced/flats housing stock figure is lower than the national average, and when coupled with its below average GDHI this suggests this may not be a significant problem in the near future. However, most cities and large towns in the UK have suburbs of terraced and apartment housing which will require recharging solutions in the longer term. Warrington's vehicle ownership density figure is slightly higher than the national average, possibly due to its excellent road connections to the nearby cities of Manchester and Liverpool encouraging much commuter traffic.

Table 3-3 Warrington demographics related to PIV charging need

| Area | Estimated Population Mid-2018 | 2018 people per sq. km | Vehicles /head of population | % Terraced homes & flats | £ GDHI 2017 |
|---|---|---|---|---|---|
| **Warrington** | 209,547 | 1,160 | 0.574 | 35.29% | £18,449 |
| | | | | | |
| **UK** | **66,435,550** | **274** | **0.55** | **46.90%** | **£19,202** |

### 3.7.2 Vehicle forecasts and targets

Using the historical baseline data for PIV registrations up to September 2019, a forecast is provided in Figure 3-13 for adoption to 2030 assuming all conditions remain the same. This can be considered as the do-nothing scenario for PIV adoption in the Warrington area.

However, it is considered that significant changes are likely in battery technology to increase energy density, battery life and vehicle range around 2025. This could have a major impact on PIV demand and availability in the latter half of the decade. The changes in battery technology and the increasing provision of rapid chargers by the public sector such as Shell and BP raise questions about provision

[22] https://www.ons.gov.uk/economy/regionalaccounts/grossdisposablehouseholdincome
[23] Dwelling data from https://www.nomisweb.co.uk/census/2011/data_finder

for commuters. A reasonable question for a local authority is to consider, with EV average range of 150 miles and increasing is there a need for mass deployment for commuters? The RAC foundation reports an average commuting distance in the North West of 9 miles against an English average of 9.9 miles and a range across all English regions of 8.7 to 10.8miles.

A forecast is also provided including a compound 20% uplift to 2030 (blue line) for comparison in response to activities WBC may take to accelerate PIV adoption in the area. Table 3-4 shows the calculated forecast figures for 2020, 2025 and 2030 in each scenario, which are displayed in chart format in Figure 3-13.

Table 3-4 PIV forecast figures for Warrington area

| PIV | Baseline | Do Nothing scenario | | | 20% increase scenario | | |
|---|---|---|---|---|---|---|---|
| LA area | Q3 2019 | Q4 2020 Forecast | Q4 2025 Forecast | Q4 2030 Forecast | Q4 2020 Plus 20% | Q4 2025 Plus 20% | Q4 2030 Plus 20% |
| **Warrington** | **486** | **606** | **1,474** | **2,719** | **620** | **1,646** | **4,367** |

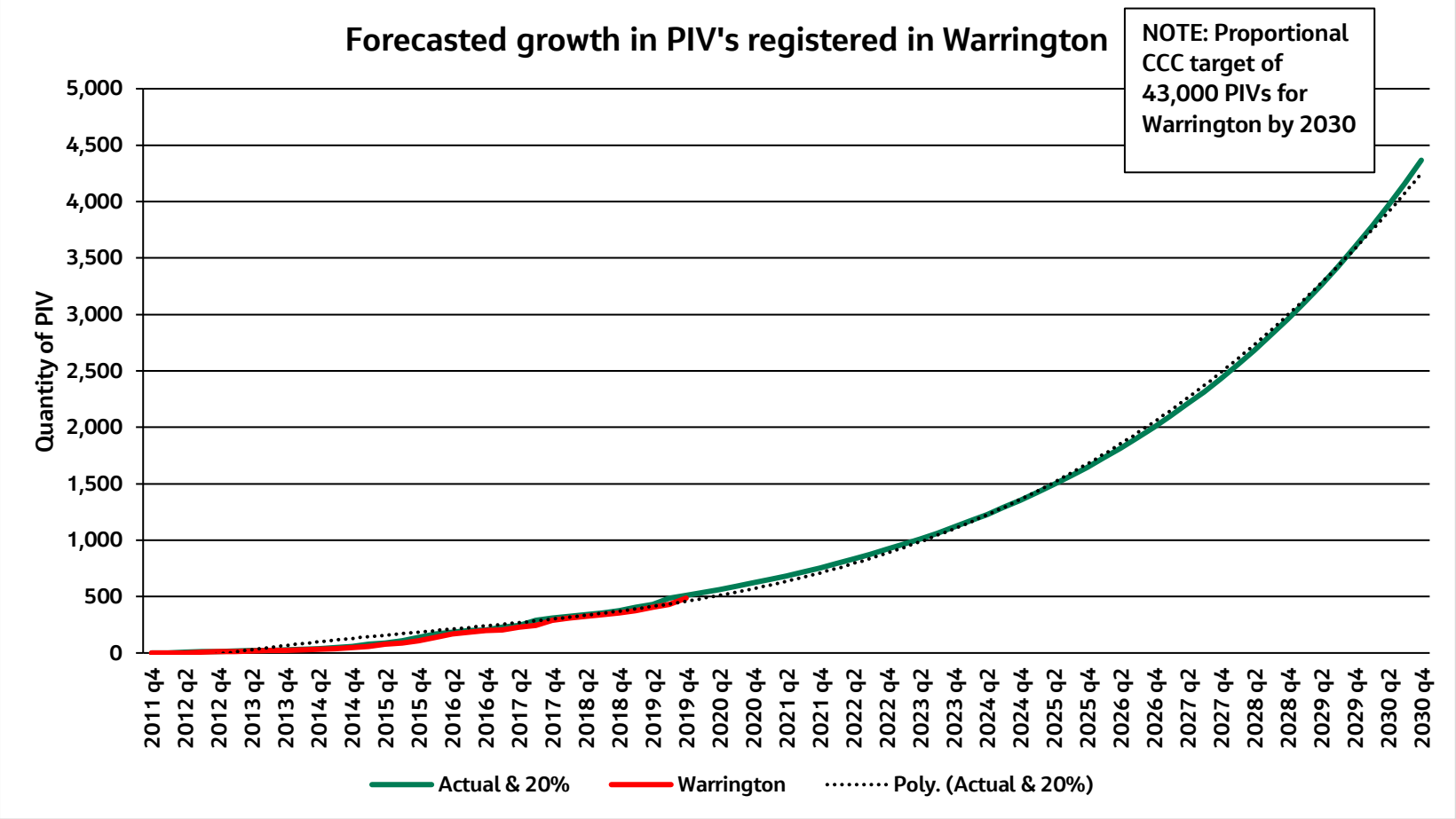



Figure 3-13 - PIV forecasts for Warrington area to 2030

The UK has a technology neutral strategy to make every new car and van sold in the UK zero emission, recently brought forward from 2040 to 2030. But vehicle targets are only set for ULEV, only some of which are PIV as explained earlier. In order to achieve this, the UK's Committee on Climate Change (CCC) has targeted the ULEV market to reach 9% share of new car and van sales by 2020 and 60% by 2030. The related total ULEV registration targets for the UK by those dates are:

• 680,000 ULEV licensed by 2020 - The UK has not reached this target.

• 4,600,000 ULEV by 2025.

• 13,600,000 ULEV by 2030.

However, no systematic ULEV targets have yet been set for UK regions or individual LAs to enable comparison of their performance against the UK goals. Therefore, this strategy has calculated proportionate targets for Warrington by 2025 and 2030 using its 0.33% contribution to the current UK fleet as a basis. Warrington PIV registrations currently make-up 97% of its ULEV figure, so this percentage has then been applied to calculate PIV targets for the area shown in Table 3-5.

Table 3-5 PIV targets based on 0.33% of UK fleet CCC targets

| PIV Registered | Baseline | Warrington proportionate CCC targets @ 0.33% | | |
|---|---|---|---|---|
| LA area | Q3 2019 | Q4 2020 Target | Q4 2025 Target | Q4 2030 Target |
| **Warrington** | **486** | **2,177** | **14,725** | **43,534** |

This exercise demonstrates that the calculated PIV targets are way above the current PIV projections in both the do-nothing and 20% increase scenarios, so further action should be taken to encourage an increase in PIV uptake in the area. For the purposes of producing a strategy for EV in Warrington and using predictive techniques which use past performance the following must be considered. The UK government is correctly setting ambitious targets which include the phasing out of the internal combustion engine. The challenge for the UK and all local authorities is that control over the allocation of vehicles rests with the car makers of which none are headquartered in the UK. Any further action should be to make Warrington EV ready which means reacting to market signals and other factors such as current infrastructure utilisation. It is therefore unlikely that the installation of more infrastructure will translate to an increase in EV uptake in the next 5 years, over and above encouraging early adopters.

### 3.7.3 Comparative areas

In Table 3-6 we compare Warrington's PIV situation with other areas with a similar population density and total car & van figures (within 20%). This demonstrates the wide variation in PIV uptake across the UK. Warrington currently sits roughly in the middle of similar LA areas in terms of PIV adoption.

This comparison is interesting because Stockton and Rochdale both benefitted from early OLEV Plugged In Places programme funding to install charge points operated free of charge to EV drivers from 2010 onwards, but their PIV adoption rates are very low even 10 years on, so this questions whether charging infrastructure provision actually increases PIV uptake in the current context.

Table 3-6 PIV adoption in areas with similar population density and total car/van figures

| Area | Population Density | Total Cars & vans registered | PIV Q3 2019 | % PIV (ranked) |
|---|---|---|---|---|
| Wokingham | 939 | 106,081 | 781 | 0.74% |
| Aberdeen City | 1,225 | 103,147 | 454 | 0.44% |
| **Warrington** | **1,160** | **120,267** | **486** | **0.40%** |
| Rochdale | 1,391 | 98,862 | 323 | 0.33% |
| Thurrock | 1,055 | 92,944 | 283 | 0.30% |
| Stockton-on-Tees | 962 | 100,351 | 225 | 0.22% |

Investigating high PIV adoption in areas with similar population density to Warrington shown in Table 3-7 identifies some UK leaders with their activities set out below. It is noted that given there is a net inflow of commuters into Warrington the % PIV may be higher in terms of vehicles operating on the highway network however at present there is no available evidence to demonstrate this.

Table 3-7 Highest Ranking PIV uptake areas with similar population density

| Area | Population Density | Total Cars & light goods vans registered | PIV Q3 2019 | % PIV (ranked) |
|---|---|---|---|---|
| Swindon UA | 965 | 280,064 | 5,227 | 1.87% |
| Milton Keynes UA | 870 | 377,422 | 6,719 | 1.78% |
| Leeds | 1,430 | 441,287 | 6,389 | 1.45% |
| Solihull | 1,205 | 206,925 | 2,238 | 1.08% |
| **Warrington** | **1,160** | **120,267** | **486** | **0.40%** |

Swindon is home to automotive manufacturing plants and multiple vehicle lease companies which sometimes cause a spike in vehicle registration data which does not necessarily reflect where vehicles are kept and used. Swindon has not been part of government funded charging infrastructure programmes however the council owns its own power company Public Power Solutions Ltd (PPS) to deliver innovative power and waste solutions to benefit the local population. PPs are working on a charging strategy for the area and are investigating solar carports for charging facilities[24]. The council has also introduced new development planning requirements calling for charging facilities to be installed in every new home built with a parking space, in 10% of all new retail parking spaces, and 20% at new employment developments[25].

Milton Keynes was originally part of the Plugged in Places programme from 2010 installing charge points for public use across the city. In 2016 Milton Keynes was announced as one of four 'Go Ultra Low' cities receiving a further £9 million investment for a range of initiatives to make the city EV-ready. This included the introduction of a world-first consumer-facing EV Experience Centre, EV filling stations, charging technology innovation and further development of the charging network, and is matched with an incentivised permit parking offer for ULEV

[24] https://www.local.gov.uk/electric-vehicle-charging-and-solar-carports-swindon
[25] https://www.swindon.gov.uk/news/article/249/swindon_is_charging_ahead_with_plans_for_an_electric_vehicle_future

vehicles coming into the city. MK council has offered capital grants for public and workplace chargers and alternative residential charging solutions to cater for those with no access to off-street parking.

West Yorkshire Combined Authority developed an EV charging feasibility study considering potential locations in 2017 including Leeds which has since gone on to introduce some ground-breaking schemes to encourage EV adoption. Leeds plans to introduce a Clean Air Charging Zone (CAZ) in 2020, penalising the most polluting vehicles entering the city centre. Leeds also offers free parking for all EV in council operated carparks, offer grants and interest free loans to taxi, PHV, freight and bus operators for cleaner vehicles and operates an EV trial scheme covering electric PHV, vans and bikes. The Council is in the process of converting their entire vehicle fleet to EV including the charging infrastructure needed to support the transition at depots and key destinations.

The rate of take up in in the West Midlands in one of the highest in the UK, and Solihull has the second highest level of PIV registrations after Birmingham growing far faster than the UK average. TfWM are currently rolling-out regional charging infrastructure opportunities to deliver a consistent service across the region. Birmingham has been awarded OLEV Taxi funding to install 197 EV charging points in approximately 80 locations for the exclusive use of electric and hybrid Taxis and Private Hire Vehicles from 2020[26].

Many initiatives have been implemented since the first plugged in places projects commenced some 10 years ago to increase the uptake of EV such as pop up charge posts, lamppost charging, and solar powered car ports. To date there is no evidence that any of these initiatives have increased EV uptake and have been mainly been financed by grants. Previously in this report it has been articulated that there is a supply constraint of enough vehicles at the correct price and this situation is unlikely to change in the short term. Although targeted and data driven provision of charging infrastructure has an important role to play in supporting early adopters and preparing for mass market EV uptake, at present there is a significant risk that provision of extensive charging infrastructure may represent poor value for money.

## 3.8 Electric Buses

This section provides an overview of electric bus policy, technology, applications and charging requirements. Electric bus technology includes full electric, plug-in hybrid, trolleybus IMC (in motion charging) and fuel cell models. According to Bloomberg New Energy Finance, at the end of 2017 there were 3 million city buses in operation worldwide only 13% of which were electric. By 2019 98% of the global electric bus fleet was reported to be deployed in China, with only approximately 4,000 electric buses operating in Europe. However, demand for electric buses in Europe is likely to rise in the coming years with increasing urban emission reduction targets.

[26] https://www.birmingham.gov.uk/info/20013/roads_travel_and_parking/566/electric_vehicles


Figure 3-14 - England's buses summary

### 3.8.1 Bus Policy

Buses are England's most used form of public transport, accounting for more than 60% of all public transport trips.[27] Bus services can provide a reliable and innovative mobility service reducing congestion, increasing productivity and connecting communities, however bus patronage in many places of the UK has seen a decline in passenger numbers, with the Coronavirus pandemic resulting in further sharp downturns in usage. Bus operators and transport authorities therefore are increasingly looking at measures to rebuild the bus networks and encourage passengers to return.

The majority of UK bus fleets use diesel powered ICE buses contributing to the poor air quality in urban areas, so the Bus Services Act 2017 encourages LAs and the bus industry to work together to achieve economic, environmental and social objectives for their communities. The government's aim is to create a growing market for low emission buses in the UK, speeding up the eventual transition to an entirely ultra-low emission bus fleet.

A Low Emission Bus (LEB) is defined as producing 15% less GHG than a conventional Euro V diesel bus and meet Euro VI engine regulations[28]. An Ultra-low emission bus (ULEB) is defined as saving at least 30% well-to-wheel

[27] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664318/bus-services-act-2017-new-powers-and-opportunities.pdf
[28] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/694955/uleb-scheme-participant-guidance.pdf

GHG emissions compared to a Euro VI diesel bus of equivalent passenger capacity and has a Euro VI certified engine or equivalent emissions capability[29].

Government incentives through the Green Bus Fund have helped deploy 1,200 low carbon buses since 2009, the Low Emission Bus Scheme facilitated a further 326, and the ultra-low emission scheme will enable another 263 ULEBs from 2019. The latest ULEB funding awards cover LAs from Brighton to Cardiff to North East England and include both electric and hydrogen buses and infrastructure[30].

In Feb 2020 the government announced £5bm funding to 2025 to improve bus and cycling services in England[31] and local areas were encouraged to apply to become Britain's first all-electric bus town[32] receiving up to £50m as part of a £170m fund intended to make journeys easier, greener and more reliable. The press release stated that 200 electric buses could offset 3,700 diesel cars and also encouraged the development of improvements including bus-lanes and priority traffic lights to increase bus flow and speed-up trips.

### 3.8.2 Electric bus case studies

At the end of 2018, the largest fleet of electric buses in Europe was operated by Connexxion around Schipol airport in The Netherlands. VDL Bus & Coach supplied 100 electric buses for the Amstelland Meerlanden concession creating the largest electric bus fleet with a single operator in Europe. These articulated e-buses collectively cover up to 30,000 km per day and are fitted with the latest generation of batteries quick charging in 20 minutes or less at charging points along the route, allowing a 24-hour service. VDL have also supplied 55 electric buses to Rotterdam public transport operator RET who will use a combination of overnight depot charging with on-route rapid charging.

In 2019 London announced that it had the largest electric fleet in Europe[33] with more than 200 electric buses and12 Low Emission Bus Zones resulting in a 90% drop in bus-related NOx emissions in these areas. In addition, 2 routes became Europe's first exclusively electric double-decker routes and a further 78 electric double-deckers were on order for delivery in 2020.

To support this transition in 2018 the Chinese bus company BYD and Scottish bus company ADL with partner SSE transformed the historic and land-locked Shepherd's Bush bus depot in West London into an advanced smart electric bus operating centre, with the aim of becoming RATP Dev's first zero emission bus garage in London. SSE already operates large scale electric bus charging infrastructure at five facilities in London including the landmark fully electric depot in Waterloo. BYD's smart charging management system enabled the simultaneous overnight charging of all Shepherd Bush's electric buses with minimal manual supervision.

