tactran
Tayside and Central Scotland
Transport Partnership

Tactran Regional EV Strategy

Angus Council

Dundee City Council
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CHANGING FOR THE FUTURE

PERTH & KINROSS COUNCIL

Stirling Council

Urban Foresight® is a multidisciplinary innovation practice that is dedicated to advancing the next generation of technologies, services and policy frameworks for cities. We work with ambitious organisations around the world on projects that improve lives, protect the environment and boost local economies.

Tactran is one of seven statutory Regional Transport Partnerships covering the whole of Scotland, which were created under the Transport (Scotland) Act 2005. The primary purpose of the Partnership is to develop a Regional Transport Strategy setting out a vision for the medium to long term future of transport in the area and to oversee its implementation. The Tactran region forms an important "hub" lying at the heart of Scotland's transport network and includes the local authority areas of Angus, Dundee City, Perth & Kinross and Stirling which together make up just under 10% of Scotland's land mass and nearly 12% of the nation's population.

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Executive Summary

A significant amount of work has already been undertaken in recent years across the region placing it at the forefront of the switch to electric vehicles (EVs), particularly in Dundee which was named Europe's Most Visionary EV City in 2018 at the World Electric Vehicle Association. The region is currently recognised for having some of the most innovative and extensive infrastructure in the UK.

However, there is still a significant amount of work to be undertaken in the next few years to meet both the ambitious objectives of this strategy and the national government's target of removing the need for petrol and diesel car and vans by 2032. Following consultation with its four local authorities, Tactran recognised that to maximise the roll out of Electric Vehicles and supporting charging infrastructure within the region there is a need for an overarching strategy and action plan. Urban Foresight were commissioned by Tactran to undertake this in partnerships with the local authorities and other relevant stakeholders, with the aim being to strengthen the region's collective progress in delivering EV growth.

This process has resulted in a 2032 vision, objectives and action plan which are summarised below. These focus on areas in which the Tactran region can implement meaningful change in light of the national and international context.

The main areas to be developed in relation to vehicles are to align the incentives offered to EV users across the Tactran region to create a simple and consistent set of offerings. This will include areas such as tariffs for both charging vehicles and parking of electric vehicles. The region will also require to expand the work to electrify the public sector fleets to set an example. This example should then be used to support local partners and businesses to make that switch as well.

The development of guidelines and toolkits to assist local authorities, partners and businesses with the installation of charging infrastructure is seen as key to ensure that the installation continues at the rate required to meet the future demand scenarios. A significant action is to deliver a feasibility strategy on the long-term management of the infrastructure across the region that works for the region and ensures that the investment to date is used to deliver best value to the partners

The final group of actions are around the promotion of the electrification of vehicles in a consistent approach that allows for some flexibility within each area, building on the work completed to date in each area and also national campaigns.

To ensure that the strategy delivers its vision and objectives, it is key that a Regional EV Forum representing the 4 local authorities and other significant partners is created and takes full ownership of the action plan to co-ordinate local and regional activities in this space. This body will not only ensure that a holistic and regional approach is taken across the Tactran region but will also be able to support significant funding bids and will be able to pool resources to provide all the factors required to promote the region as an exemplar in the electrification of transport.

Vision

To be Scotland's exemplar region for enabling the electrification of transport in the context of a smart, integrated, sustainable mobility system.

Objectives

Economy

1. To establish a financially sustainable public charging network, scalable to growth in demand and flexible to changes in type of demand

2. To attract private sector investment in charging infrastructure and manage a smooth transition from public management of infrastructure, , capturing revenue generating opportunities for local government.

3. To achieve a notable increase in economic activity in the region directly attributable to electric mobility

4. To be an internationally recognised e-tourism destination

People & Place

5. To ensure that electric mobility services are equitably accessible across urban and rural geographies in the region, and those with and without access to off-street parking

6. To ensure that electric mobility services are equitably accessible across the full range of demographic groups and income levels present in the region

7. To ensure the citizens and businesses of the region are engaged and appropriately educated in regard to the benefits and use of electric mobility

8. To support public health outcomes through improving air quality in the region

Holistic & Integrated

9. To support the uptake of EVs across all vehicle types and uses from private cars to buses

10. To ensure EVs are supported by – and contribute to - a resilient and decarbonised energy network

11. To normalise the provision of EV infrastructure and electric mobility services within new or developed property

12. To support the convenient and reliable journey planning, booking, payment and access of shared and public electric mobility services as part of multimodal journeys in the region

13. To direct the development of connectivity and automation of EVs in the region towards the aims of a smart, integrated, low carbon mobility system

Strategy and Actions

Supporting Vehicle Uptake

- Private cars
- Shared mobility
- Public sector fleets
- Taxi & private hire
- Business fleets
- HGVs and Large Service Vehicles
- Buses and coaches

Developing Infra-structure

- Long term management of public charging assets
- Deploying public infrastructure
- The development of charging hubs
- On-street charging solutions
- Home charging
  EVs in relation to other emerging technology

Promoting Electric Mobility

- Short-term engagement strategies
- Long-term engagement strategies
- Promotion for business
- Second-hand market
- Creating an exemplar region

Contents

1. Introduction

Urban Foresight were commissioned by Tactran to create an overarching strategy and action plan that maximises the roll out of electric vehicles (EVs) and supporting charging infrastructure within the Tactran region.

The aim of the strategy is to strengthen the region's collective progress in delivering EV growth, building on the excellent work already being undertaken by partners and maximising the benefits across the region. The strategy and action plan should enable the region to be well positioned for the "Take-off" phase beyond 2020.

1.1 Introduction to Tactran

Tactran is the Tayside and Central Scotland Transport Partnership. The Tactran region lies at the heart of Scotland and its transport network and includes the local authority areas of Angus, Dundee City, Perth & Kinross and Stirling which together make up just under 10% of Scotland's land mass and nearly 12% of the nation's population.

Central to Tactran's role in bringing together its constituent local authority areas is the Regional Transport Strategy which was last refreshed in 2015. Subsequent to this the Scottish Government published Switched on Scotland Phase Two: An Action Plan for Growth which sets out a 10 point plan placing an emphasis on growth, focusing on actions that accelerate the uptake of EVs as part of a wider sustainable transport system and a smart energy grid.

Much progress has been made by the constituent Councils in the Tactran region since the Switched On Scotland roadmap which is captured within the Tactran Regional Transport Strategy (RTS) Delivery Plan 2018 Progress Report (Section 3.10 Climate Change). However, following consultation with our 4 Local Authorities, it was recognised that to maximise the roll out of Electric Vehicles and supporting charging infrastructure within the Tactran region there is a need for an overarching strategy and action plan. This would build on the excellent work already being undertaken by partners, for example showcasing the projects that Dundee City Council have delivered through the Go Ultra Low project and maximise the benefits across the region. It should also ensure that the maximum benefit to local communities and economies can be achieved from initiatives such as the Electric A9 project being delivered by Transport Scotland.

1.2 Introduction to Urban Foresight

Urban Foresight is an award-winning consultancy focused on the smart and sustainable transformation of cities and regions. By taking an integrated and holistic approach we offer expertise in the key sectors and services where progress is required to achieve a brighter future for cities, communities and industry.