London's plan is that by 2037 all 9,200 buses across London will be zero emission[34]. In central London, all single-deck buses should emit zero exhaust emissions by 2020 and all new double-decker buses should be at least hybrid. As a further step towards this goal, 34 CaetanoBus electric buses will hit London roads for the operator Abellio from March 2020, the first Caetano electric buses in the UK.

In 2019 Nottingham launched the UK's first all-electric Park & Ride services from two sites using 13 electric BYD single decker buses. This complements the city's fleet of 45 electric Optare Solo buses and Versa minibuses which have delivered over one million electric miles and saved over 1000 tonnes of $CO_2$ emissions since 2012, innovatively part-funded by the council's Workplace Parking Levy[35]. Nottingham City Council own the electric bus

[29] https://www.lowcvp.org.uk/Hubs/leb/ultra-low-emission-bus.htm#ULEB
[30] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/774207/ultra-low-emission-bus-scheme-winning-bidders.csv/preview
[31] https://www.bbc.co.uk/news/uk-politics-51453457
[32] https://www.gov.uk/government/publications/apply-for-the-all-electric-bus-town-scheme
[33] https://www.london.gov.uk/press-releases/mayoral/london-has-europes-largest-electric-bus-fleet
[34] https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/cleaner-buses
[35] https://www.nottinghamcity.gov.uk/wpl

fleet and contract CT4N to operate it. Nottingham also uses 53 Bio-Gas double-decker buses and has secured ULEB funding to expand their gas refuelling station to enable a further 67 to be deployed.

York has one of the largest electric double-deck fleets outside of London, adding 21 new buses manufactured by Optare in 2019, to the 12 existing single-deck buses operated by First York from two Park & Ride sites (a cornerstone of York's transport strategy) since 2014. The new double-deckers have a range of 150 miles requiring overnight charging only.

The Harrogate Bus Company, a subsidiary of Transdev, began using the UK's first opportunity-charged electric buses in 2018 (Volvo 7900e). The buses recharge in approximately 6 minutes using ABB's TOSA (Trolleybus Optimisation Système Alimentation) solution using pantograph attachments installed on masts at Harrogate's bus station to deliver power, but the long-term plan is to provide these charging systems at bus stops around the town.

Glasgow was the first UK airport to introduce a fleet of electric buses to its car park operation. Three all-electric Enviro200EV buses built by BYD and Alexander Dennis Limited (ADL) replaced the diesel fleet used to shuttle passengers between the terminal and long-stay car park.

### 3.8.3 Electric bus charging

Battery electric buses offer zero-emission, quiet operation, better acceleration, higher energy efficiency and lower cost of ownership compared to traditional ICE buses. For both fleet vehicles and buses the charging times must match the stationary opportunities that exist within the operating schedule, to minimise lost revenue. Maintaining the same number of buses, the same trip schedule, same number of drivers etc is paramount in ensuring that moving to electric does not negatively impact the existing operating model and business case.

Appropriate charging solutions for buses depend upon routes, pay-load, hours of operation, energy landscape (availability of power) and dwell-times at stops and depots. DC plug-in charging solutions may be appropriate at depots where buses are parked overnight or between shifts. However, costs for new high-power grid connections may be prohibitive so smart-charging tools may be required to manage peak power loading, energy costs and provide more flexibility for operators. Pantographs and underbody collectors may be integrated into bus-stops to provide quick top-up charges, reducing the initial vehicle investment by enabling smaller batteries to be used but increasing the required infrastructure cost.

ABB provides multiple charging solutions for buses[36]. Depot charging at powers ranging from 24 – 150 kW using the DC CCS connector with smart charging, sequential charging and remote-control capabilities enable large fleets to optimise charging activities. ABB also offer top-down and bottom-up pantograph solutions for on-route charging. ABB's innovative TOSA[37] (Trolleybus Optimisation Système Alimentation) solution offers a flash-charging technology with onboard traction equipment to suit high-frequency urban bus routes.
Batteries mounted on bus roofs of buses are flash-charged in 20 seconds at 600 kW at selected stops while passengers are embarking and disembarking, with a further 5 minutes at the terminus at the end of the line providing a full recharge before the next journey begins. ABB also provides the onboard drivetrain solution including the Energy Transfer System (ETS) that connects the e-bus to the infrastructure, and a suite of network management tools to assist in selecting optimal stops for flash-charging deployment.

[36] https://new.abb.com/ev-charging/
[37] https://new.abb.com/substations/railway-and-urban-transport-electrification/tosa-electrical-bus-charging-infrastructure


Figure 3-15 - ABB charging solutions for electric buses

Siemens portfolio includes a range of equipment suiting different charging requirements of operators and bus manufacturers[38]. Solutions include off-board top-down pantograph charging from 150 - 600 kW power, 60 – 120 kW on-board bottom-up pantograph chargers for en-route opportunity charging and DC plug-in solutions from 30 - 150 kW suitable for depot use.


Figure 3-16 - Siemens eBus charging solutions

Multiple manufacturers now offer e-bus charging equipment in Europe, either independently or in a package with e-buses e.g. Circontrol, Nidec, Proterra, Cummins.

Where capacity in the local power network is limited innovative approaches are being used to overcome this challenge. Stagecoach is using Tesla Powerpacks to reduce the cost of charging a large fleet of ADL and BYD electric buses in Guildford, making it a "battery-supported bus depot". Energy company Zenobe installed 78 stationery batteries and several charging stations at Stagecoach's depot when the cost of electric supply upgrade proved cost prohibitive to Stagecoach's electrification plans. The Tesla energy storage units charge from the grid at off-peak prices and then charge the electric buses overnight.

[38] https://new.siemens.com/global/en/markets/transportation-logistics/electromobility/ebus-charging.html

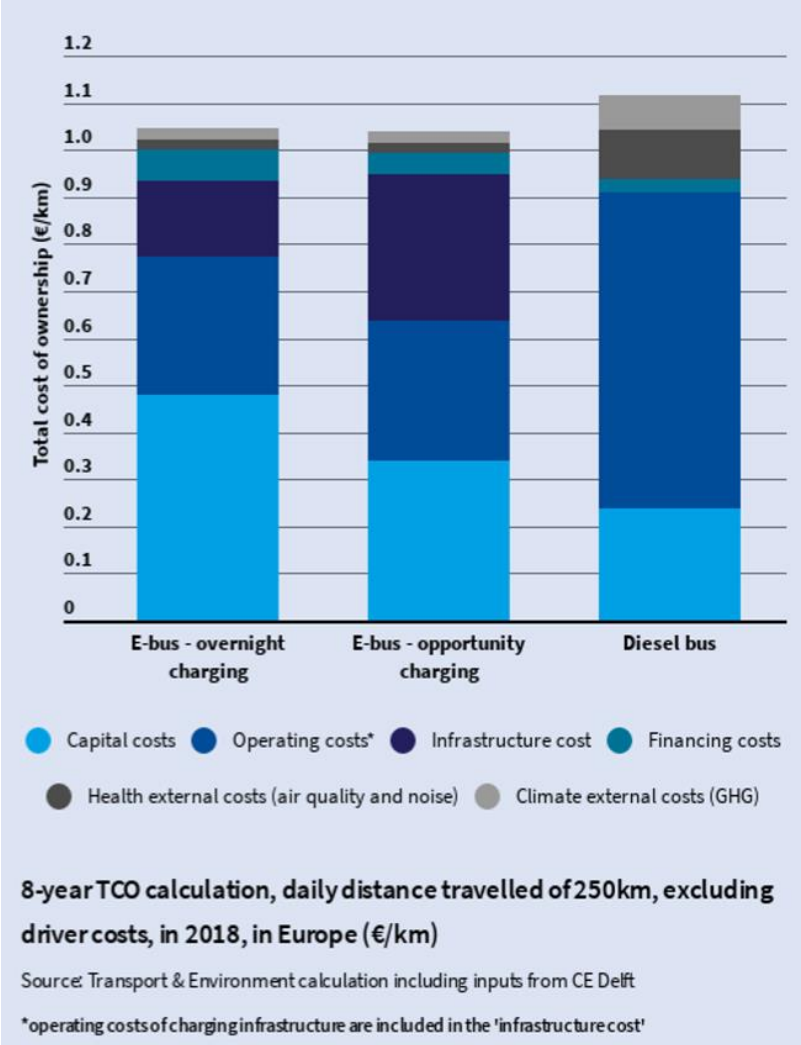



Figure 3-17 Cost comparison between electric bus and diesel bus in 2020 with 200km travelled per day[39]

Figure 3-17 shows that an electric bus with overnight charging has potential for lower combined capital and operation costs than a diesel bus, due to significantly lower operating costs for e-buses in this example. It is expected that overnight charging buses will be increasingly common as battery prices decrease and gradually become more attractive than opportunity charging buses where infrastructure cost is much higher.

### 3.8.4 Availability of Electric Buses

Table 3-8[40] provides a sample of electric bus models on and coming on to the market, with different battery capacity, power and charging requirements to suit the complex range of bus operating models. Electric range does not appear in this summary, but due to the fixed and repeatable nature of bus routes the power required can be calculated. The technology challenge for bus operators is do they charge slowly over night, charge high power at a convenient point, opportunity charge or continuously draw power such as the old trolley buses.

[39] Electric Buses arrive on time (November 2018) – a study by Transport & Environment (https://www.sustainable-bus.com/wp-content/uploads/2018/11/Electric-buses-arrive-on-time-2.pdf)
[40] https://www.mobilityhouse.com/int_en/solutions/solutions-for-electric-bus-fleets

Table 3-8 Sample of Electric Bus models and Charging connectors (from Mobility House website – 5th Feb 2020)

| Manufacturer: | Models: | Capacity: | Power: | Charging mode: |
|---|---|---|---|---|
| Solaris | Urbino 12e \| 18e | 240 kWh \| 75 - 240 kWh | 160 kW \| 240 kW | CCS & Pantograph |
| BYD | Enviro 200 EV | 240 kWh | 160 kW \| 240 kW | CCS & Pantograph |
| Sileo | S12 \| S18 | 225 kWh \| 380 kWh | 240 kW \| 480 kW | CHAdeMO |
| Irizar | i2e | 90 - 120 kWh | 180 kW | CCS |
| VDL | SLF120 \| SLFA180 | 63 - 240 kWh \| 63 - 180 kWh | 153 kW \| 255 kW | CCS & Pantograph |
| Volvo | 7900 Electric | 4x19 kWh | 200 kW | CCS & Pantograph |
| SOR | NB 12 Electric | 225 kWh | 160 kW | Pantograph |
| Caetano | e.City Gold | 85 kWh – 250 kWh | 180 kW | CCS |
| Proterra | Catalyst 35/40 Foot | 94-440 \| 94-660 kWh | 2 x 190 kW | CCS & Pantograph |
| Ebusco | Electric City Bus 2.1 | 311 kWh | 110-220 kW | CCS |
| Ursus | City Smile 12E | 226 kWh | 105 kW | CCS |
| Daimler | Citaro E-Cell | 243 kWh | 150 kW (CCS) | CCS & Pantograph |

Note: There is an arrangement where ADL are assembling BYD buses in Scotland.

## 3.9 Household Type and Levels of Deprivation

Mapping of these two aspects can identify the need for charging infrastructure measures to specific localities as outlined below.

### 3.9.1 Census 2011 Household Composition

A review of baseline data has been undertaken to establish an understanding of the demographics across Warrington and the potential areas where a higher demand for charging may exist.

Figure 3-18 shows the density of flats across Warrington using Census 2011 data.

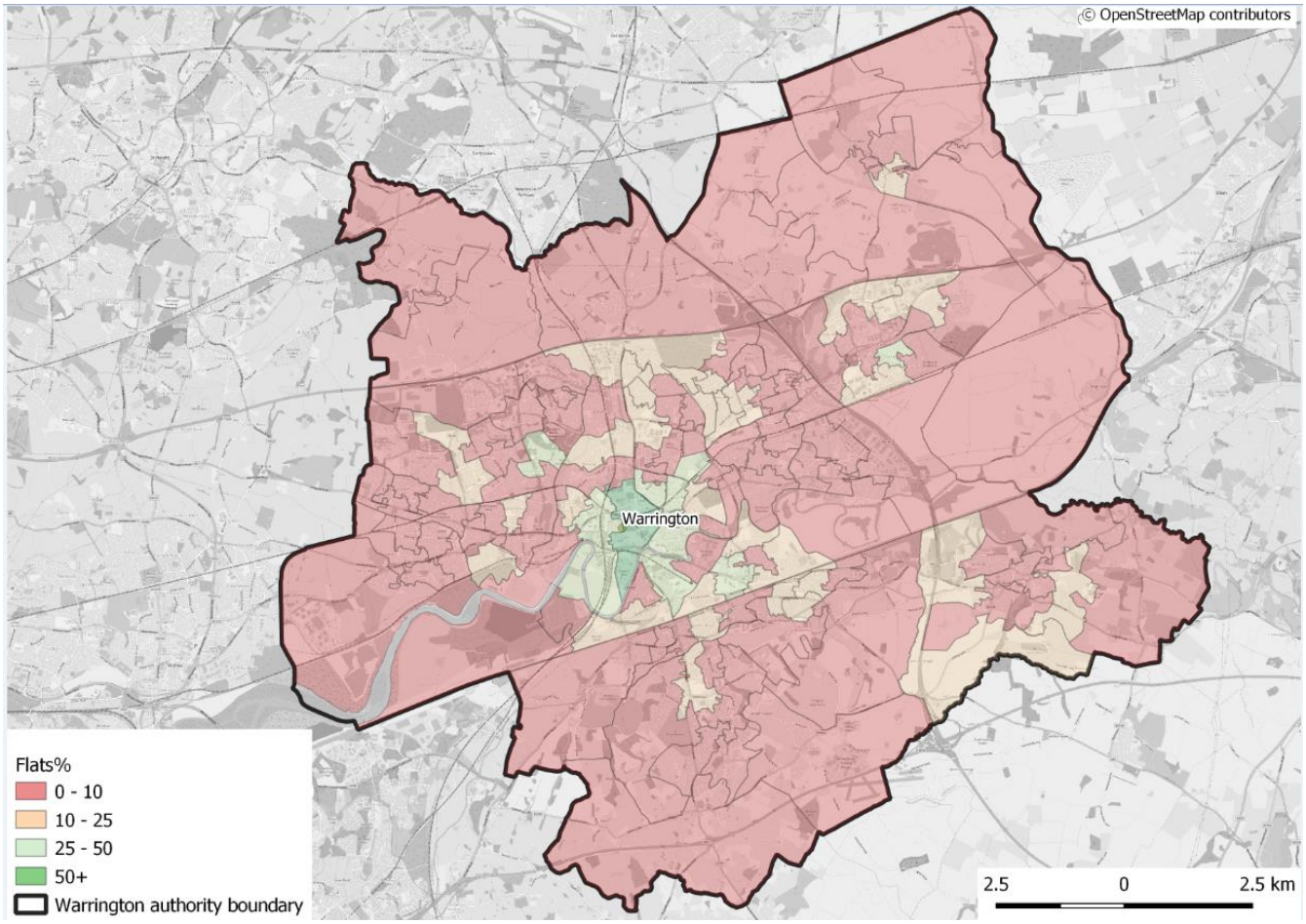



Figure 3-18 Density of households living in flats across Warrington

Figure 3-18 shows that there is a concentration of flats within Warrington town centre. Flats also form part of the household structure on the residential areas on the edge of the town centre. It is likely that residents within flats have limited access to off-street parking and would therefore require on-street charging points or alternative public charging services in suitable parking locations close to home.