Headquartered in Newcastle, with a Scottish office in Dundee, Urban Foresight have developed globally recognised expertise in low emission mobility and delivered an array of related projects, from developing national strategies to the design and procurement of charging and refueling facilities.

Urban Foresight has over 10 years of experience of successfully delivering EV projects across the UK and around the world. We are globally recognised experts in accelerating and supporting widespread adoption of EVs and in helping local communities to realise the multiple benefits that they bring.

We are experienced in the development of electric vehicle strategies helping to involve different sectors and multiple stakeholders in Scotland. We have previously worked with Transport Scotland, developing the 'Switched on Scotland Roadmap Review' & the 'Switched on Scotland Phase Two: An Action Plan for Growth'. In addition, we developed the 'Smart Cities Scotland Blueprint' with the Scottish Cities Alliance, which includes Tactran members Dundee, Perth, and Stirling. Our work included consideration of business models, funding, operation and maintenance requirements, and site-specific installation criteria, and we look to bring this knowledge and expertise to the project.

This document

This EV Strategy and prioritised Action Plan includes proposals for supporting the roll out of electric vehicles in the Tactran area including the deployment, operation and maintenance of EV infrastructure, public and private vehicle usage and their promotion and marketing.

In addition, consideration has been given to the transport and land use policies of the 4 constituent Councils and the strategy tailored to the different urban, semi-urban and rural circumstances across the region.

The development of a regional EV strategy and action plan aims to bring understanding of the EV landscape across the region by establishing a baseline of the current position in the Tactran region, as well as forecasting future demand, strategy and action and monitoring plan.

This document, when finalised, will become a formal sub-strategy of the Tactran RTS and is supported by three referenced documents:

- Tactran Regional EV Strategy: Interim Report;
- Tactran Regional EV Strategy: Baseline Report;
- Tactran Regional EV Strategy: Demand Forecast Technical Paper.

The scope of this work primarily related to plug-in battery electric vehicles. Some reference is made to the role of alternative fuels, particularly hydrogen. However, it is recognised that this area is more fully addressed through other initiatives in the Tactran region. This strategy acknowledges the role that particularly hydrogen can play in a sustainable mobility system and includes actions to ensure complementary activity with relevant initiatives.

Similarly, electrified micro-mobility services such as e-bikes and e-scooters are out of scope of this strategy. E-bikes in particular are growing in popularity in the region and an e-bike cycle hire scheme is going to be launched in Dundee later this year. Despite being battery assisted vehicles, as it was felt that these types of services would be more appropriate addressed in the context of active travel rather than electric mobility.

2. Background

Since the launch of the Switched On Scotland Roadmap in 2013, Scotland has been taking steps to advance widespread adoption of electric vehicles with a stated vision: "By 2050, Scottish towns, cities and communities will be free from the damaging emissions of petrol and diesel fuelled vehicles."

Scotland's Cleaner Air for Scotland strategy notes that the impact of poor air quality has been estimated to cost around £15bn annually in the UK. In Scotland in 2010, fine particulate matter was associated with 2,000 premature deaths and around 22,500 lost life-years across the population. In Dundee, for example, around 1-in-30 residents were estimated to be living in areas at risk of exceeding the national air quality standards for NO2 and PM10 in 2009. A large proportion of harmful emissions effecting local air quality are emitted from the exhaust pipes of petrol and diesel fuelled vehicles, particularly at roadsides and in urban areas. Low Emission Zones are being introduced initially in Scotland's four largest cities to help address this, and the Scottish Government will be consulting on making a shift to zero or ultra-low emission city centres by 2030.

In terms of carbon reduction, transport accounts for 28% of Scotland greenhouse gas emissions, a key contributor to climate change. The Scottish Government is committed to continuing to drive down emissions and has set ambitious targets to reduce emissions of greenhouse gases.

The Scottish government has pledged to phase out the need for new petrol and diesel cars and vans across Scotland by 2032.

It is in light of these factors that the Roadmap was developed and that the Scottish government, in 2017, pledged to phase out new petrol and diesel cars and vans across Scotland by 2032, eight years ahead of the UK Government target.

The 'Switched on Scotland Phase Two Action Plan' was published the same year, defining the activities that Transport Scotland were to undertake in the second phase of implementing the Roadmap, in the period 2017-2020. This places an emphasis on growth, focusing on actions that accelerate the uptake of EVs as part of both a wider sustainable transport system and a smart energy grid. One of the 10 key actions was to "Support local authorities in deploying measures that encourage adoption of EVs."

As the regional transport partnership, Tactran and its constituent local authorities are keen to share learnings and best practice across the region, but also to ensure momentum is maintained in terms of EV roll-out. With reference to the three phases set out in the 'Switched on Scotland Phase Two Action Plan', namely, 'Launch', 'Growth' and 'Take-off' (see Figure 1), having a shared regional EV Strategy and Action Plan will enable the Tactran region to be well positioned for the

Take-off phase beyond 2020, as well as strengthening the region's collective progress in delivering EV Growth to suit the area's unique circumstances.

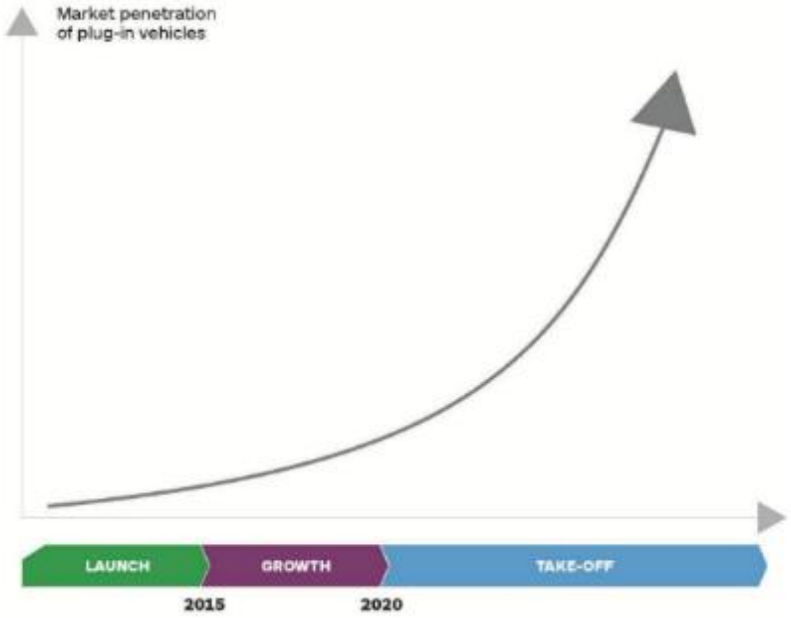

Figure 1: Three phases of market penetration of plug-in vehicles as set out in Transport Scotland's Switched on Scotland EV Roadmap,

Earlier this year, the Scottish Government communicated its intention to commit to net zero greenhouse gas emissions by 2045. This was reiterated recently in the Government's Programme for Scotland 2019-20 which sets out a 'Mission Zero' for transport which will be further developed in the forthcoming National Transport Strategy which will "redefine investment priorities to put sustainable transport at the heart of decision-making and ensure that transport plays a key role in delivering net zero emissions by 2045."[1] It is likely that this commitmenot, as well as the 2032 zero emission vehicle target, will be captured with the "Scottish Green Deal" which is currently in development.

Also relevant to the development of this strategy are the three Key Strategic Themes of the Tactran RTS, namely:

- Economic prosperity – the importance of the strategic transport network to the region's economy.
- Connecting communities and being socially inclusive - improving community connectivity, accessibility and social inclusion.
- Environmental sustainability and promoting health and wellbeing - achieving reductions in local and global transport emissions and improving local air quality and health.

[1] https://www.gov.scot/binaries/content/documents/govscot/publications/publication/2019/09/protecting-scotlands-future-governments-programme-scotland-2019-20/documents/governments-programme-scotland-2019-20/governments-programme-scotland-2019-20/govscot%3Adocument/governments-programme-scotland-2019-20.pdf

3. Progress to date

3.1 EV uptake

As of December 2018, there were 1,882 electric vehicles registered in the Tactran region. This equates to 0.7% of cars/Light Good Vehicles registered in the region, and is around 17% of the total EVs registered in Scotland. However, these figures are unlikely to be suitable in determining actual EV usage in the region, mainly due to the fact that many vehicles used and located in the region will be registered elsewhere.

A more suitable proxy could be derived from regular users of the public charging infrastructure in the region. Table 1 summarises analysis of ChargePlace Scotland (CPS) charging session data for each region. This data includes a unique – and anonymised – identifier for each user of the network and therefore it is possible to determine the number of different users utilising public charging infrastructure in the region. By assuming an EV is primarily located in an area if it is charging on average once a month. There is clearly a disparity between this number and the number of EVs registered.

Table 1: EV registrations (2018 sourced from DfT) and unique CPS IDs by local authority (sourced from local authorities for 2018 CPS charging sessions)

	EV registrations (sourced from DfT)	Unique CPS IDs	Number that charged more than once a month
Angus	219	820	156 (19%)
Dundee City	347	1737	608 (35%)
Perth and Kinross	357	2289	353 (15%)
Stirling	959	1378	117 (13%)

Estimating the number of EVs in a local authority is challenging without home charging data or private network data but using CPS IDs currently gives a more representative figure than the Department for Transport (DfT) registration data. For full analysis of the considerations around estimating EV uptake see the Tactran Regional EV Strategy: Baseline Report.

Using the same metric over the past 5 years presents a picture of how EV uptake has grown in the Tactran region as illustrated in Figure 2 below.

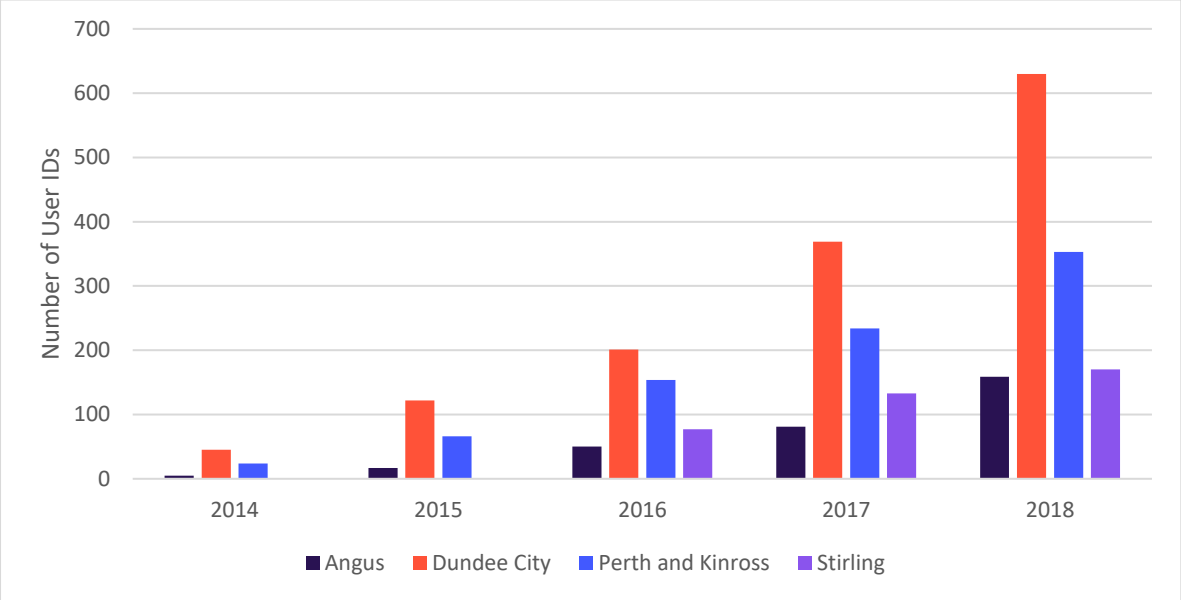

Figure 2: Number of User IDs that have charged on average more than once a month for each given year

Private vehicles

Regardless of how the uptake of EVs is measured, the proportion is clearly relatively low compared with the Scottish government's aspirations. The target to electrify all new car and van sales by 2032 equates to between 60-70% of all cars and vans on the road. Even Dundee, which is much further ahead than most cities in the UK, is still in the early stages of development and much is to be achieved over the next 13 years.

Much of the progress to date has been through investment in the electrification of fleets rather than the private car market.

Council fleets

Dundee City Council first introduced EVs in 2011 with the deployment of 4 vehicles and 4 chargers at a single site. They now have the most EVs of any local authority in the UK. This currently stands at 101 vehicles but is growing year on year. A recent £2.5m grant from Transport Scotland through their Switched On Towns and Cities (SOTC) programme includes a further 14 electric cars and 42 vans. (A full description of this project can be found in the Tactran Regional EV Strategy: Interim Report.)

Dundee City Council has the most EVs of any local authority in the UK (101).

There are around 26 and 10 EVs in the Perth and Kinross Council (PKC) and Angus Council fleets respectively, but with the intention to introduce many more.

To date there are 8 EVs in Stirling Council's fleet. However, they have recently secured funding through the SOTC programme to introduce a further 46. This includes 10 vans and 2 electric minibuses. (A full description of this project can be found in the Tactran Regional EV Strategy: Interim Report.)

There are also plans to introduce electric low floor minibuses within both Stirling and Dundee's local authority fleets.

Other fleets

Alongside local authority fleets, academic establishments in the Tactran region have been electrifying their fleets to some extent. The University of Dundee and Dundee and Angus College currently have around 10 each with several more in the pipeline, mainly through the SOTC project. Stirling University don't currently have any EVs in their fleet but will be buying 10 (1 car, 7 vans, 2 grounds vehicles) through SOTC project

The Switched On Towns and Citiies programme will see more than 150 new EVs introduced to fleets in the Tactran region.

NHS Tayside have 26 EVs (with an additional 11 cars and 11 vans coming through the SOTC project) and NHS Forth Valley have 6.

Other notable fleet vehicles in the Tactran region are:

- Dundee Chamber of Commerce (1 EV);
- Lomond and The Trossachs National Park (2 EVs);
- Scottish Environment Protection Agency (including 2 vehicles coming through Stirling's SOTC project);
- Housing association fleets. Hilcrest, for example, have an electric van and two electric cars in their fleet.

Private sector adoption has been lower with a few notable exceptions. ZippyD, for example is a Dundee-based start-up which launched a food delivery service in May 2019 using a fleet of 8 BMW i3s.