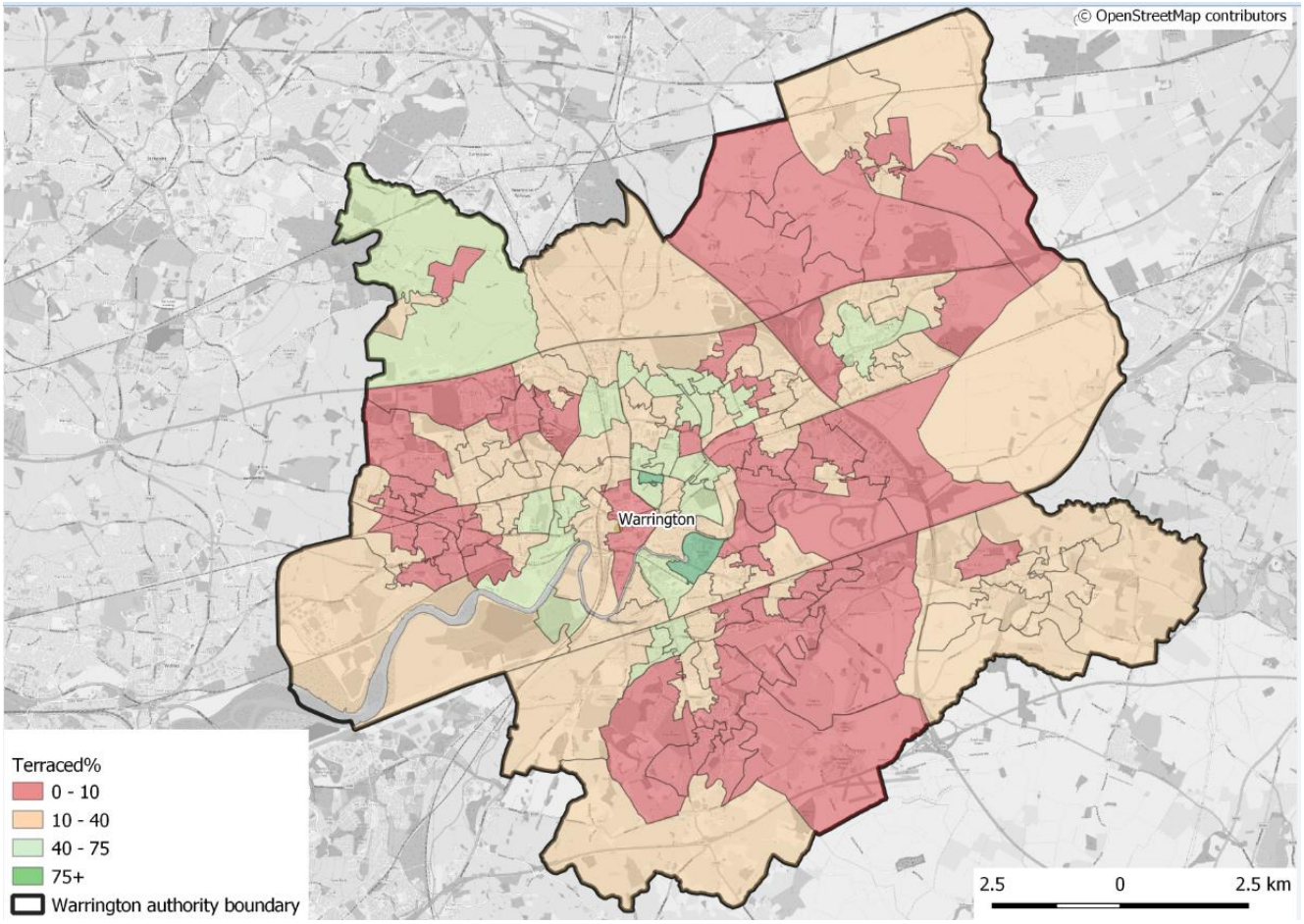



Figure 3-19 Density of households living in terraced properties across Warrington

Figure 3-19 shows that there is a concentration of terraced properties in central Warrington, the west of Warrington, and to the north-east of Warrington. Terraced properties also form part of the household structure on the residential areas to the south and east of the Warrington borough. The remaining areas of Warrington have a relatively low density of terraced properties. It is likely that residents of terraced properties have limited access to off-street parking and would therefore require on-street charging points or alternatives in suitable parking locations close to home.

The terraced street and high rise accommodation provide a challenge for local authorities if the prevailing thought is to provide an alternative to off street parking for all individuals in this position. Traffic Regulation Orders are required for charging locations on the public highway so only EV can park in these spots which can be challenging in terms of public acceptability on streets that have limited parking. There is also a need to ensure other users of the public highway are not negatively impacted. Cables trailing across footpaths cause hazards for pedestrians and should be avoided. Additionally, charging posts/columns should not be installed on footways where this narrows the pavement and causes an obstruction. Relatively compact products are available that provide charging post connections at the kerbside to avoid trailing cables and wherever possible larger infrastructure should be hosted on the carriageway (with suitable protection provided) to avoid impacting on pedestrian accessibility. Another option is to install replacements for petrol stations where cars can charge on rapid chargers relatively quickly.

## 3.10 Income Levels Distribution

Figure 3-20 shows the Index of Multiple Deprivation (IMD) across Warrington. The IMD is the official measure of relative deprivation for small areas in England and ranks every area from 1 (most deprived area) to 32,844 (least deprived area).

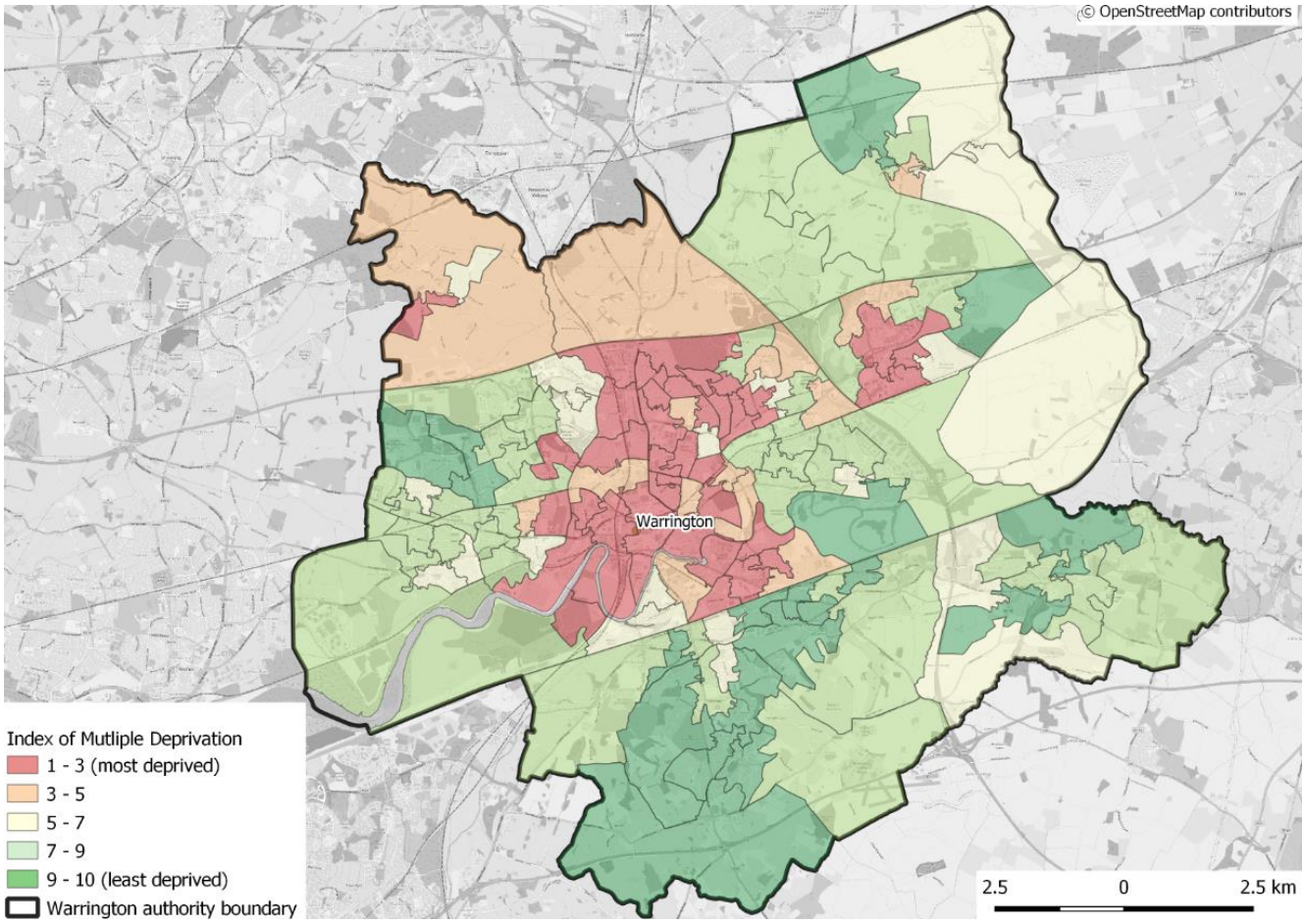



Figure 3-20 Index of Multiple Deprivation in Warrington

Figure 3-20 shows the most deprived area in Warrington is in the town centre and the surrounding residential areas. Areas of Birchwood (to the east) and Burtonwood and Winwick (north of M62) also have relatively high deprivation levels. The south and south-east of Warrington have low deprivation levels. Currently, the cost of an EV and the associated infrastructure is relatively high and therefore uptake in these areas of higher deprivation may not be strong in the near term whilst there is still a price premium on these vehicles.

Conversely in more affluent areas to the south and east of Warrington uptake of EV is likely to be stronger. Detailed mapping of propensity to purchase an EV is currently being conducted as part of the Charge project by Scottish Power to identify priority areas at which electricity capacity will need to be strengthened. Once this data is available it is recommended this information is factored into more detailed consideration of charging infrastructure locations.

### 3.10.1 Cross referencing

A comparison between deprivation levels and areas of limited off-street parking can guide the direction of the strategy. Areas with limited off-street parking and high levels of deprivation include the town centre and

immediate surrounding area, and Burtonwood, to the north-west of the Borough. The areas with lower levels of deprivation and limited off-street parking include areas slightly south of the town centre such as Lower Walton and Stockton Heath.

Strategy recommendations can be framed differently for these respective areas with more emphasis placed in the short term on enabling flexible and more cost-effective access to EV through car clubs in areas with higher levels of deprivation and limited off-street parking. Conversely in areas with lower levels of deprivation and constrained levels of off-street parking more emphasis can be placed on the provision of charging infrastructure in the short term.

## 3.11 Planned Development

Through identifying areas of planned or potential development, these areas can be future proofed with EV charging infrastructure to contribute to the presence of supporting EV infrastructure across the Borough.

### 3.11.1 Local Plan Sites

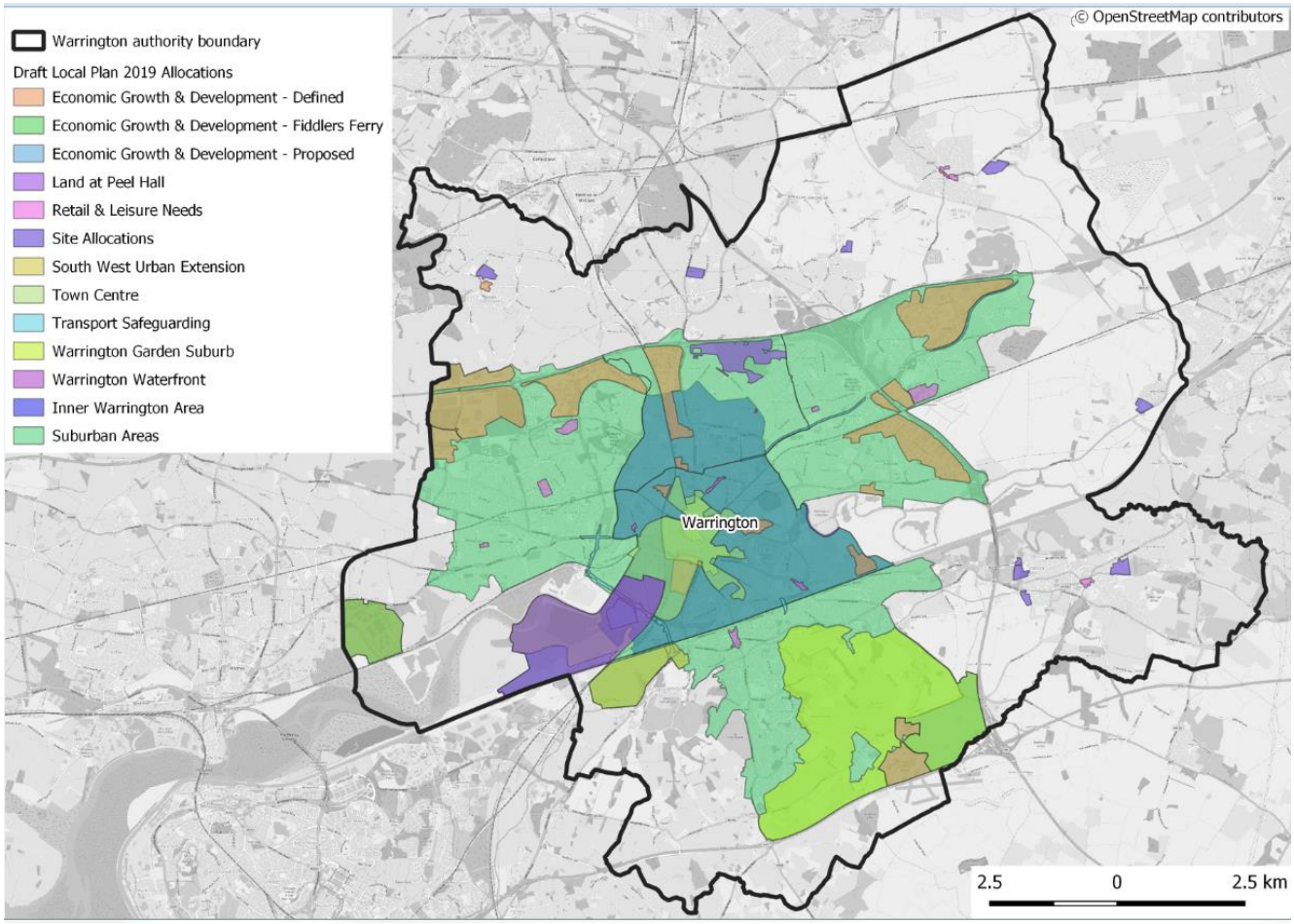



Figure 3-21 Draft Local Plan 2019 sites

Figure 3-21 shows the draft Local Plan (LP) sites that are likely to generate demand for charging infrastructure. Those LP sites which will not generate economic and residential development (i.e. habitats and ecology) have been removed from Figure 3-21. This shows that the LP developments are primarily focused in the centre of Warrington, with economic growth areas to the north and garden suburbs / suburban areas to the south. This

highlights areas of major opportunity for future proofing with charging infrastructure for both residential areas, and employment / retail developments.

## 3.12 Travel to Work Flows

Analysis of travel to work flows contained in WBC's LTP4 has been pulled through into this strategy to understand the dominant everyday movements to and from Warrington.

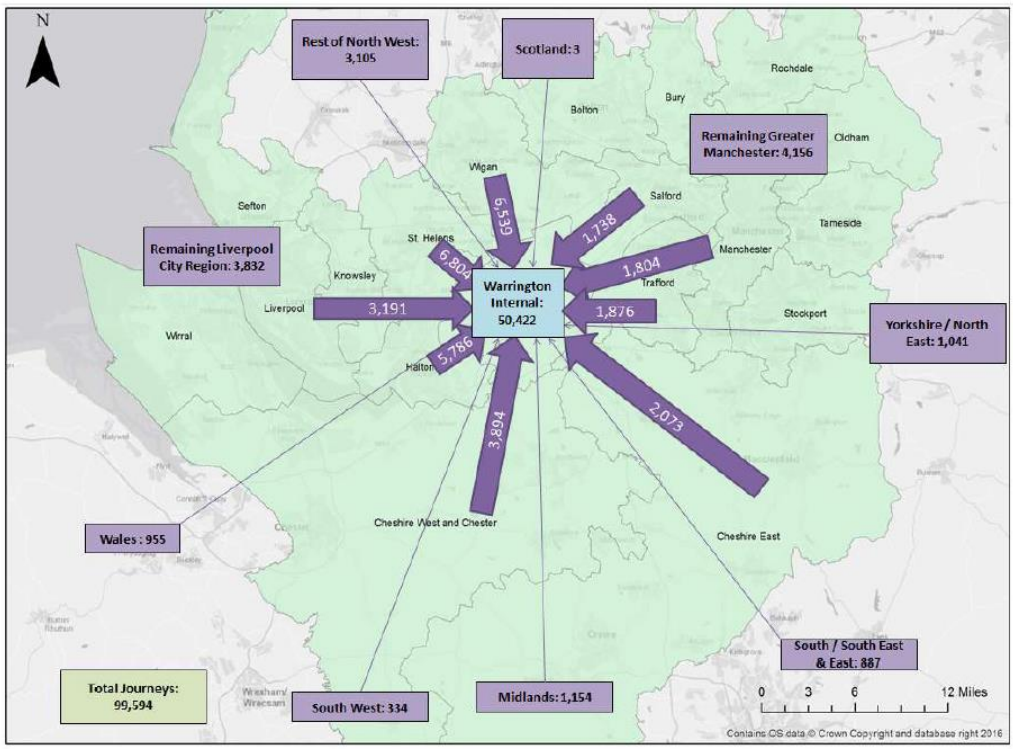



Figure 3-22 Travel to work inflows to Warrington
Source: Warrington Fourth Local Transport Plan Evidence Base Review (2018)

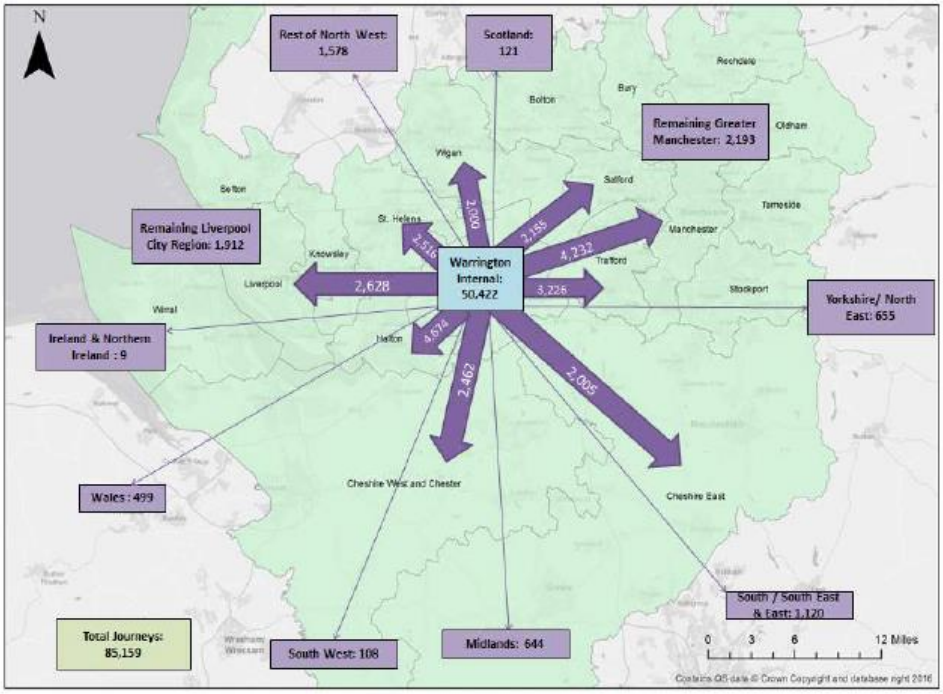



Figure 3-23 Travel to work outflows from Warrington
Source: Warrington Fourth Local Transport Plan Evidence Base Review (2018)

The greatest number of movements are internal and include journeys within Warrington. This suggests that the majority of journeys are of a shorter distance (i.e. below 5km). There are also a number of journeys to surrounding areas of Warrington such as St Helens, Wigan and Halton. Commuter trips to these areas are likely to be undertaken by public transport or car travel with an average distance of 10-15 miles for a one-way journey and these journeys could be completed by a single charge using a BEV or PHEV.