Taxis

One of the main elements of Dundee's success to date is the uptake of EVs by the taxi industry. There are now 129 electric taxis in the city across several companies. This has been down to combination of partnership working with Dundee City Council, initial leadership by the 203020 Private Hire company, proactive provision of charging infrastructure, and incentives in relation to licensing, vehicle testing, parking and free charging.

The other areas of the Tactran region have not seen the same growth. There is currently only one electric taxi in Stirling and none based in Perth or Angus.

Car clubs

There are a growing number of car club vehicles available to businesses and individuals in the Tactran region. A proportion of these are currently electric. Of Dundee's 9 Co-Wheels cars, for example, 6 are EVs including an electric van based at Abertay University.

Car club operators are generally very supportive of the introduction of EVs within their fleet. However, some can be hesitant to use EVs in practice due to what they perceive to be concerns of users around vehicle ranges and user experience. Often their approach involves an initial introduction of hybrid vehicles which are then transitioned to EVs over time as appropriate. This in the case in Stirling Council who are introducing a car club scheme with Enterprise Car Club.

Angus Council have been looking into the feasibility of car club deployment in Arbroath. Similarly, PKC are planning to introduce car club vehicles as part of their low carbon transport hub initiative.

Electric car club vehicles are also being introduced throughout the region for use by housing associations and care providers, such as ECar Club's deployments with Blackwood Care Homes.

Buses and HGVs

There are no fully electric buses currently operational in the Tactran region. Xplore Dundee were using a plug-in electric Wright Streetlite bus as part of their city centre circular service which is currently being trialled. However, after experiencing some technical issues the buses were replaced with a hybrid version of the same model.

In terms of heavy goods vehicles (3.5 tonnes and higher), there are currently no vehicles on the market which would be readily available to the Tactran region.

Dundee City Council are looking to trial the deployment of two electric Refuse Collection Vehicles from their current supplier, Dennis Eagle (1 x 300kWh battery and 1 x 240kWh) as well as an electric 18t Street Sweeper. Analysis of the duty cycles and battery capacity will be carried out during the first 6-12 months of operations which will help develop business cases for future roll out in Dundee and other areas.

Comparison with the rest of the world

Several markets have experienced greater adoption to date than Scotland and the UK. A summary of these countries is presented in Figure 3. Higher EV market share is usually linked with national level policy such as fiscal incentives or mandates. For example, every electric car purchaser in Norway is exempt from acquisition tax, representing around £9000, as well as the 25% VAT usually payable on car purchases[2]. Norway is the most generous country in the world for EV subsidies, but with high vehicle taxes it is viable to reduce taxes for EV adopters rather than increase them for petrol/diesel ICEV (Internal Combustion Engine Vehicle) owners. In other countries, it is not deemed politically viable to increase taxes for petrol/diesel ICEVs to incentivise adoption of low emission vehicles. Other countries have chosen different policy methods to increase electrification such as mandates rather than fiscal incentives. For example, China has implemented their New Energy Vehicle (NEV) policy framework. This is an annual mandatory requirement for auto-manufacturers to achieve a certain number of NEV credits. These credits are gained by producing or importing NEV passenger cars. Manufacturers with surplus NEV credits can either be used to offset corporate average fuel consumption credit deficits, sold to other companies, or banked for the following year. This system is similar to the Zero Emission Vehicle (ZEV) credit scheme in California.

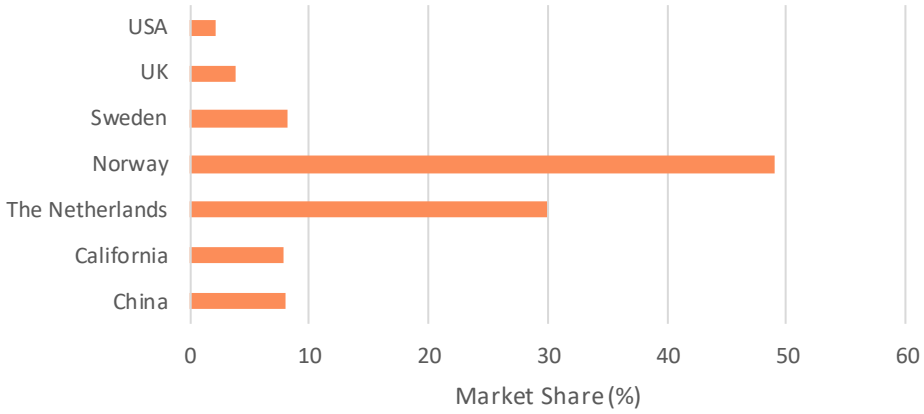

Figure 3: EV Market Share of light duty vehicle markets in 2018 (Data sourced from IEA Global Outlook).

[2] E. Figenbaum, T. Assum, and M. Kolbenstvedt, "Electromobility in Norway – Experiences and opportunities," *Res. Transp. Econ.*, vol. 50, pp. 29–38, 2015.

3.2 Charging infrastructure

There has already been notable investment in infrastructure in the region. Dundee is regarded as Scotland's leading city in the adoption, promotion, and operation of electric vehicles and is Scotland's only Go Ultra Low city, a status awarded by the Office for Low Emission Vehicles (OLEV). The city has been at the forefront of developments in EVs, implementing one of Europe's most extensive city-wide EV charging networks. Scotland's first rapid charging hub was deployed in Dundee by 203020 taxis, with support from Dundee City Council and Transport Scotland. There are currently over 90 publicly available charging posts in the city, most notably through three charging hubs at priority locations – the city centre, Lochee and Broughty Ferry – with dedicated EV parking.

Alongside Dundee, other parts of the region have also deployed charging infrastructure and sought to encourage EV roll-out. Several key projects are also in the pipeline. For example, Perth & Kinross Council's Low Carbon Transport Hub at Broxden Park & Ride will be incorporating battery storage technologies and renewable energy solution.

Table 1 shows the number of publicly available charging posts and charge points[3] across the four Tactran local authorities. Figure 4 illustrates the public charging posts in the region categorised as either slow (<3 kW), fast (7-22 kW) or rapid (>43 kW)[4].

Table 1: Publicly available charge points across the four TACTRAN local authorities in 2019[5] (Note this does not include restricted use e.g. workplace, or home chargers, data was sourced from the respective local authorities complemented by data from Zapmap).

	Total publicly available		Total on CPS network	
	Charging posts	**Charge points**	**Charging posts**	**Charge points**
Angus	35	68	32	62
Dundee City	91	157	75	133
Perth and Kinross	48	84	31	62
Stirling	29	55	18	33

[3] Here and throughout this document we make the distinction between charging posts – the physical charging units - and charge points– the number of individual connections through which vehicles can charge. Many charging posts are dual socket and therefore consist of two charge points.

[4] This categorisation is in line with the approach generally adopted by industry. For example, both the Energy Savings Trust and the International Energy Agency group together 7kW to 22kW charging powers. This is primarily because these charging speeds require dedicated charge posts.

[5] Urban Foresight endeavoured to accurately estimate this number of publicly accessible charge points as of June 2019, but with continual expansion of the charging network, the numbers given here are accurate to the best of our knowledge.

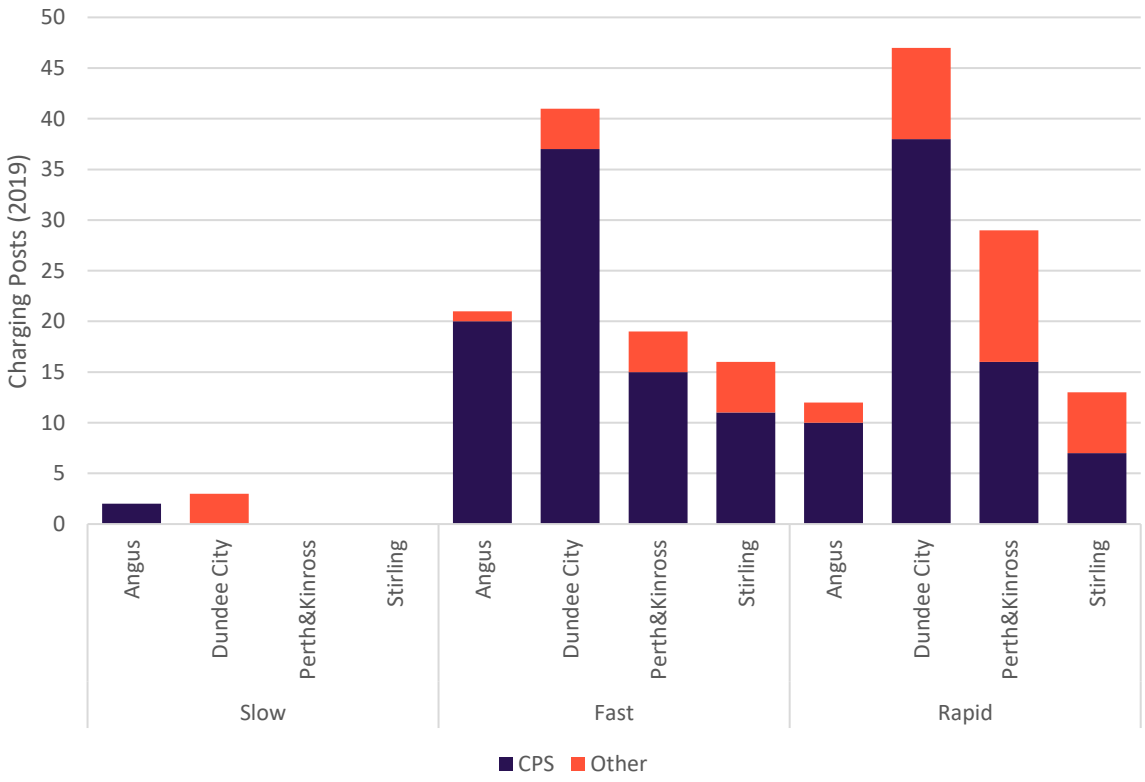

Figure 4: Charging Posts in the Tactran region split by charging speed and network

The majority of publicly available EV charge points in Scotland are on the ChargePlace Scotland (CPS) network. Across the four Tactran local authorities it is estimated that 80% are on the CPS Network. The devices which are not on the CPS network are primarily Tesla charge points privately installed in either supermarkets or hotels, such as the 8 Tesla superchargers on the west side of Dundee. Other private networks are becoming established in Scotland such as Ecotricity, Engenie and Polar.

There are 71 rapid charging posts on the ChargePlace Scotland network in the Tactran region.

For the Tactran region as a whole there are 71 rapid charging posts on the ChargePlace Scotland network. There are also more than 83 fast charging posts and approximately 2 slow charging posts on the CPS network. In Angus and Stirling there are greater numbers of fast charge points, whereas in Dundee City rapid charge points dominate the publicly available charge point mix.

An analysis of data recorded in relation to the use of the CPS network in 2018 has been undertaken. The Baseline Report includes an extract of this analysis with statistics pertinent to the Tactran region. The analysis demonstrates how Dundee City has the highest number of charging events across Scotland. Perth & Kinross have a significantly greater number of charging events than for the average Scottish local authority, Angus and Stirling are marginally lower than the average. The low number of households per sq km in Angus, Perth & Kinross, and Stirling, highlights the additional challenges of rurality for these local authorities compared to Dundee City.

Charging Hubs

A key feature of the public charging infrastructure in the Tactran region is charging hubs. These normally feature a number of rapid chargers at least and give comfort to the user in overcoming any queuing anxiety. The fast and rapid charging infrastructure at Broxden Park & Ride, for example, provides a strategically important charging hub at a central node on the Scottish strategic road network, with plans for future development of the hub.

Strategically positioned hubs combine rapid charging with renewables and battery storage.

The 3 hubs delivered in Dundee to date feature 6 rapid chargers and a minimum of 3 fast chargers, these can charge up to 20 vehicles at a time on each site and also include solar and battery storage at some sites. The major benefit of these charging hubs is the ability to support a variety of users, the taxi trade in the city, local businesses and members of the public with no off-street parking, on a single site without the requirement for significant additional infrastructure.

As well as these identified groups they are also able to support local and visiting public to the city. One of the keys to the success of the charging hubs is their location close to local communities and so supporting business while providing facilities without requiring additional expense. Dundee are set to develop a 4th hub in the North of the city on the main road to Aberdeen this will be complemented by the development of a hub in Forfar.

Certain hubs are important for enabling EV trips through the Tactran region rather than just within it. The charging infrastructure at the Broxden Park and Ride site is a key example of this; approximately 85% of charging sessions in Perth & Kinross were “occasional” users, i.e. users charging less than 12 times a year.

Charging behaviour

While the number of electric vehicles on the roads in the Tactran remains relatively low at present there a number of noticeable trends and issues developing across the sector. The main areas that have been identified to date are issues with how users interact with the available infrastructure and the powers the host has to control them and also the varying trends in user habits.

Each local authority has their own method of controlling the length of stay at their chargers, these vary from no time limits to strict time limits controlled through local Traffic Regulation Orders. While in general EV drivers are reasonably supportive in using the infrastructure in a responsible manner there have been issues with drivers overstaying their required time on a specific charger and therefore blocking other users. Other behaviours identified that are causing issues and need to be addressed are plug-in hybrids utilising rapid chargers when not required, drivers pressing emergency stop buttons for quick release and bay blocking by fossil-fuelled vehicles.

Operation and Maintenance of the EV charging network

Each local authority manages its own network of EV charge points. In each local authority different sections of the council are responsible for this. The Charge Place Scotland back office system records all charging events including the user ID, the length of charging session and energy drawn. All local authorities received funding from Transport Scotland for maintenance and warranty package for their EV charging network which will continue until December 2022.

The costs for the maintenance, warranty and comms of the EV charging network will be variable depending on how suppliers are procured. As a guideline, based on historical cost data , maintenance fee per dual-headed 7 kW - 22 kW post would usually be at least £600 per year. This cost would cover annual preventative maintenance / warranty as well as the sim-card/connection to the supplier's back office management system. For higher-powered, rapid chargers, the costs would be higher at least £1,800 per annum. Using these figures, the annual maintenance cost for a local authority hosting, say, 30 fast charging posts and 25 rapid charging posts would be approximately £63,000 per annum.

Payment regimes

To date, EV charge points on the Charge Place Scotland network have been free to use for EV drivers. However, this is likely to change with councils implementing their own tariffs.