A greater number of people travel into Warrington for work compared to those travelling out of Warrington to work. The greatest number of commuter movements are within Warrington, and analysis shows that the areas which have the greatest worker inflows are concentrated in Warrington town centre; Birchwood; Westbrook; and Woolston. There are some commuter movements to surrounding areas such as Halton and Manchester. The average distance to surrounding areas is approximately 20-40 miles for a two-way journey, which could be undertaken in most EV on a single charge.

Journeys to areas of a greater distance from Warrington such as the remaining Liverpool City region and remaining Manchester regions may require drivers to recharge their vehicle to undertake a complete two-way journey, particularly for older BEVs or PHEVs.

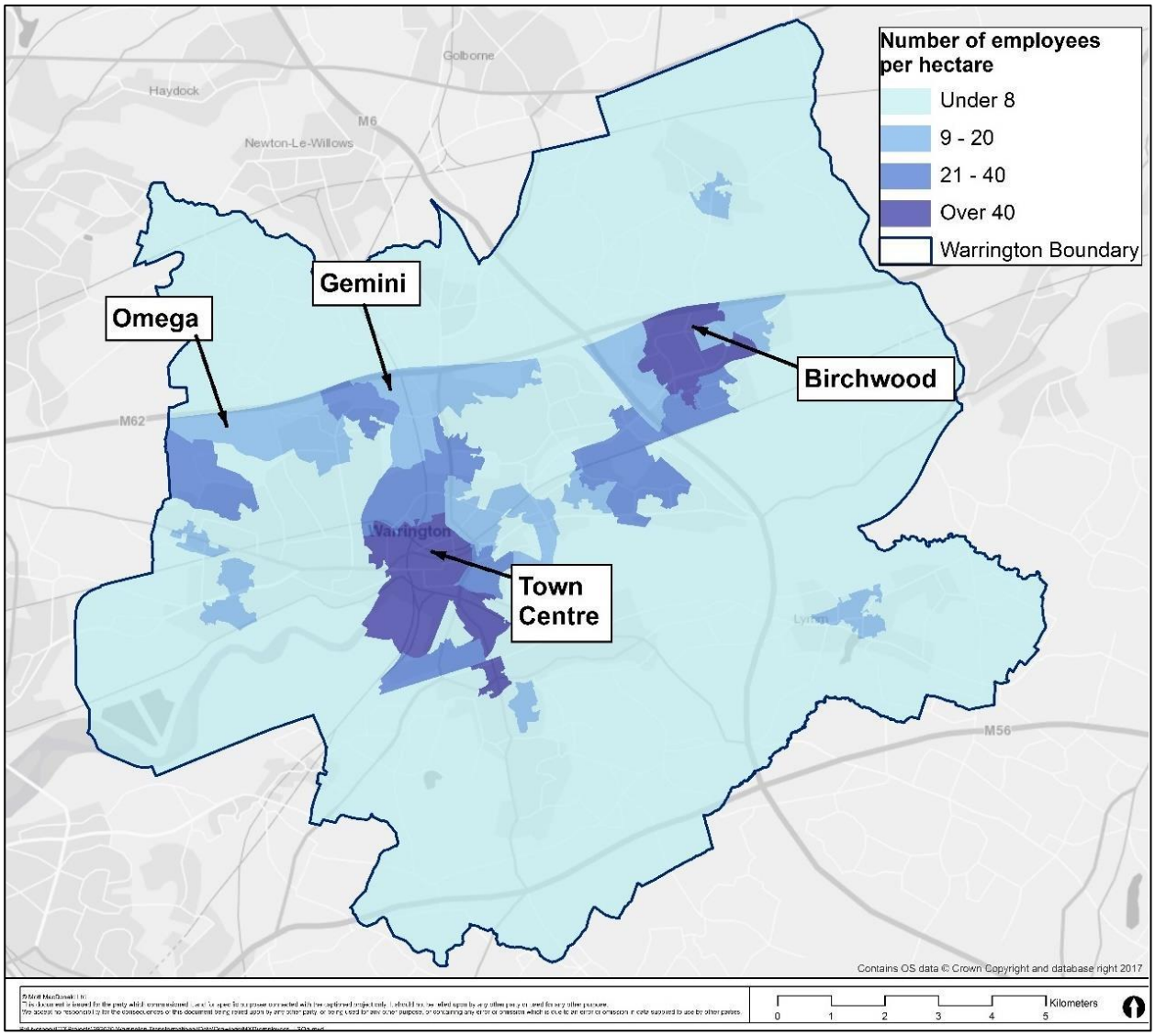



Figure 3-24 displays concentrations of employees per hectare within Warrington.

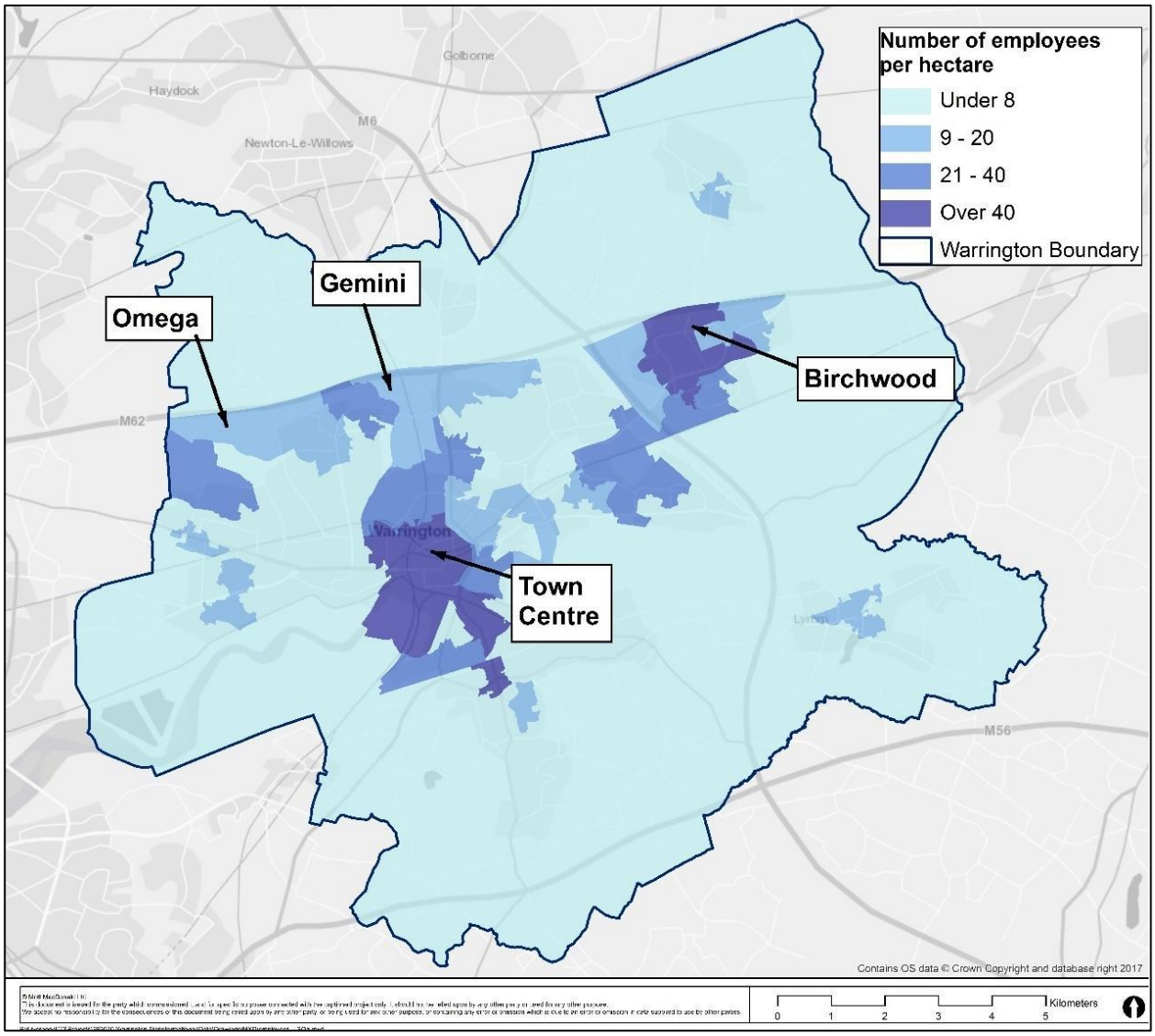



Figure 3-24 Employees per hectare in Warrington
Source: Warrington Fourth Local Transport Plan Evidence Base Review (2018)

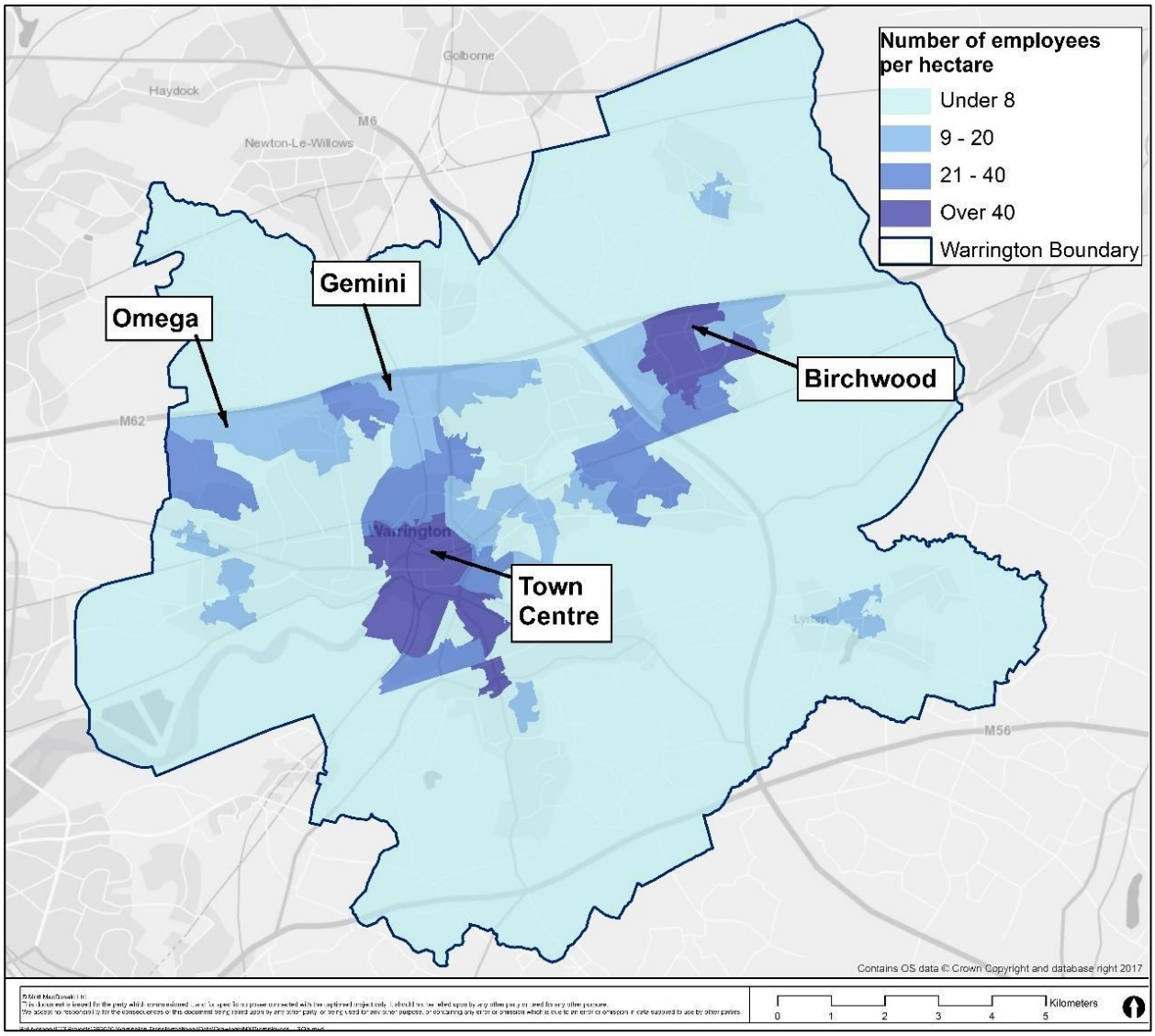



Figure 3-24 shows that the areas of Warrington with the greatest concentration of employees are the town centre, Birchwood, Omega and the Gemini Retail Park. This shows that EV charging points at these employment sites could be well utilised since employees could charge their vehicles throughout the working day.

The Warrington LTP4 Evidence Base further outlines areas of the greatest parking demand. These include access to Warrington's rail stations, and high utilisation levels of town centre car parking facilities such as Cobden, Town Hall and Cockhedge car parks.

## 3.13 Stakeholder Engagement

A range of stakeholder engagement methods have been undertaken to capture the views of industry stakeholders and ensure these are reflected in the strategy.

### 3.13.1 Workshop

A key part of forming the strategy is to engage a range of stakeholders with the views and opinions informing and shaping the strategy. A stakeholder workshop was held on the afternoon of the 25/03/2020, and was

attended by representatives from across WBC, Jacobs, ZCF, and Scottish Power. The workshop involved a discussion around five key themes:

1. **Who are we planning for and what are their needs?**
2. **Key objectives for the strategy?**
3. **Challenges for accelerating the transition to EVs in Warrington?**
4. **Opportunities for accelerating the transition to EVs in Warrington such as policies, projects or measures?**
5. **Suggestions for locations to site EV charging infrastructure in Warrington: residential areas; workplaces; destinations; key traffic routes etc?**

The key points raised in the workshop are listed below:

- The EV Strategy needs to form an overarching strategy with which future strategies can be integrated;
- Aim to improve air quality and AQMA locations in the Borough;
- There is a need to educate drivers who are less aware / educated on EVs and are currently reluctant to transition from petrol and diesel vehicles;
- Opportunity for Council owned bus company and potential funding opportunities to transition fleet to EVs;
- Growth and development planned around town centre may bring the opportunity for charging hubs / sites;
- Identify whether there is potential to transition Council fleet to electric, or identify Car Clubs;
- Identify potential areas for EV charging infrastructure e.g. Birchwood Business Park, future Local Plan development sites.

### 3.13.2 Engagement with Scottish Power

Engagement has been undertaken with Scottish Power around the “Charge” project. The "Charge" project will identify areas with insufficient electricity supply to support charging infrastructure. WBC should continue to engage with Scottish Power to identify areas where there is insufficient electricity capacity to support charging infrastructure, and jointly develop a business case to seek funds to strengthen capacity where required. This strategy will provide a starting point for discussions. However, further more-detailed work will be required to support a future business case.

### 3.13.3 Summary

The stakeholder engagement has shown that an EV Strategy is required in order to provide some direction for future development within the EV industry across Warrington. The workshop raised numerous opportunities for further investigation, including potential charging point locations and introducing electric into various different transport modes, both of which will assist in working towards air quality targets.

Engagement with other influential bodies such as Scottish Power and Greenfleet identified different guidance on the technicalities of charging points and potential areas to investigate with various private firms.

The stakeholder feedback received will be used to inform the development of the potential measures outlined in Section 4.

## 3.14 Summary

The information in this chapter forms the evidence base, combined with the policy summary within Chapter 2. The key summary outputs are outlined below:

- There is an increasing focus within policy towards increasing EV uptake to contribute to carbon emission targets;
- Car and bus EV models are readily available, but fewer models are available for LGVs and none yet for HGVs;
- Manufacturers indicate that the range of models of BEVs/PHEVs will increase and this will create a wider range of vehicle prices encouraging adoptions. Consumers are however currently reporting relatively long waiting times for some PIV purchases;
- Charging can be from a single charge point or a charging station, with slow, fast and rapid chargers offering different charging speeds. There are multiple benefits of smart charging and various innovative recharging technologies emerging which WBC could consider;
- The uptake of EVs in Warrington is below the national average and is lower than other UK areas with a similar population density. An increase of over 40,000 EVs would need to be registered in Warrington by 2030 to align with government targets which would require a significant acceleration in EV uptake above previous growth;
- Multiple manufacturers now offer e-bus charging equipment with a wide range of electric bus models on and coming to the market;
- There is a concentration of flats within Warrington town centre and concentrations of terraced housing to the north and on the outskirts of the town centre. There is a correlation between this household composition and the IMD, with areas of greater deprivation focused around the town centre and to the north of Warrington town centre;
- Areas to the south of Warrington are overall more affluent and have a greater density of detached housing and as such, these areas are typically more likely to be able to purchase EVs and have access to off-street parking for household charging points. Opposingly, areas to the north of Warrington have higher levels of deprivation and have areas with limited off-street parking and so could be an area to trial EVs through car clubs, and consider on-street accessible charging points where appropriate;
- The Local Plan 2019 outlines a number of new development sites which presents an opportunity for such developments to be futureproofed with EV charging infrastructure;
- Travel to work flows show there is a greater number of commuters travelling in to Warrington than out of Warrington. The majority of movements are within Warrington with some movements to surrounding areas such as St Helens, Halton and Manchester; and
- The EV market and technology is continuously evolving and there appears to be a supply issue in terms of manufacturers meeting future demand for EV and this will have implications for the potential use of charging infrastructure provided.