The Baseline Report details the tariffs for the different private networks, indicating the variation of tariffs already in use. It provides an overview of charging tariffs adopted by different public and privately operated charging networks across the UK. There is a clear variety of different charging and payment mechanisms currently in operation.

EV charging tariffs can be used to encourage different types of behaviour such as to discourage charging at times of peak electricity demand when there could be strain on local distribution grids. Price variations for charging at different times of the day could be effective at controlling when users charge. A tariff could be structured that informs consumers of rates in advance. Vehicles can also be programmed to begin charging at a set time when preferential pricing begins, therefore acting as a financial incentive for users. Similarly, the charging of vehicles can be remotely interrupted (i.e. paused) to reduce the costs of charging at a specific time. Most of this functionality could be made available through mobile apps for user convenience.

3.3 Innovations to Date

As mentioned previously the region is at the cutting edge of technology in this field and below are examples of these innovation currently in operation;

- Integration of battery storage and solar generation at charging hubs.
- Lamp post chargers.
- Dynamic Load management of chargers.
- Integration of active travel and low carbon transport hubs.
- Development of multi alternative fuel filling sites.

Dundee City Council has also set up The Mobility Innovation Living Lab (The MILL) as an innovation centre to make the city and region a global test bed for advanced transport technologies and services and is ideally situated to support the region in becoming an exemplar. This is done through developing user-led solutions that meet real needs and support positive behavioural changes, providing access to infrastructure, data and end-users to pilot new products and services and provide support in accessing funding and finding routes to market nationally and globally.

4. The need for action

4.1 Predicting vehicle uptake and infrastructure demand

To support this strategy different scenarios for electrification of the light duty vehicle fleet in Scotland have been considered (see Figure 5 for fleet scenarios). These scenarios are illustrative futures, not projections of the fleet. The 'high' scenario represents a future such that the Scottish Government's target of removing the need for conventional fossil fuel cars and vans by 2032 is met. The adoption of EVs is assumed to follow an 'S-shaped' adoption curve (as illustrated in Figure 6). This S-shaped adoption curve is based on 'Roger's curve' where there are innovators, mass adopters then laggards in adopting new technologies. This behaviour has been well documented across many different technologies including mobile phones[6], electronics[7], and renewable energy technologies[8]. From the S-shaped adoption curve, it is evident that there is a 'surge' in adoption in the mass market, where the technology moves from the niche market to the mass market. In this model, the S-shaped adoption curve is assumed to be symmetrical, however, models of this type can be asymmetrical, meaning that it is challenging to predict when a technology will reach its inflexion point.

A fleet turnover model translates market share (percentage of new car registrations) into fleet share (percentage of total on-road car registrations). The fleet turnover model here assumes the average scrappage age is 14 years in line with data from the Society of Motor Manufacturers and Traders (SMMT)[9]. It is assumed that the total number of cars registered will remain static to 2040. The likelihood of this assumption is discussed below in the context of estimating required infrastructure provision.

The 'low' scenario in this note is chosen in line with National Atmospheric Emissions Inventory (NAEI) projections[10]. The figures given are Scotland specific but are provided in share of vkm (vehicle kilometres travelled) rather than fleet share (percentage of total car registrations). From the vkm, the market share (percentage of new car registrations) is estimated. The 'medium' scenario is a pathway halfway between the low and high scenarios.

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[6] C. Michalakelis, D. Varoutas, and T. Sphicopoulos, "Diffusion models of mobile telephony in Greece," Telecomm. Policy, vol. 32, no. 3–4, pp. 234–245, 2008.

[7] E. W. Ford, M. N., and M. T. Phillips, "Predicting the adoption of electronic health records by physicians: when will health care be paperless?," *J. Am. Med. Informatics Assoc.*, vol. 13, no. 1, pp. 106–112, 2006.

[8] K. U. Rao and V. V. N. Kishore, "A review of technology diffusion models with special reference to renewable energy technologies," *Renew. Sustain. Energy Rev.*, vol. 14, no. 3, pp. 1070–1078, 2010.

[9] Society of Motor Manufacturers and Traders, "Average Vehicle Age," 2018 AUTOMOTIVE SUSTAINABILITY REPORT, 2018.

[10] NAEI, "Vehicle Fleet Composition Projections (Base year 2016)," 2017. .

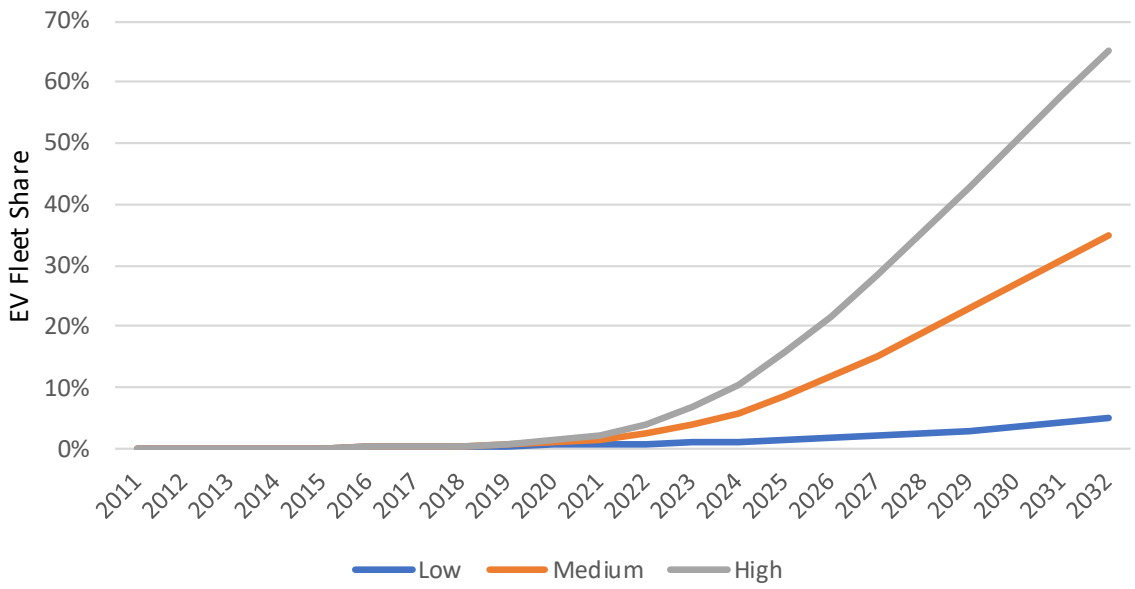

Figure 5: Scotland EV Fleet share of Light Duty Vehicles under the low, medium and high EV adoption scenarios.

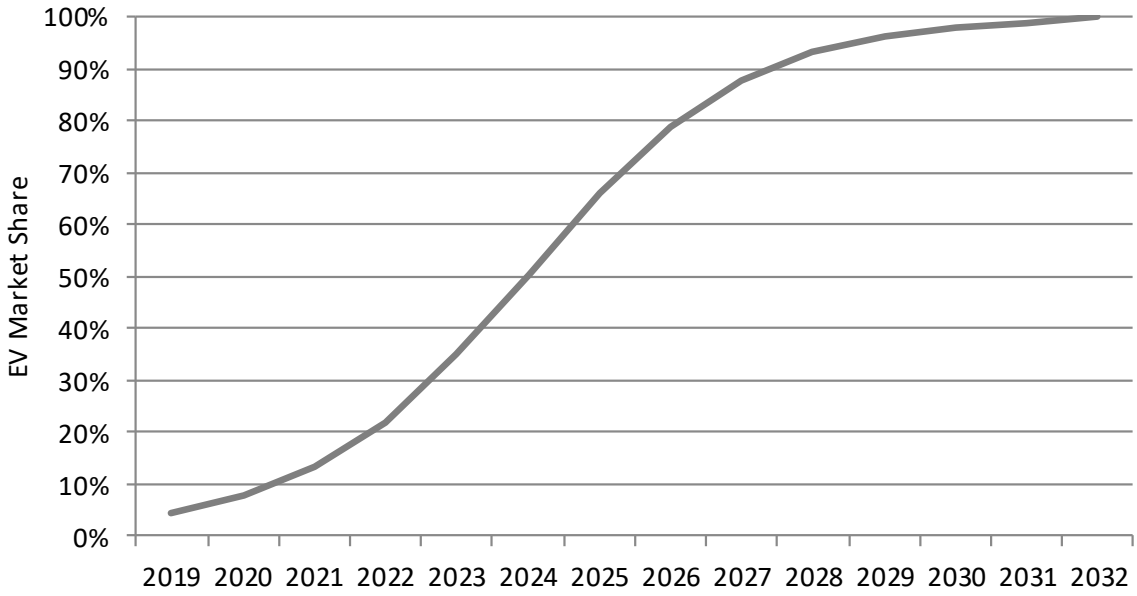

Figure 6: Scotland EV Market share of Light Duty Vehicles illustrating 'S-shaped' adoption curve for high EV uptake scenario.

Charging infrastructure provision

Fleet scenarios are important for planning infrastructure needs as the vehicle fleet electrifies. Charging infrastructure is key to supporting adoption of EVs across the market and the provision of charge points needs to be greatly increased to accommodate an electrified fleet. However, the exact requirements for charging infrastructure are difficult to predict. For example, the EU suggests a ratio of 1 publicly accessible charge point for 10 electric cars under the EU Alternative Fuels Infrastructure (AFI) Directive[11]. However, countries such as Norway have only deployed 1 publicly accessible charge point for every 19 EVs[12]. Table 2 presents the projected figures for publicly available charge points under those two scenarios if we were to simply apply those ratios to the 'high' EV adoption scenario.

Table 2: Number of publicly accessible charge point in each local authority under the 'high' EV adoption scenario using different EV to charge point ratios.

	# publicly accessible charge points				
	2019	2025	2025	2032	2032
	Current provision	Ratio of 1 charge point per 19 EVs	Ratio of 1 charge point per 10 EVs	Ratio of 1 charge point per 19 EVs	Ratio of 1 charge point per 10 EVs
Angus	68	550	1045	2292	4355
Dundee City	157	494	941	2063	3921
Perth and Kinross	84	716	1360	2983	5668
Stirling	55	533	1013	2220	4219

Many factors will affect the necessary publicly available charge point provision in the future and could dramatically impact the estimates in Table 2:

- The AFI directive which indicates a target of a ratio of 1 charge point for every 10 EVs does not specify the type of charge points needed. The provision of different types of charge points (e.g. slow, fast, rapid) and the location (e.g. hubs vs on street) will affect the number of charge points needed as the fleet electrifies. The proliferation of rapid charging hubs will likely mean that the 1 to 10 ratio is not necessary.

[11] IEA, "Global Electric Vehicle Outlook," 2018.

[12] E. Figenbaum, T. Assum, and M. Kolbenstvedt, "Electromobility in Norway – Experiences and opportunities," *Res. Transp. Econ.*, vol. 50, pp. 29–38, 2015.

- Increased electric vehicle range stemming from higher battery capacity (see Section 5 for more details of future battery technology) may mitigate the need for the higher ratios indicated in Table 2.
- At present, tariffs on the CPS network are free therefore the introduction of tariffs will likely incentivise more people to charge at home overnight.
- Without current data on home charging behaviour it is challenging to predict how home charging and public charging will interplay in the future. If the majority of private car users charge overnight then the need for publicly available infrastructure will be lower.
- Changes in mobility such as the rise of Mobility as a Service (MaaS) or the proliferation of electric car clubs could affect car ownership, therefore putting different pressures on publicly available charge points.
- Electrification of the taxi fleets will necessitate the need for rapid charging hubs in strategic locations in urban areas. Similarly, if businesses electrify their fleets this could put additional strain on public charging infrastructure.
- Between now and 2032 there are likely to be a range of other disruptive technologies and private innovations which are currently unforeseen but could have a significant impact on requirements for public charging infrastructure.

4.2 National and international context

It is important to recognise that many of the key factors in achieving the Scottish government's 2032 target are outside the direct control of Tactran, its constituent local authorities, and local stakeholders. Scottish, UK, and international policy all influences the EV market, however, local policies and activities can play an important role in encouraging and persuading EV uptake.

International factors which will inevitably affect EV uptake in the Tactran region include:

- European transport policy which is legislated by the European Commission. This mainly concerns the fleet average emissions standards which will affect the mix of vehicles automotive manufacturers are selling. Manufacturers must observe fleet average CO_2 emissions of all light duty vehicles manufactured at below 95 g/km in 2020, with every fully electric vehicles sold counting as five sales.
- Supply side issues are prevalent across Europe with wait times exceeding a year for many consumers looking to purchase electric vehicle models. This stems from bottlenecks in battery manufacture which have not sufficiently scaled up to meet the exponential increase in demand.

National factors which will inevitably affect EV uptake in the Tactran region include:

- Fiscal policy legislated by OLEV which mainly concern EV capital subsidies. These are currently offered for fully electric Light Duty Vehicles at up to £3500 for new cars and up

to £8000 for new vans. Trucks and buses are currently eligible for subsidies at present at up to £20 000 for the first 200 orders, falling to up to £8000 thereafter. These subsidies are revised every year and reduced or restructured depending on EV uptake.[13]

- Loans for purchasing EVs. The Scottish Government have to date provided over £40 million of support to Scottish-based businesses and consumers to purchase ULEVs through the Low Carbon Transport Loan scheme. An additional £17 million to support the demand for ULEVs has recently been announced.
- The structure of vehicle excise duty currently favours low carbon vehicles. This has been found to greatly influence purchasing behaviour but is under the control of central UK government.
- The company car tax structures are graduated by CO2 emissions and have incentivized many of the Plug-in Hybrid Vehicle purchases to date. These are legislated for by central UK government. July 2019 saw significant changes to the Benefit in Kind (BIK) tables that come into effect next year with 0% on EVs from April 2020 with this increasing by 1% to reach 2% in 2022-23 regardless of registration date. This is a significant change from 16% for zero emission vehicles in 2019/20 and with over 900,000 people paying BIK in 2018, this could have a significant impact on the number of electric vehicles on the road from April 2020.
- The Electric Vehicle Homecharge Scheme (EVHS) provides grant funding of up to 75% towards the cost of installing electric vehicle charge points at domestic properties across the UK and is regulated by OLEV.