## 3.15 EV Strategy Objectives

Through engagement with stakeholders and review of relevant data, strategies and policies the following objectives of the strategy have been defined:

- Reduce carbon emissions in Warrington in line with WBC's declaration of a climate emergency.
- Improve air quality levels in line with the Air Quality Management Strategy.
- Align with the LTP4 ambition to reduce single occupancy journeys (particularly for shorter journeys) and move towards an integrated transport network.

The above objectives have been used to guide option development and appraisal that is outlined in following chapters of this strategy.

# 4. Charging Infrastructure Mapping

A range of key factors can influence charging demand in different areas as outlined in the evidence base, including the number of origins and destinations, key traffic routes, areas of car parking provision and areas with high residential densities. As such, a review of these factors has been completed in Warrington in order to inform potential future locations of charging infrastructure. This is displayed visually in Figure 4-1 below and analysed in further detail.

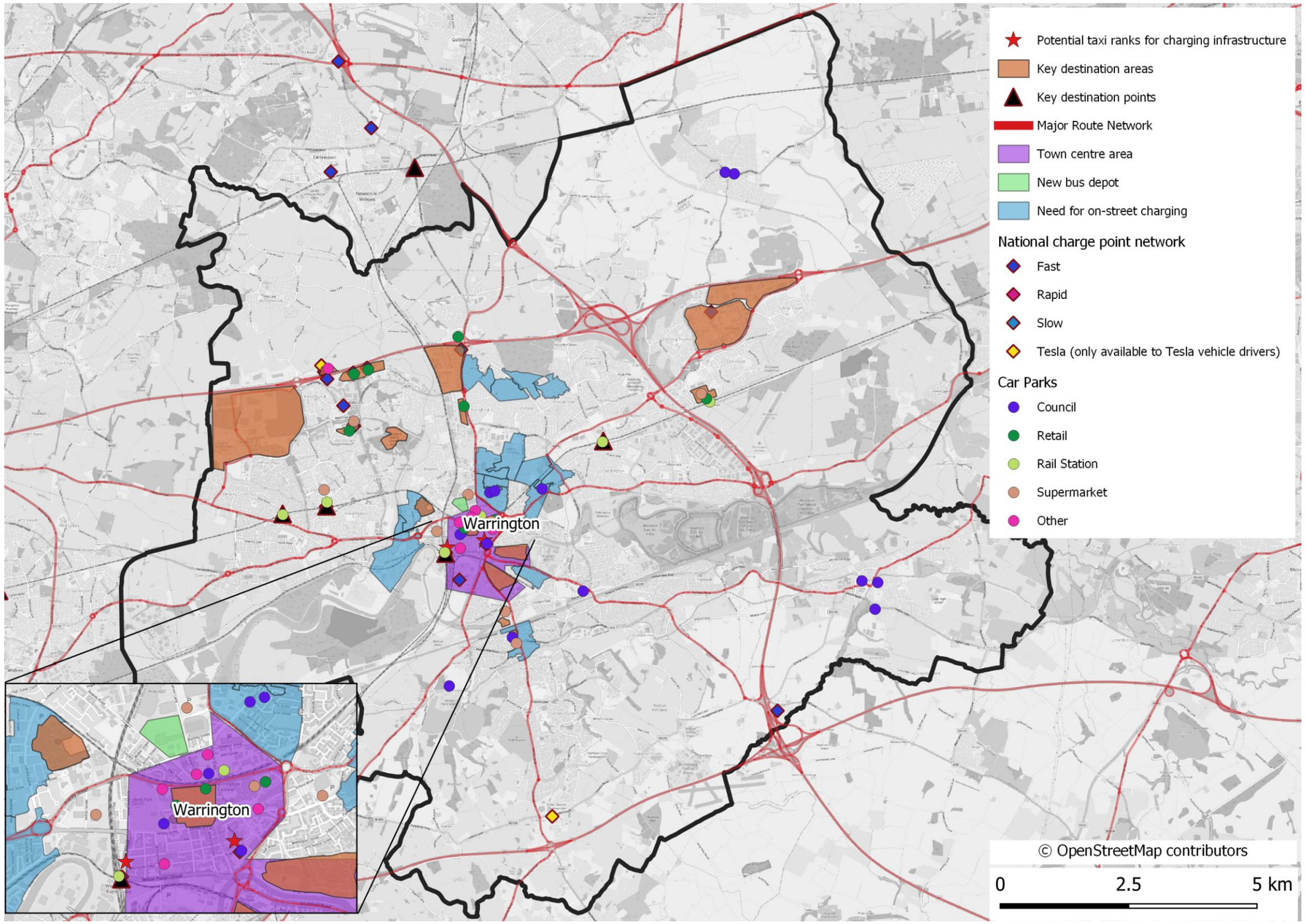



Figure 4-1 Warrington charging demand analysis

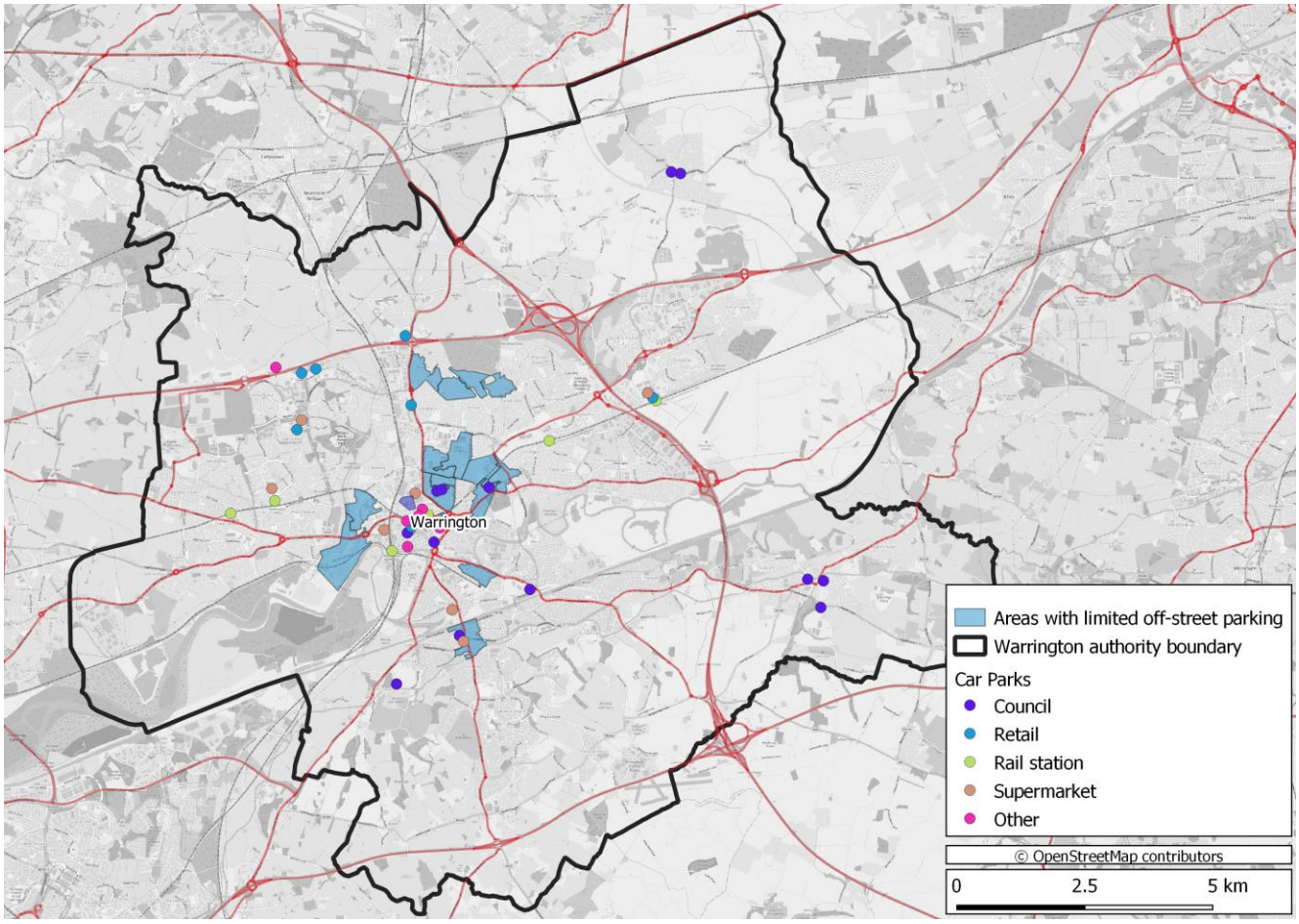



Figure 4-2 Publicly available off-street parking in Warrington

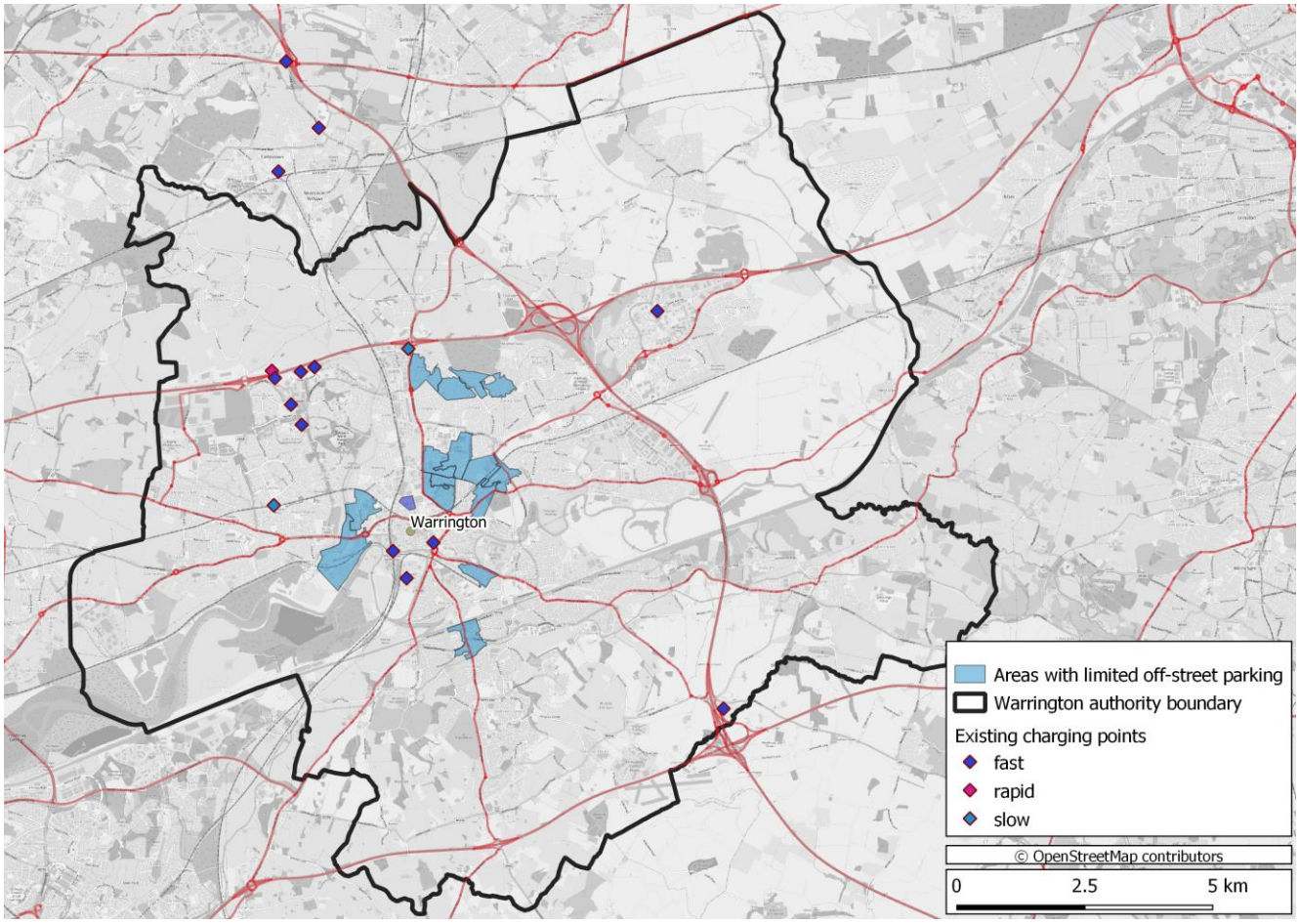



Figure 4-3 Publicly available existing charging infrastructure in Warrington

## 4.1 Existing charging infrastructure

Existing charging infrastructure is located in various destination areas such as the town centre (Times Square car park), Warrington Bank Quay station CCP car park (for onward travel), and retail areas such as Asda and IKEA. There are however large sections of the Borough that do not have any publicly accessible charge points.

Different charging points provide different levels of power which affects the charging time which is required in order to achieve a full charge. Slow units are charging points between 3kW and 6kW, fast chargers offer a speed between 7kW and 22kW. Rapid chargers typically charge at 50 kW and ultra-rapid charge points charge at 100kW+ power. Table 4-1 below outlines the existing charging points serving Warrington and their speed classification. There is currently a lack of rapid charger provision in Warrington with a key gap in the town centre. The only location at present is Burtonwood Motorway Services that is only accessible from Junction 8 of the M62. This will act as a barrier for the uptake of EV in Warrington for a range of use cases, most notably taxis.

Table 4-1 Existing charging points

| Existing charging point location | Charging speed |
|---|---|
| Haydock Lane Industrial Estate | Fast |
| Lymm Services M6 (north) | Rapid |
| Burtonwood Motorway Services | Rapid |

| | |
|---|---|
| IKEA Warrington | Rapid |
| Birchwood Park | Fast |
| Birchwood Shopping Centre | Fast |
| Queens Park Sports Centre, St Helens | Fast |
| Warrington Bank Quay rail station; CCP car park | Fast |
| Times Square car park | Fast |
| Ibis Court, Warrington | Fast |
| Warrington West rail station car park | Slow |
| Premier Inn, Warrington | Slow |
| Miller and Carter, Warrington | Fast |
| Asda Westbrook | Fast |
| Apollo Retail Park | Fast |
| Marks and Spencer, Gemini Retail Park | Fast |

*Source: zapmap.co.uk*

Table 4-1**Error! Reference source not found.** details the charging points which are publicly available. There are other charging points at many EV dealerships within Warrington and in some workplaces however these have restricted access.

The limited number of charging points across all key use cases acts as a barrier to EV uptake according to surveys.

## 4.2 Areas with limited off-street parking

Figure 3-18**Error! Reference source not found.** displays Census 2011 data on household type which shows those areas with a high density of terraced residential properties and flats, indicating areas which may have limited access to off-street parking. This creates a requirement for alternative public charging provision either on-streets or in nearby carparks so residents can recharge whilst at home. Research has shown that people are willing to walk up to 10 minutes from their house and the closest charging point and therefore this should be considered a feasible range when considering the location of charging infrastructure. There is a high density of flats within the town centre and there are also a number of car parks within the town centre where charging infrastructure could be implemented. In areas with a high density of terraced housing, on-street charging points could be utilised where footpaths and power allow without causing streetscape concerns.

Some areas with lower levels of deprivation (IMD of 7 and above) have limited off-street parking to the south of the town centre, such as Stockton Heath. Affluent residents in these areas may be early adopters of EV and on-street charging infrastructure will support this. Options for charging infrastructure include rapid chargers that would be utilised in a similar way to existing fuel forecourts or installing slower speed charging posts that would charge vehicles whist they are parked at residential locations.

In areas of highest deprivation, such as the town centre, north of the town centre and north-west of the town centre, a feasibility study into the potential and business case for introducing car clubs could be conducted, including the provision of supporting charge points (including assessing options such as slow/fast, rapid and wireless charging). This would provide a vehicle for use for those households which may not have access to a personal vehicle, and also provide access to an EV for those residents where purchase price may be a barrier in transitioning to EV.

A trial project funded by Innovate UK is currently being rolled out with Virgin Media to host slow chargers using their fibre network to reduce the costs of creating new connections to the electricity network. It is recommended WBC review outcomes from this trial to inform the future approach for providing charging infrastructure in residential areas.

Further feasibility work is required, including wider stakeholder engagement, to identify locations for the deployment of on-street charging in residential areas where off street parking is limited.

## 4.3 Destinations

The main destination areas comprise of employment, retail and major transport hubs. These areas are predominantly located within the town centre and along the M62 corridor. To the north-east Birchwood Park is a major employment site and to the north-west is IKEA and Gemini Retail Park. In addition, employment sites with available parking provide an opportunity for charging during the day and perhaps overnight if close to residential areas so slow or fast chargers would be suitable.

The town centre has a number of destinations such as Bank Quay and Central rail stations, retail areas, Warrington hospital and areas of employment. A number of these areas have existing car parks where charging infrastructure could be introduced however this would require working alongside private landowners to improve their understanding of the benefits of providing charging infrastructure. Charging infrastructure located on private land may be restricted to customers, staff and visitors to the particular site if public access agreements are not agreed.

Further investigation is required into potential areas of off-street parking that would be suitable for rapid charging in the town centre and along key routes. A careful balance will need to be struck in respect of destination charging in the town centre to provide charging infrastructure for car journeys that are made for employment, retail and leisure whilst also linking with wider transport policy to discourage unnecessary car trips into the heart of the town centre. Car parks located on the edge of the town centre include Cobden Street, Grammar School Road, Marsh Street and Sharp Street which may be suitable for charging provision.

As such, further investigation of potential charging infrastructure should be considered at the following locations:

- Warrington hospital;
- Birchwood Park;
- Gemini Retail Park;
- Padgate rail station;
- Warrington West rail station;
- Junction NINE retail park;
- Lingley Mere business park;
- Warrington Support for All Centre (A50);
- Penketh Swimming Pool and Community Centre (A57);
- Broomfields Leisure Centre (towards M56);
- Outskirts of the town centre, Council-owned car parks (e.g Cobden Street, Marsh Street, Sharp Street);
- Working alongside larger superstores to help them understand the benefits of offering charging infrastructure.

Table 4-2 shows the locations of larger supermarkets with associated car parks.

Table 4-2 Warrington supermarkets for new or additional charging infrastructure

| Supermarket | Area of Warrington |
|---|---|
| Asda | Birchwood |
| Tesco Extra | Warrington town centre |
| Asda | Warrington town centre |
| Sainsburys | Warrington town centre |
| Aldi | Warrington town centre |
| Sainsburys | Great Sankey |
| Tesco | Paddington |
| Asda (existing charging posts) | Westbrook |
| Morrisons | Walton |
| Co-Op | Latchford |
| Co-Op | Padgate |
| Co-Op | Sankey |

## 4.4 Taxis

Taxis undertake a significant number of journeys and thus travel significantly more miles per day than a typical driver. As such, a transition to EV within the taxi industry would heavily contribute towards increasing EV miles and reducing urban emissions. The high number of miles also means that taxi drivers may require top up charging and experience from elsewhere in the UK indicates the availability of convenient rapid charging facilities is key to the transition of taxis to EV. The current mileage range for LEVC TX taxi is 64 miles on pure EV[41] suggesting that some taxi drivers will require daily top up charging. An LEVC TX also has a range extender which can be used as the battery charge decreases extending the range to 301 miles.

Key taxi ranks have been identified in the town centre and at Warrington Bank Quay station as part of the stakeholder engagement workshop with WBC officers. Whilst the charging infrastructure could not be implemented directly onto the taxi rank (at least until wireless charging becomes a feasible proposition), convenient off-street rapid charger locations should be considered close to taxi stops and main routes. Ideally charging infrastructure for taxis should be bookable and ringfenced only for use by taxis as quick recharging will be crucial in ensuring minimal downtime for drivers. An audit of off-street opportunities is required in the town centre and surrounding Bank Quay station, covering council, network rail and private car park operators.

## 4.5 On-route

The surrounding highway network of Warrington town centre includes the A56 to the south, A50 to the east, A49 connecting the north to the town centre, and the A57 to the west. Further, there is the M62 east towards Manchester, the M62 west towards Liverpool, the M6 north and south towards Lancashire and Cheshire East respectively, and the M56 south towards Cheshire West. The travel to work commuter movement analysis shows there are a number of movements from Warrington towards these areas, and therefore potential demand for rapid charging points at service stations and along key links.

Potential on-route locations for further investigation could include A57 W (Great Sankey), A49 N Orford, A49 (S) Stockton Heath, A50 S (West).

[41] TX https://www.levc.com/tx-electric-taxi/)

## 4.6 Buses

As noted earlier in this report, charging infrastructure to support a transition to electric buses should be considered at Warrington Interchange and at key bus depots including the proposed new site to the south of Dallam Lane. There is a range of charging infrastructure available to support charging of buses as noted in Section 3.8.3 and further detailed work is needed to understand the requirement of the local bus network and optimal charging solutions.

## 4.7 Summary

In summary, the potential locations for charging infrastructure are shown below according to their suitability for the various use cases.

Table 4-3 Potential charging infrastructure locations

| Potential charging infrastructure locations | Use Cases | | | | |
|---|---|---|---|---|---|
| | Areas with limited off-street parking / car clubs | Destination | Taxis | On-route | Buses |
| Locations in the vicinity of Warrington Bank Quay station | | | | | |
| On-street charging within town centre (detailed audit and feasibility required alongside stakeholder engagement) | | | | | |
| On-street charging within residential areas to the south, north and north west of the town centre (detailed audit and feasibility required alongside stakeholder engagement) | | | | | |
| Rapid charging along main arterial routes including A57 W (Great Sankey), A49 N Orford, A49 (S) Stockton Heath, A50 S (West) | | | | | |
| Off street town centre car parks | | | | | |
| Various destinations (see Section 4.3) | | | | | |
| Supermarkets with car parking provision (referred to in Table 4-2) | | | | | |
| Warrington Interchange | | | | | |
| New bus depot, Dallam Lane | | | | | |

## 4.8 Recommended Process for Delivery

Alongside consideration of potential commercial models as detailed in the following chapter, the process for delivery of charging infrastructure is recommended in Appendix A. Stages of work are broadly sequential however some elements could be delivered in parallel:

- Determine WBC's preferred commercial model;

- Stakeholder / partner engagement to understand sites that are being brought forward by commercial providers, further opportunities for sites, conducting informal market sounding, understanding key areas of electricity capacity constraint and assessing stakeholder acceptability;

- Developing a long list of sites that gives WBC a scalable pipeline of infrastructure provision – it is recommended a minimum provision of charging infrastructure is implemented across all use cases to give early adopters the confidence to transition to EV with further infrastructure brought forward to keep pace with demand as evidenced by monitoring of usage. It is also recommended that key actions are taken to strengthen and future proof the energy network including collaborative working with Scottish Power Energy Networks;

- Conducting audits, assessment and option appraisal to determine the suitability and deliverability of sites for the various use cases;

- Following determination of WBC's preferred commercial model, scoping and delivering a suitable procurement exercise;

- Detailed site design, construction and operation / monitoring.

# 5. Potential Measures

From the evidence base and stakeholder engagement set out in the preceding chapters, the following potential measures which could contribute to meeting the objectives of the EV strategy are outlined in the Table 5-1 below alongside future certainties. Chapter 6 of the strategy considers whether these measures should be taken forward for further planning and notes whether measures should be delivered in the short, medium or long term.

Table 5-1 Potential Measures

| Theme | Potential Measure | Rationale for Measure | Future Uncertainty |
|---|---|---|---|
| Transitioning Taxis to EVs | Development and roll out of an EV (or ULEV) taxi strategy for the Borough including engagement with the Hackney Carriage (HC) and Private Hire (PHV) trade umbrella organisations. | Measures to support the transition to EV of HC and PHV to EV are becoming increasingly common in the UK recognising the potential benefits of reducing carbon emissions and improving air quality from vehicles that are highly utilised in urban areas. WBC have recently secured funding from Defra for the development of a taxi strategy as well as the purchase of a demonstrator EV HC. Taxis account for a significant proportion of overall journeys within critical air quality areas so the development of a strategy that articulates the measures for driving a step change in taxi EV uptake is critical.<br>Taxi journey unpredictability (distance and frequency) require quick-turnaround rapid charging solutions close to ranks and key routes. High reliability and availability of charging facilities will be critical to successful adoption of EV by taxi operators. This will assist in the identification and delivery of measures noted in the following rows in this table. Work conducted in other areas of the UK demonstrates that early, sustained and comprehensive engagement with the HC and PHV trade is key to success.<br>Other low-emission fuel options available (e.g LPG) could also be considered as part of the development of the taxi strategy. | Extensive uptake of Mobility as a Service could increase demand for EV taxi solutions and as a result may require additional charging infrastructure. |
| | Amend existing licensing laws to support the uptake of EV taxis. | A change in policy for vehicle conditions to make EVs mandatory would lead to increased EV uptake, however as noted in Chapter 5 significant engagement with trade organisations would be required and complementary supporting measures. | National policy and legislation changes could have local implications. |
| | Create EV only HC ranks. | HC ranks in the town centre and at Warrington Bank Quay station have been identified as being highly in-demand by feedback from the stakeholder workshop. Giving priority to EV may therefore encourage a transition to EV HC within Warrington. Wireless charging at taxi ranks has been considered in a number of cities (i.e. Nottingham) however the technology requires a significant level of improvement and is not yet widely commercially available, particularly in the case of HC vehicles. There are however question marks in terms of acceptability and deliverability of this measure as noted in Chapter 5. | Should other measures proposed be successful and a large scale transition to EV taxis takes place then this measure would not be required. |
| | Encourage uptake by providing loans, a scrappage scheme, or the Council leasing vehicles to taxi operators (in addition to the existing OLEV fund). | OLEV offer subsidies though Plug in Taxi Grant (PiTG) which represents a 35% reduction in vehicle cost. However even with this grant, stakeholder engagement in other areas has shown that HC and PH operators find the upfront cost of purchasing EV challenging and that further financial support is required. This could take the form of a loan provided by WBC, making further vehicle subsidy available which follows a similar format to the delicensing scheme (TfL "scrappage scheme"), or WBC purchasing vehicles and leasing these to operators. | Future government policy may change including the grant level available for taxis. |
| Transitioning local buses to EV | Develop a business case and specific proposals for the transition of the local bus fleet to EV. | The evidence base shows there are a range of EV bus models available alongside a variety of other low emission technologies such as hydrogen fuel cell and biomethane models, enabling operators to choose appropriate technology solutions to meet their operational needs. Electric buses have been introduced successfully in other areas of the UK such as Manchester and Nottingham. There is a particular opportunity in Warrington given that 80% of the bus fleet is under the management of council owned arms-length bus company, thereby providing greater potential to influence this transition. There is also significant work already being conducted by WBC to scope out the potential for this measure to be implemented as part of the DfT's Electric Bus Towns fund. A bid is being prepared to the fund to electrify the full bus fleet including the smaller operators in Warrington. | The fast developing and fluid Coronavirus situation is requiring social distancing measures coupled with a significant recession that is likely to affect travel demand and revenues from local buses. A recent survey has indicated public transport patronage may reduce by 20% compared to prior levels[42]. There is therefore an opportunity to rebuild the transport network and make bus travel an attractive and low carbon option for the future, with transitioning to EV an important element in this agenda. Additionally, by procuring a new bus fleet there is also an opportunity to improve vehicle facilities to amend seating arrangements, and include the addition of more doors, contactless ticketing and hand sanitiser. |
| Transitioning HGV and LGV to EV | Supporting the transition of HGV to EV | HGVs comprise a significant proportion of traffic in Warrington and therefore are contributing to air quality issues and carbon emissions. HGVs and LGV contribute 20% of NOx in Warrington, yet account for only 9% of distance travelled. However, at present there is a lack of commercially available EV options for HGVs. | EV technology for HGVs is still developing and the extent and timescales in which these vehicles will be available is uncertain. However, other ULEV technologies are being |

[42] https://www.transportxtra.com/publications/local-transport-today/news/65233/20--in-public-transport-use-predicted-post-pandemic/

| | | | | |
|---|---|---|---|---|
| | | | brought forward for this vehicle class, and significant work is being undertaken to investigate the potential for hydrogen as a fuel source, including within the Liverpool City Region. | |
| | Supporting the transition of LGVs to EV including the provision of grants and/or loans (in addition to the existing OLEV fund) | LGVs comprise a significant proportion of traffic in Warrington and a move to EV would increase the number of EV miles undertaken since LGVs typically complete a greater daily mileage than the average vehicle. HGVs and LGV contribute 20% of NOx in Warrington, yet account for only 9% of distance travelled. There are a number of options available for smaller LGVs however this is more limited for larger LGVs. The majority of electric vans on sale in the UK have a range of around 80-120 miles in everyday use, which may be sufficient for many local deliveries in Warrington. There is an ongoing piece of work being undertaken by Highways England and Leeds City Council supporting the uptake of EV LGVs in Leeds and the surrounding Strategic Road Network. | The availability of Li-ion batteries (or lack of) will affect the supply of these vehicles in the future in a similar manner to cars, giving uncertainty to the project uptake. | |
| Increase number of charging points | Increase provision of rapid charging infrastructure for taxis in convenient locations. | As noted, taxis contribute to air quality issues and carbon emissions, particularly near taxi ranks and key routes into the town centre. Whilst high-level potential convenient charging locations have been identified in this strategy, further engagement with the taxi industry should be undertaken to inform more detailed planning as part of the EV Taxi Strategy. Engagement with the HC and PHV industry elsewhere in the UK shows that quick top-up charging using rapid chargers in convenient locations is important to enable taxi transition to EV. | If technology around wireless charging develops further into a commercial proposition for taxis, charging infrastructure could be incorporated within taxi ranks or feeder areas. | |
| | Provide charging infrastructure for buses. | As noted, WBC are investigating options for transitioning bus fleets to EV which will require bus charging infrastructure at depots and potentially top-up charging at some bus-stops too. WBC are currently planning for a new depot for Warrington's Own Buses with planning permission secured. Engagement with Scottish Power will be crucial to jointly scope out electricity requirements and supporting capacity enhancements (or alternative solutions such as battery storage should the cost of capacity enhancements be prohibitive). | As noted above impacts from the Coronavirus pandemic on travel demand are anticipated, however this also represents an opportunity to build back towards a better transport network with EV buses a key element of this. | |
| | Provide charging points at key destinations (e.g. Town Centre, Warrington Bank Quay station, retail parks (e.g. Gemini and JunctionNINE), and at major employment sites (e.g. Birchwood Park). | Evidence shows that the public highly value the opportunity to top-up at publicly accessible charge points to complement the bulk of charging which is carried out at home. Without the public charging infrastructure in place, this could delay the uptake of EVs. Evidence demonstrates that some of the most popular publicly accessible locations for charging EV are key destinations where drivers can park for a significant period of time. A high proportion of current vehicles (and in the short term) are anticipated to be plug-in hybrids which have relatively short ranges and older BEVs have relatively small batteries. Therefore, top up charging at key destinations will support journeys to work and for other everyday purposes such as retail and leisure, at least in the short term | As noted in the evidence base there is significant uncertainty regarding the rate of EV uptake due to manufacturing capacities and the affect of the Government's 2030 ban. In addition, price parity between EV and ICE is not expected until the mid-2020s which may continue to affect rates of transition. With this in mind it is recommended a minimum provision of charging infrastructure is implemented across all use cases to give early adopters the confidence to transition to EV with further infrastructure brought forward to keep pace with demand as evidenced by monitoring of usage. | With increasing battery sizes and range the requirement for destination charging may reduce in the medium to long term. |
| | On-route charging points on the Major Road Network. | As noted above, the opportunity for top up charging is highly valued, particularly for when longer distance journeys are required. Without the infrastructure in place, this could delay the uptake of EVs. Warrington is situated on key strategic longer distance traffic routes including the M6, M62, M56 and a number of regional routes providing access to North Wales, Merseyside, Cheshire, and Greater Manchester.<br>Charging infrastructure is already provided at motorway service stations and Highways England is investigating opportunities to improve provision on the Strategic Road Network. | | With increasing battery sizes and quicker charging times via higher powered chargers the requirement for charging at home may reduce with a move to a situation similar to ICE refuelling. At present there is no firm evidence for this scenario however and the situation should be monitored as EV technology develops. |
| | Provide charging points to support residents with limited access to off-street parking provision and charging. | Homes in areas with limited off-street parking may not have the option to introduce a household charging point and therefore will require alternative public charging points. From the evidence base there are notable areas of flats and terrace housing clustered in the town centre and the fringe to the north and the west which are likely to require on-street charging or alternative public charging car parks close to homes. | | |
| | Introduce charging hubs / forecourts. | Charging hubs / forecourts are being trialled in a number of locations. Hubs can range in size from clusters of fast charging points to extensive sites with ultra-rapid charging and complementary facilities / retail opportunities. Smaller charging hubs can be a solution to the challenge of charging EVs for residents who do not have off street parking. However, at present the business case for larger and more extensive hubs is uncertain due to questions regarding the uptake of EV in the short to medium term and how owners will charge their vehicles in the future. | | |
| Promotion / education | Myth busting campaigns and practical support for the general public. | Previous public surveys indicate there are a number of perceived issues including the range of EV, cost, driving style, battery life, and the number of charge points that are available. Although some issues are real and this strategy seeks to address the myths, some aspects can be dispelled through promotional campaigns and engagement such as 'experience event'. Evidence shows that once people actually drive an EV this addresses most common concerns. The provision of locally tailored information including the locations of charge points would be helpful to overcome a range of myths. | Promotional campaigns in the short term would secure best value from existing and forthcoming charging infrastructure, however the supply of vehicles in the short term is limited so impact of these measures may also be constrained. | |
| | Work with local businesses to encourage transition to an EV fleet / grey fleet. | Due to the number of fleet vehicles held by businesses and organisations (or grey fleet consisting of personal vehicles used for business purposes) there is an opportunity to achieve significant benefits by transitioning these to EV. | | |

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| | | Some businesses and organisations could achieve cost savings by switching to EV in addition to environmental benefits and the free service provided by the Energy Saving Trust can be promoted through existing business connections such as the Travel Choices work currently conducted by Warrington, economic development support services and the chamber of commerce. | |
| | Establishment of financial support (grant or loan scheme) to support businesses with the transition of fleet vehicles to EV. | Although there is already OLEV grants in place additional support could be provided in the form of grants or loans to purchase EV, particularly for organisations for who usage is not intensive enough to offset the higher purchase price against reduced operation costs. | |
| | Transition WBC fleet and operations vehicles to EV. | Introducing EVs amongst WBC fleet and operations vehicles could be viewed as the Council "leading the way" in future vehicles whilst also increasing visibility of EV across the Borough. There is scope to integrate this measure with the provision of an EV car club in the town centre, with WBC using the vehicles within business hours and then the general public using them outside business hours, increasing the financial sustainability of the measure.<br>Data provided by WBC shows that the existing opportunities to lease company cars is proving popular with significant numbers of BEVs on order to take advantage of beneficial tax rates. | The Coronavirus pandemic is changing if, how and when people travel and this may impact on the services and transport solutions that are required in the future. |
| Engagement with the District Network Operator | Continuous engagement and joint working with Scottish Power through the "Charge" project. | Scottish Power are currently conducting the "Charge" project that merges electricity and transport planning to create an over-arching map of where EV charge points will be required and where they can be best accommodated by the electric grid. The project will also determine where future upgrades to electricity supply capacity are required to futureproof the network and feed into future business cases to secure investment as part of broad network development. If these locations can be identified this will avoid costly investment later which hinders the business case for charging infrastructure. The project is in progress with an end date of December 2022 and there is an opportunity for WBC to use the recommendations in this strategy and subsequent detailed planning to position the Council at the forefront of EV infrastructure provision in the region. | As noted above, significant uncertainties regarding the supply and uptake of vehicles alongside the availability of V2G technology will affect the level of power required from the grid. Joint work with Scottish Power should explore the impact of varying uptake scenarios to inform an assessment of likely upgrades to the network. |
| Local policy changes | Update Parking Standards (currently 2015) to encourage EV uptake. | Parking Standards contain requirements which new developments need to meet, including the number of EV parking spaces or charging points. The policy review shows that since the current Parking Standards were developed significant developments have occurred in EV planning and technology and therefore an update is required to reflect the changes in the vision and commitment of the Council. | Vehicle and charging technology is rapidly evolving and periodic updates will be necessary to ensure the standards reflect current best practice. |
| | Encouragement through contract procurement. | This measure is somewhat in place in many areas of the UK since procurement contracts often get a score for environmental sustainability. Discussions in the stakeholder workshop suggested there was some scope for broadening and strengthening requirements since many WBC contracts include vehicle operations and are approaching their procurement renewal period. | The impact of the Coronavirus situation on budgets and income for local authorities may impact on the deliverability of this option should enhanced vehicle standards increase the costs of procured services. |
| | Investigate potential for offering subsidised parking for EV. | Subsidised parking for EV could be an incentive for those individuals who drive to key destination areas, giving cost savings and encouraging the transition to EV. A parking study would be useful to understand areas of greatest parking demand and parking charges income to inform the scope for providing financial incentives and how increased EV uptake and reduced emissions could be considered against loss of revenue. The provision of EV car clubs is currently being investigated by WBC as part of the Town Centre Travel Plan. | As noted, public finances are highly uncertain due to the Coronavirus situation and the likely significant recession may hinder the scope for financial incentives. Additionally, the rate of uptake of EV will affect the required funding for some measures. |
| | Investigate potential for emissions based parking giving free, subsidised, or priority parking for EV in WBC owned car parks. | Research shows that cost is a barrier to EV uptake and therefore offering drivers cheaper operational costs is an incentive to encourage EV uptake. Experience from Greater Manchester shows that free charging is popular and helps to build EV uptake however the Greater Manchester network and others are now moving to a model that includes a fee for all public charging due to the significant and sustained financial costs of this measure.<br>In high demand car parks, offering EVs prioritised parking spots could influence commuters to convert to EVs. This is only likely to be effective whilst EV uptake is low-medium since if the majority of vehicles were EVs, this measure would have little impact. This measure would also be taken forward in coordination with providing charging infrastructure. | |
| Integrated transport solutions | Support the development of a car club in Warrington giving flexible access to EV. | As noted in previous measures development of an EV Car Club will enable the public to have flexible access to an EV which increases experience and propensity to use or buy EV, overcomes issues surrounding household parking/charging, and the cost of purchasing an EV. The provision of EV car clubs is currently being investigated by WBC as part of the Town Centre Travel Plan.<br>There are significant areas of the borough, particularly near to the town centre that do not have access to off street parking and therefore are likely to find EV ownership more challenging. Although providing EV charging solutions can partly address this issue establishing a Car Club can encourage the transition away from car ownership and ultimately reduce motorised | Mobility models are rapidly evolving and forthcoming innovations expected through workstreams such as Future Mobility Zones should be capitalised upon to ensure the customer offer is as persuasive as possible. |

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| | | vehicle trips bringing additional benefits, in line with WBC's LTP4. In addition, some of these areas also experience higher levels of deprivation and a car club model would give more affordable and flexible access to EVs. | |
| | Increase use and roll out of electric cargo bikes / e-scooters | Electric cargo bikes can be a key measure to address issues regarding last mile transport for freight. They allow heavier goods to be transported faster and more efficiently and are also accessible for individuals who may not be physically able to ride a push bike. E-scooters are also an emerging option for relatively short journeys – they are currently not legal in the UK however the government is consulting on making these legal in certain contexts such as when ridden on the carriageway or on cycle tracks. These solutions could be promoted through existing Travel Choices streams of work already being conducted. | |
| | Allowing EVs to utilise bus lanes | A trial is planned to allow electric vehicles to use bus lanes in various areas including Milton Keynes and Derby, following the widespread implementation of this measure in Norway. There is however a risk that as the number of electric vehicles increase this will negatively impact on bus journey times and reliability. | The rate of uptake of EVs would affect the levels of benefits gained from this measure and feasibility. |

# 6. Appraisal and Sequencing

## 6.1 RAG Assessment

Following on from the identification of the potential measures in Chapter 4, a Red Amber Green assessment has been conducted for impact against the strategy objectives and deliverability.

Table 6-1 Potential measures of RAG rating and deliverability

| Theme | Potential Measure | Effective-ness | Deliver-ability | RAG Rating Justification |
|---|---|---|---|---|
| Transitioning Taxis to EVs | Development and roll out of an EV (or ULEV) taxi strategy for the Borough including engagement with the Hackney Carriage (HC) and Private Hire (PH) trade umbrella organisations. | | | Funding has been secured from Defra to fund the development of an EV taxi strategy which will commence in the coming months. Experience has shown that early and sustained engagement with the taxi industry is essential in understanding barriers and designing a strategy framework that provides the necessary support for HC and PH operators. If successful, this could lead to a significant increase in EV miles and urban emissions reduction due to the high utilisation of vehicles and can provide a key element of an integrated transport system that reduces reliance on private cars. |
| | Amend existing licensing laws to support the uptake of EV taxis. | | | A change in vehicle policy would cause all taxi drivers to progressively change their vehicle to EV. To be effective, this would require a significant amount of engagement with the taxi industry and potentially financial support due to the lack of second hand EV. The deliverability of this option could be challenging and early detailed engagement is recommended with the taxi trade to fully understand their needs and how they can be supported in making the transition to EVs. |
| | Create EV only HC ranks. | | | This is likely to only be effective if a significant number of EV taxis are operating, since there is a risk that this would otherwise reduce the availability of taxi ranks with EV-only taxi ranks getting very little use. There is also a question mark on the legality of restricting non-EV taxis from accessing such ranks and in a practical sense it may result in HC using less suitable places to stop and pick up passengers. For these reasons this measure is not recommended presently. |
| | Encourage uptake by providing loans, a scrappage scheme or the Council leasing vehicles to taxi operators or a scrappage scheme (in addition to the existing OLEV fund). | | | This is likely to be effective since research shows that cost is one of the greatest barriers to increasing EV uptake in the taxi industry. This would however require an additional government subsidy or funding mechanism since there would be significant costs involved. There could also be potential issues with this measure associated with state aid. A potential solution could be WBC purchasing the vehicles and leasing these to taxi operators. Impact is likely to be high, based on the experience of TfL since this would make upgrading their vehicle compulsory for some drivers (those that don't reach Euro VI standard). |
| Transitioning local buses to EV | Develop a business case and specific proposals for the transition of the local bus fleet to EV. | | | Since WBC have ownership of the majority of the local bus fleet (80%) through Warrington's Own Buses there is an opportunity to heavily influence the transition of local buses to EV. WBC is currently developing an expression of interest to the DfT's Electric Bus Towns fund and should this be successful then further detailed work can be conducted to identify: optimal vehicle and supporting charging infrastructure options; likely capital investment required by WBC to complement DfT funding, operating costs and implications regarding state aid regulations. |
| Transitioning HGV and LGVs to EVs | Supporting the transition of HGVs to EV | | | Although transitioning HGVs to EV would likely produce large benefits in terms of reducing carbon emissions and improving air quality, the evidence base review indicates there are no commercially available EV options for HGVs at present, therefore this option is not presently deliverable. Currently there appears to be greater potential for Hydrogen as a fuel source for HGVs and it is recommended separate work is conducted into this with sub-regional and regional partners including Liverpool City Region who are looking to use hydrogen through a Liverpool-Manchester hydrogen cluster including hydrogen production and hydrogen storage. |
| | Supporting the transition of LGVs to EV including the provision of grants and/or loans (in addition to the existing OLEV fund) | | | The short to medium term impact from this measure could be high due to the significant proportions of LGVs using corridors on which air quality is a concern. Although there are some LGV EV models commercially available the distance range is limited and there is relatively limited choice and availability vehicles. Given these constraints it is recommended that WBC monitor the success of other similar projects such as the Leeds / Highways England trial and technological developments and consider this measure in greater depth in the medium term. |
| Increase number of charging points | Increase provision of rapid charging infrastructure for taxis in convenient locations. | | | A greater number of strategically located charging points for taxis could encourage EV uptake giving drivers confidence that reliable and accessible charging infrastructure is in place. This measure would need to be taken forward as part of developing a broader EV Taxi Strategy as noted above. Although charging infrastructure cannot currently be sited on taxi ranks engagement with the taxi trade can identify locations at which breaks are regularly taken where rapid charging infrastructure could quickly recharge batteries. |
| | Provide charging infrastructure for buses. | | | This measure would link in with the above option to develop a business case for transitioning the local bus fleet to EV. There is potentially a strong business case for this and given WBC own the majority of the local bus fleet this would be deliverable, however early discussions are needed with the District Network Operator (Scottish Power) regarding capacity in the power network in incorporating significant EV charging at the proposed new depot and any top-up charging during shift patterns. |
| | Provide charging points at key destinations (e.g. Town Centre, Warrington Bank Quay station, retail parks (e.g. Gemini and JunctionNINE), major employment sites (e.g. Birchwood Park). | | | Providing charging infrastructure at key locations will give people the confidence to transition to EV. Slower speed (up to 7Kw) chargers are typically low cost and can be provided at key destinations, with OLEV grants available for employers. This measure could partly be delivered through existing WBC communication channels with key employers. In addition, key destination locations within the Council's control and those of key partners (e.g. rail station car parks) could be considered for charging infrastructure. |

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| | On-route charging points on the Major Road Network. | | | This option is deliverable due to Council land ownership and partners (e.g. supermarkets and commercial companies) who are looking to increase charging infrastructure. |
| | Provide on-street charging points to support residents with limited access to parking provision and home charging. | | | This measure would increase the visibility of charging infrastructure and may increase confidence amongst residents for investing in EVs. However, introducing on-street charging may be met with resistance from some residents, particularly if the EVs have parking priority in spaces with charging infrastructure. |
| | Provide off-street charging points to support residents with limited access to parking provision and home charging. | | | As above this measure would provide a charging solution for people who do not have off street parking to charge their vehicle. This measure would be more deliverable however there may be challenges with off street parking being disconnected from residential units that may affect the attractiveness of this charging infrastructure. |
| | Introduce charging hubs / forecourts. | | | Due to uncertainties regarding the uptake of EV in the short to medium term there is a question mark regarding the business case for large charging hubs. There is evidence that drivers prefer the use of hubs due to availability and convenience. In the short term it is recommended that smaller clusters of charging infrastructure are provided (linking to the use cases outlined above) to give users the confidence a charge point will be available for use. |
| Promotion / education | Myth busting campaigns and practical support for the general public. | | | This measure is deliverable and may increase the usage of existing charging infrastructure such as in the Times Square car park within Warrington Town Centre, and increase the numbers of people contemplating purchasing an EV. There is however a limit on the short term potential of this measure due to the current high purchase price and limited supply of new and used vehicles constraining uptake. |
| | Work with local businesses to encourage transition to an EV fleet / grey fleet. | | | This option is highly deliverable and can have a significant impact particularly if businesses with larger fleets transition to EVs. The Energy Saving Trust currently offer government funded support for fleet reviews to help develop a business case for individual businesses which can be promoted. A range of companies can also provide engagement and experience activities as research shows that once people drive an EV many myths can be dispelled. |
| | Establishment of financial support (grant or loan scheme) to support businesses with the transition of fleet vehicles to EV. | | | A grant scheme for new vehicles from OLEV is already in place and beneficial Benefit in Kind (BiK) tax rates provide an additional incentive for company cars. On this basis it is recommended WBC promote already existing offers to businesses. |
| | Transition WBC fleet and operational vehicles to EV. | | | Given that the Council fleet accounts for a limited percentage of total vehicles across the borough, the overall impact of this measure on EV uptake may be limited. Further, some of the Council fleet consists of HGVs (e.g. household rubbish collection) and the technology isn't currently available to support the transition of these vehicles to EV. However, the Council have an important role to play in leading by example and this measure would increase EV awareness in the community whilst directly supporting other policy aims regarding reducing carbon emissions and improving air quality. It is recommended that an early action is working with the Energy Saving Trust to develop a business case to understand likely costs and benefits. A combined business model for a car club as noted above could make a transition for pool cars to EV more financially deliverable and could provide additional benefits through public use. |
| Engagement with the District Network Operator | Continuous engagement and joint working with Scottish Power through the "Charge" project. | | | The "Charge" project will identify areas with insufficient electricity supply to support charging infrastructure. WBC should continue to engage with Scottish Power to identify areas where there is insufficient electricity capacity to support charging infrastructure, and jointly develop a business case to seek funds to strengthen capacity where required. Although this measure would have limited short term impact, in the medium to long term this work will be crucial in delivering a large-scale transition to EV at little cost to WBC. |
| Local policy changes | Update Parking Standards (currently 2015) to further encourage EV uptake. | | | This could be delivered by the Council and this change would align with wider Council policy. With the significant scale of development planned in Warrington this measure could play a crucial role in future proofing new developments to enable transition to EV. Updates to the policy could include increasing the percentage of parking spaces that would be EV charging, and strengthening residential requirements to include EV charging points or passive provision. |
| | Encouragement through contract procurement. | | | This measure is somewhat in place in many areas across the UK since procurement contracts often get a score for environmental sustainability. This could be introduced with more vigour however the impact of the Coronavirus situation on budgets and income for local authorities may impact on the deliverability of this option should enhanced vehicle standards increase the costs of procured services. |
| | Investigate potential for emissions based parking giving free, subsidised, or priority parking for EV in WBC owned car parks. | | | This measure could be delivered within WBC owned car parks, however detailed consideration will be needed regarding the likely costs, affordability and stakeholder acceptability. Introducing this measure may also create parking demand issues and lead to illegal parking on-street. Consideration would also be needed on which car parks this would apply to given car trips into the town centre need to be discouraged in line with the aims of the Last Mile study and the LTP4. As the uptake of EV increases, ongoing consideration will be required to determine an appropriate point at which this measure would be discontinued once EV demand had been stimulated. |
| | Investigate potential for priority or subsidised charging at public charge points. | | | Experience from elsewhere such as Greater Manchester shows that free charging is popular and helpful in incentivising drivers to change to EV, however there is a clear issue of affordability for public authorities and many areas (including GM) are now introducing recharging fees. As a result, careful consideration is needed to determine whether retaining free charging at the current Times Square car park is sustainable and whether subsidised or priority charging can be provided at additional sites as they come forward. |

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| Integrated transport solutions | Support the development of a car club in Warrington giving flexible access to EV. | | | The EV car club model has been successfully rolled out nationally and internationally including in towns of a similar size to Warrington such as Exeter. If high utilisation of the vehicles can be achieved, then this would represent a sustainable business model and lead to a relatively high number of petrol/diesel miles being avoided. As noted above this measure would be taken forward with the WBC pool car option. |
| | Increase use and roll out of electric cargo bikes / e-scooters. | | | Previous government funding schemes have been available for e-bikes through the Energy Saving Trust and there is potential that future funding opportunities may arise. E-bikes are readily available and therefore considered deliverable. These solutions have the potential to significantly reduce first / last mile freight movement, particularly in and around the town centre, and could be considered as part of the Town Centre Travel Plan. |
| | Allowing EVs to utilise bus lanes | | | This measure in combination with other actions may help incentivise the uptake of EVs however the benefits may be counter balanced by a negative impact on journey times and reliability for buses. |

## 6.2 Sequencing of Measures

The measures have been sequenced based upon the RAG assessments of effectiveness and deliverability. Highly effective measures that can be introduced quickly are recommended in the short term and more challenging measures that require scheme development or do not give benefits in the short term are classified as medium or long term.

Table 6-2 Timescales of potential measures

| Potential Measure | Rationale |
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| **Short Term (0-2 Years)** | |
| Development and roll out of an EV (or ULEV) taxi strategy for the Borough including engagement with the Hackney Carriage (HC) and Private Hire (PH) trade umbrella organisations. | Funding has been secured from Defra to fund the development of an EV taxi strategy. Key to realising benefits from this measure will be early and detailed engagement with the taxi trade to co-develop a deliverable programme of measures. Through this strategy the various sub-options noted in this report should be investigated with stakeholder input crucial to determining their deliverability. |
| Increase provision of rapid charging infrastructure for taxis in convenient locations. | A key early measure as part of the EV taxi strategy will be planning for and delivering rapid charging infrastructure for taxis to complement other measures brought forward. |
| Develop a business case and specific proposals for the transition of the local bus fleet to EVs. | Scoping of a business case for this measure has already begun and there is potential government funding to support this from the DfT Electric Bus Towns fund. |
| Provide charging infrastructure for buses. | Alongside development of the business case, planning for the provision of charging infrastructure at bus depots and for top up charging where necessary should be prioritised. In particular, early engagement with Scottish Power to scope out electricity supply capacity at the new depot will be crucial. |
| Provide charging points at key destinations (e.g. town centre, Warrington Bank Quay station, major retail parks, major employment areas). | Although there is uncertainty regarding the rate of EV uptake given the constraints noted earlier in this strategy, a minimum provision across each use case will be required to give people considering the transition to EV the confidence to purchase / lease an EV. Later sections of this strategy give further details on the recommended approach and key potential locations. |
| On-route charging points on the Major Road Network. | |
| Provide on-street or off-street charging points to support residents with limited access to parking provision and home charging. | |
| Myth busting campaigns and practical support for the general public. | To gain maximum value from early investments in charging infrastructure (including the bank of charge points already provided in the Times Square car park), a proportionate roll out of this measure is recommended, bearing in mind that supply of vehicles will be constrained in the short to medium term. |
| Work with local businesses to encourage transition to an EV fleet / grey fleet. | This option is highly deliverable through existing WBC engagement channels with businesses. |
| Transition Council fleet and operational vehicles to EV. | WBC have direct control of fleet vehicles and initial scoping of the business case to be provided through government funded support from the Energy Saving Trust. |
| Continuous engagement and joint working with Scottish Power through the "Charge" project. | As noted above early and continued joint working with Scottish Power will be crucial in future proofing the electricity network and efficiently identifying early sites for deployment of charging infrastructure. |
| Update Parking Standards (currently 2015) to further encourage EV uptake. | The quantum of development coming forward presents an early opportunity to futureproof new development sites. |

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| Encouragement through contract procurement. | As contracts begin to reach their end point, the Council can amend the scoring criteria for tenders to give a greater focus to environmental and sustainability considerations including specific requirements for EV where appropriate. |
| Support the development of a car club in Warrington giving flexible access to EVs. | This measure aligns well with other transport aims in the LTP4 and there appears to be significant potential to provide flexible access to EV for Council pool cars and residents living in or near the town centre without access to a car or who are limited in terms of purchasing an EV by the lack of off-street parking. |
| Increase use and roll out of electric cargo bikes / e-scooters. | E-cargo bikes is a deliverable measure and funding has periodically been made available by Government. There could be scope for the Travel Choices team and other communication channels engaging local businesses to promote these solutions. However, in the case of e-scooters, UK trials are ongoing and further evaluation is required. |
| Conduct study into allowing EVs to utilise bus lanes | Consideration would be needed as to whether this measure would negatively impact on bus journey times and reliability, with stakeholder engagement with bus operators recommended. |
| **Medium Term (2-5 Years)** | |
| Amend existing licensing laws to support the increase uptake of EV taxis | Initial feasibility of these measures could be included within development of the EV taxi strategy however significant planning and assessment will be required before these measures can be rolled out. These measures would also be most effective once rapid charging infrastructure has been provided in the short term to support top up charging during shift patterns. |
| Encourage uptake by providing loans or a scrappage scheme (in addition to the existing OLEV fund). | |
| Supporting the transition of LGVs to EVs. | Given there are limited commercially available models and relatively low distance ranges it is recommended this measure is kept under review, with outcomes from the initial trial in Leeds evaluated prior to proceeding. |
| **Medium to Long Term (5+ Years)** | |
| Supporting the transition of HGVs to EVs. | The technology for HGV charging is still under development and as such, this measure isn't deliverable in the current situation |
| Introduce charging hubs / forecourts. | Although clusters of charging infrastructure should be provided in the short term for each use case, due to significant uncertainty regarding the uptake of EV and how drivers will want to charge their vehicles, the development of larger charging hubs should be considered when there is more clarity on these issues. Given the high cost, a cautious approach is recommended regarding investing in this measure and understanding whether these solutions can be provided by the private sector. |

# 7. EV Charging Commercial Models

This section details potential options for how charging infrastructure can be delivered and maintained.

The long-term financial business model for recharging services relies fundamentally on the demand generated by the number of EV in the marketplace. A successful model needs to create both value to the charge point owner to help them make a return on their investment, and value to the driver who wishes to use the service at a price they believe is reasonable. So, the challenge lies in balancing supply and demand to achieve an acceptable return on your investment, as well as achieving your emissions reduction objectives.

Much of the UK's charging infrastructure has historically been supported by capital grants from government and provided free-to-use to drivers to encourage the conversion to EV. However, public funding is becoming less readily available and private investors require an acceptable return on their investment which is difficult to define in this evolving market. Since it is proving difficult to change from free-to-use to fee-based charging services in some areas of the UK (e.g. Newcastle), it is recommended new charging facilities have a fee applied from the outset. A fee encourages consumers to recognise the value of the service and provides revenue for ongoing maintenance and operation. However, if fees are considered to be too high, this limits demand for charging services and could slow-down EV uptake, ultimately limiting emissions reduction.

Appendix C details a range of considerations that will need to be assessed in developing the preferred commercial model.

## 7.1 Ownership and asset management

In the early years of UK charger deployment, the Public ownership model was favoured for slow and fast chargers due to the availability of capital funding for councils from OLEV. However, this left councils with an ongoing opex cost burden without the funds to support it, causing poor reliability and availability and customer dissatisfaction. Recognising this, private charging suppliers began offering to cover the operation and maintenance costs if the council or private organisation paid the capital and electricity costs. In this way the council maintains asset ownership but passes on responsibility for operation and maintenance for a fixed period, usually with the option of extension, in the supplier's contract. This requires a Service Level Agreement (SLA) with the supplier setting clear requirements for maintenance response and reporting, against which performance should be monitored.

Meanwhile, Public-Private-Partnership models (PPP) were used to establish national networks of rapid chargers, led by vehicle manufacturers with some funding from European and UK government and the PPP model is now favoured by many councils for all public charging provision.

The tax-payer has ultimately funded much of slow and fast local charging infrastructure to date in the UK, through government grants and local government funding, but vehicle manufacturers and charging suppliers have also invested in charging infrastructure. A number of charge point manufacturers, such as Podpoint in the UK and Fastned in Holland, have launched Crowdfunding schemes with some success to fund this.

## 7.2 Value creation and operation

The historic operation of most local charging services has been funded by local subsidy, with the asset owner providing electricity and sometimes also parking free to drivers, whilst also covering operating and maintenance costs. In the case of some privately owned recharging networks e.g. Ecotricity's Electric Highway, revenue from other assets was used to cover the network's operation initially whilst demand was low However, increasingly the user pays a charge for the charging service received.

## 7.3 Funding

The UK government's early grants to kick-start charging deployment have reduced in recent years and they are keen to encourage private investors into the market, so there are a number of funding opportunities which WBC could consider:

- **EV Charging Infrastructure Investment Fund (CIIF)**

This Public-Private fund launched in 2018 provides a £200M cornerstone investment by government to be matched by the private sector. The Fund is now managed on a commercial basis by a private sector fund manager, Zouk Capital. CIIF supports faster expansion of publicly-accessible EV charge points along key road networks, in urban areas and at destinations. Its intention is to increase capital invested in the sector to increase EV adoption.

- **OLEV's On-street Residential Charging Grant**

  Offers councils 75% funding towards the capital costs of procuring and installing charge points for residential areas, which must be available 24/7 and have dedicated parking bays covered by TROs. The council must provide 25% match funding and cover the ongoing operating and maintenance costs. In our experience of TRO consultation, residents have expressed concerns about converting general parking bays to EV only on already congested residential streets, perceiving this as an unfair benefit to individual affluent residents.

  The capital funding covers:
  • purchase cost of the charging unit;
  • purchase cost of electrical components related to the charge point including electrical grid connection;
  • civil engineering works related to the installation;
  • Labour costs of the installation;
  • Hardware costs of the installation
  • capital costs of a parking bay and traffic orders (paint and signage)

- **OLEV's Workplace Grant**

  Available to business and offers 75% funding for up to 20 outlets per workplace, in off-street locations dedicated to staff or fleet charging use, without public-access. Capital funding as above.

# 8. Summary Programme of Work

Table 8-1 below outlines the potential measures which have been identified and displays these in the recommended sequencing order.

Table 8-1 Warrington EV Strategy Sequencing Programme

| Potential Option | Short term (0-2 Years) | (2-5 Years) | 5+ Years |
|---|---|---|---|
| Development and roll out of an EV (or ULEV) taxi strategy for the Borough including engagement with the Hackney Carriage (HC) and Private Hire (PH) trade umbrella organisations | | | |
| Update Parking Standards (currently 2015) to encourage EV uptake | | | |
| Develop a business case and specific proposals for the transition of the local bus fleet to EVs | | | |
| Work with local businesses to encourage transition to an EV fleet | | | |
| Myth busting campaigns and practical support for the general public | | | |
| Increase provision of rapid charging infrastructure for taxis in convenient locations | | | |
| Provide charging infrastructure for buses | | | |
| Provide charging points at key destinations (e.g. town centre, Warrington Bank Quay station, major retail parks, major employment areas) | | | |
| Increase use and roll out of electric cargo bikes / e-scooters | | | |
| Transition Council fleet and operational vehicles to EV on a rolling basis as renewals are required | | | |
| Encouragement through contract procurement | | | |
| Work with Development Control colleagues to increase EV uptake and EV car clubs at new developments | | | |
| Support the development of a car club in Warrington giving flexible access to EVs | | | |
| Provide off-street or on-street charging points to support residents with limited access to EV charging at home | | | |
| Continuous engagement and monitoring of the "Charge" project with DNO | | | |
| Investigate potential for emissions based parking giving subsidised or priority parking for EV in WBC owned car parks | | | |
| Provide on-route charging points where gaps exist in commercial operators provision | | | |
| Conduct study into allowing EVs to utilise bus lanes | | | |
| Investigate potential for EV conversion grant / "scrappage scheme" | | | |
| Supporting the transition of LGVs to EVs | | | |
| Amend existing licensing laws to support the increase uptake of EV taxis | | | |
| Support the transition of HGVs to EVs | | | |
| Introduce charging hubs / forecourts | | | |

## 8.1 Targets and Monitoring

Most strategies set out proposed criteria by which they will be judged, and how success will be measured. In this case, because too many variables remain regarding EV uptake and the factors that influence this, it could be unwise to set a figure for how many new charging points are envisaged to be installed or figures for EV uptake as a result of this strategy, and in what timeframe.

It is recommended the uptake of EVs in Warrington is tracked against the Climate Change Commission projections for EV uptake (43,000 proportional PIVs for Warrington by 2030) and progress is tracked regarding the implementation of measures contained in this strategy.

# Appendix A Recommended Process for Delivery

| Stage of Delivery | Recommendations |
|---|---|
| Determine WBC's preferred commercial model | - Utilising key information contained in the follow chapter;<br>- Horizon scanning of future grant funding opportunities from OLEV / Innovate UK / central government. |
| Stakeholder / Partner Engagement | Discussions with a wide range of stakeholders / partners including:<br>- Charging infrastructure operators to understand what sites are being brought forward by them to reduce future financial risk for WBC. There would also be value in conducting informal market engagement prior to any tendering exercise to understand the appetite for investment in Warrington and the attractiveness of initial sites listed in this chapter. There could also be value in discussing potential opportunities with Gridserve who are currently working with WBC on various solar array opportunities to understand their appetite to invest given their involvement in EV charging in Braintree, Essex.<br>- Scottish Power to understand key areas of constraint / opportunity in terms of electrical capacity (including the initial locations scoped out in this report) as part of the Charge project.<br>- Key partner organisation that may be interested in hosting charging infrastructure such as the NHS for Warrington Hospital, Police and Fire Services etc. |
| Further site option development | - It is recommended a long list is developed that gives WBC a scalable pipeline of infrastructure provision. As noted earlier in this report, a minimum charging provision across all use cases is recommended as part of the first phase of infrastructure deployment, however further sites can be scoped out to be brought forward as and when demand to charging increases, noting the significant uncertainties in this regard.<br>- Detailed analysis and overlaying of council owned land against areas of need for various use cases.<br>- There would be value in seeking a GIS layer from Scottish Power of LV cables and substation locations to aid initial site option development.<br>- Engagement with a range of key stakeholders including councillors, highways officers and partner organisations to understand further opportunities for potential sites. |
| Option appraisal | - Conduct high level audits and assessment to determine the suitability and deliverability of sites for the various use cases, investigating aspects such as: available electrical capacity (utilising the LV cable and substation GIS layer noted above or the planning tool being developed as part of the Charge project); accessibility and open access; site attractiveness across the various use cases; nearby facilities; site security (and perceived security); deliverability including land ownership and the requirement for TROs; and conflicts / synergies with other transport objectives (e.g. supporting access to car clubs or avoiding potential impacts on pedestrian facilities). |
| Developing and actioning procurement exercise (as appropriate) | - Following determination of WBC's preferred commercial model, scoping of a suitable procurement exercise can commence including: determining whether a new bespoke framework / tender for Warrington is appropriate or whether other frameworks such as GMEV framework (available to WBC as part of AGMA) or ESPO will be utilised; further market engagement if required; developing a detailed specification for infrastructure covering aspects such as minimum version of OCPP standards to ensure interoperability and futureproofing. |
| Detailed site assessment / design | - Site design;<br>- Engagement of Scottish Power to obtain connection quotes; |

| | |
|---|---|
| | - Developing any necessary TROs;<br>- Developing any site hosting agreements or lease agreements if giving concessions to the private sector. |
| Construction / delivery | - Delivery through preferred method identified within commercial model. |
| Maintenance and operation | |

# Appendix C. Commercial Model Considerations

The elements to consider in developing a suitable commercial model for WBC includes:

**Upfront capex costs**

- Charger purchase including warranty and delivery; Site civil and electrical works; New power connections if necessary; Commissioning; asset depreciation and interest rates affecting the cost of capital deployed.

**Ongoing opex costs**

- Electricity; Site rental fees or land purchase costs; Back office running costs; customer support services; routine and reactive maintenance costs; and performance reporting.

**Revenue from the sale of recharging services and the investment horizon over which a return is required**

- The **price** of public charging is critical for drivers, but so are the **reliability, availability and convenience** of the service, so fees should be set to reflect the perceived value of all these factors.
- Drivers **compare public charging fees against their home electricity tariff** to assess value for money and to make decisions about where to charge but do generally accept the need to pay more for public charging than home charging.
- Most **drivers prefer to pay by electricity received (p/kWh)** as at home, but fees can also be applied by duration (either of charge transaction or of parking which may be considerably longer), or as a fixed cost regardless of time or energy. We recommend p/kWh fees.
- EV drivers **do not wish to pay more than they would pay for petrol or diesel fuel** so keep charging fees below this level.
- **Slow and fast chargers have lower fees than rapid chargers**, in recognition of the higher value a quick charge represents.
    - The highest rapid charging price in the UK is currently 35p/kWh (InstaVolt Apr 2020). But for comparison, Polar charge only 25p/kWh for PAYG users and 15p/kWh to their members.
    - Slow and fast charging fees vary depending upon operator, location and speed. For example:
        - Ubitricity's lamppost charging solution is priced at 24 p/kWh but only delivers power at 5kW,
        - Polar's 7kW fast chargers in Times Square Multi-storey are free to use for members, or £1.20 connection fee for PAYG.
- **Consider fixed connection fees** which some operators apply instead of, or in addition to p/kWh fees to guarantee some revenue from each charge event.
- **Investigate the fees other charging providers are offering** in your area and set your fees accordingly so as not to limit your demand.
- All public funding requires that chargers provide **a Pay-as-You-Go (PAYG) service as a minimum**, so that any user may use any charger without the need to pre-register. However, some charging networks also offer subscription schemes with lower energy tariffs (e.g. BP Chargemaster Polar), or additional benefits for related services such a home energy supply (e.g. Ecotricity).
- **Consider whether charging or parking is the most valuable asset at each location** and set fees accordingly. Queuing is a problem for drivers at some popular chargers and both owners and drivers require a quick turnaround to maximise availability. If overstay is a problem WBC could set integrated parking and charging fees, OR apply a time-based financial penalty to stop drivers using chargers as parking bays. This mechanism has been effectively deployed on rapid chargers, but it is a more difficult consideration on slow and fast chargers in urban centres where the parking may be more valuable to both operators and drivers than the charge.
- WBC's **fee communications** should emphasise to customers that fees cover infrastructure investment, maintenance and service development as well as the electricity supplied.

- WBC should **request a business model** proposal in the tendering process, including the fees each supplier proposes to apply. **Consider what proportion of revenue WBC requires** before tendering and assess the business case accordingly. Consider your own costs and those of the supplier against the wider objectives of emissions reduction and social provision. WBC could require a proportionate payment per charge event or per energy delivered which the operator must pay each month, quarter or year.

**Revenue generated from any additional services**

- **For drivers** - New services are being developed which provide additional value, for example live availability maps, in-car route navigation tools with links to charging network data, charging event management services, user notifications, charger reservation services and related product offers.
- **For wider stakeholders** – Surrounding businesses such as shops, cafes, leisure and healthcare facilities may receive increased business whilst drivers charge. Also charging infrastructure can integrate with energy storage solutions to provide the electricity grid operator with peak-load management services, and vehicle-to-grid (V2G), business or home services.
- **Through advertising** – drivers are a captive audience during charging sessions so information can be supplied either as fixed media at the charging location or potentially as data delivered remotely. But investors interest in this is currently low due to low EV adoption.

**Robust back-office**

- In order to charge fees, a robust back-office system is required which accurately records all transaction details and operates alongside an **effective payment management system**. For this reason, many charging network operators choose to use highly reputable payment processing services such as PayPal.
- This is also required to provide **high quality customer support** services including remote diagnostic and charge event management to support drivers at the chargers.
- The back office functions should Open Charge Point Protocol compliant.

**Reliability**

- Before introducing fees, it is essential that the chargers are reliable. Drivers are only willing to pay for a service that they have full confidence in.
- Consider the maintenance service and response times you require before procuring your charging equipment with an appropriate warranty and monitor your chosen supplier's performance regularly.