Internationally, it should be recognised that the market represented in the Tactran region is relatively small compared to other city regions across the globe, and the factors described here are out of the control of stakeholders within Tactran. However, Dundee already has an international profile with a proven record of EV best practice, this can be built on with other regions learning from Dundee's track record.

On a national scale, Tactran can have some influence; 9.38% of the population live in the region and it hosts 11.3%[14] of the Scottish road network. It is also located at heart of Scotland and caters for travel to and from the Central Belt to the North East and Highland regions so is ideally located to play a significant role in electrification. Scottish Government and Transport Scotland are working closely with the local authorities across the country to stimulate uptake of EVs across different vehicle and ownership types. The ability therefore of the Tactran ecosystem to influence and direct is significant.

This strategy reflects both of these but largely assumes progress to a certain extent at the national and international levels and focuses on levers and actions within the more immediate control and influence of the Tactran ecosystem.

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[13] https://www.gov.uk/plug-in-car-van-grants

14 https://www.transport.gov.scot/publication/scottish-transport-statistics-no-36-2017-edition/chapter-4-road-network/#Table4.2

5. Vision and objectives

5.1 Vision Statement

In line with the Scottish Government's 2032 target, Tactran and its constituent local authorities have agreed a vision statement capturing the desired position of the region by 2032 in relation to electric mobility:

To be Scotland's exemplar region for enabling the electrification of transport in the context of a smart, integrated, sustainable mobility system

The vision that Tactran and its four local authorities are aspiring to is not simply about increasing the number of EVs on the road. Instead the focus is on electrification of transport in the context of the wider changes that are currently underway in the mobility sector. This in line with Transport Scotland[15] who refer to a "transformative shift to sustainable, low carbon mobility" and are seeking to "grow Scotland's global reputation in low carbon and intelligent mobility" rather than specific goals around EV growth. This includes supporting EV roll-out in parallel with developing areas such as Connected and Autonomous Vehicles (CAVs) and Mobility as a Service (MaaS).This strategy shares the perspective that EV growth should not be considered in isolation but as part of a smart, integrated, low emission mobility future.

The Tactran region also aims to be the 'exemplar' Scottish region, leading the rest of Scotland in terms of EV deployment and support, which other regions look to for inspiration and guidance in this space. This would also mean promoting the region as an area for pilots and for shaping standards in regards to EV roll-out.

Transport Scotland's desired outcomes include Scotland being "at the forefront of markets for Ultra Low Emission Vehicles" and "a global destination for innovation and investment in sustainable, low carbon mobility". This context places Tactran's ambition to be Scotland's exemplar on an international level which is not unreasonable given Dundee's international recognition, most notably through being named Europe's Most Visionary EV City in 2018 at the World Electric Vehicle Associate awards in Japan. This strategy would seek to build on Dundee's position and expand it to the region as a whole.

[15] EV charging infrastructure workshop_18052019_slide pack

5.2 Objectives

The objectives set out here focus on the scope in which the Tactran region can implement meaningful change in light of the national and international context discussed in the previous section. These thirteen objectives aim to account for the different market segments, ownership types, and vehicle types, to set out how a holistic approach to electrification of the transport sector can benefit businesses and communities across the region.

1. To establish a financially sustainable public charging network, scalable to growth in demand and flexible to changes in type of demand
2. To attract private sector investment in charging infrastructure and manage a smooth transition from public management of infrastructure, capturing revenue generating opportunities for local government.
3. To achieve a notable increase in economic activity in the region directly attributable to electric mobility
4. To be an internationally recognised e-tourism destination

5. To ensure that electric mobility services are equitably accessible across urban and rural geographies in the region, and those with and without access to off-street parking
6. To ensure that electric mobility services are equitably accessible across the full range of demographic groups and income levels present in the region
7. To ensure the citizens and businesses of the region are engaged and appropriately educated in regard to the benefits and use of electric mobility
8. To support public health outcomes through improving air quality in the region

9. To support the uptake of EVs across all vehicle types and uses – from private cars to buses
10. To ensure EVs are supported by – and contribute to - a resilient and decarbonised energy network
11. To normalise the provision of EV infrastructure and electric mobility services within new or developed property
12. To support the convenient and reliable journey planning, booking, payment and access of shared and public electric mobility services as part of multimodal journeys in the region
13. To direct the development of connectivity and automation of EVs in the region towards the aims of a smart, integrated, low carbon mobility system

6. Strategy and Action Plan

Key themes

Three key themes were identified in developing the EV strategy for the Tactran region:

1. Supporting Vehicle Uptake
2. Developing Infrastructure
3. Promoting Electric Mobility

Vision

To be Scotland's exemplar region for enabling the electrification of transport in the context of a smart, integrated, sustainable mobility system.

Objectives

Strategy and Actions

Although, the strategy is split into three key themes it is recognised that these are all interrelated and that they must all be progressed in a co-ordinated approach.

6.1 Strategy

The proposed strategy for Tactan and its four local authorities in realising the vision and achieving the objectives can be summarised as supporting electric vehicle uptake across the variety of users in the region, developing charging infrastructure across the region, and promoting electric mobility to multiple audiences through a variety of channels.

Supporting Vehicle Uptake

Taking an integrated and holistic approach to the future of mobility allows the region to fully understand how the introduction of electric vehicles can be fully integrated into all communities. To ensure this holistic approach is effective it is important to understand the various vehicle segments (e.g. categories of vehicles and ownership types) that exist and their respective drivers and barriers. This will ensure that any actions directly impact the intended segments while at the same time form part of the overall strategy of vehicle electrification.

Developing Infrastructure

It is recognised that the region not only has some of the most innovative but the most comprehensive EV charging infrastructure in the whole of the UK. The challenge is to further develop this to ensure that all the vehicle and ownership types have the access required to drive uptake of EVs.

Promoting Electric Mobility

By taking an integrated and holistic approach to the promotion of electric vehicles across the Tactran region there will be a consistent message to the end user, recognising that travel between the different authorities in the Tactran region is a daily occurrence for a number of the residents and for visitors to the region.

6.2 Actions: Supporting Vehicle Uptake

Private cars

For private vehicles it is expected that price parity with an ICE vehicle (without EV subsidies) will be reached by 2022[16], however, there are a number of immediate actions that can be introduced to immediately influence individual's purchase decisions. While the Tactran partners cannot control the capital cost of an electric vehicle they can have a direct impact on the total cost of ownership for a vehicle through the following areas:

1. Electric Vehicle charging tariffs
2. Parking charges in relation to EV use

Both of these areas have an influence over the operating costs of the EVs. However, both can also be politically sensitive areas. With the current political situation concerning the mandate to introduce low emission zones across UK cities to tackle urban air pollution and the current declared state of climate emergency, there is a renewed sense of urgency to incentivise and push for electrification of the transport sector.

Aligning tariffs

It is proposed that the partners take a regional approach to the introduction of tariffs for charging electric vehicles. This will ensure that the private user has reasonable price certainty in the region as a large number of car owners travel between the different local authorities for business and personal travel on a regular basis.

Most of the local authorities in the Tactran region have already been considering the sort of tariff structure that would need to be applied to ensure the long-term financial sustainability of the infrastructure. Dundee City have drafted full proposals along these lines as have Scotland's Electric Vehicle Association.

Ideally charging tariffs would be aligned not just within the Tactran region but across the whole of Scotland. It is proposed that the Tactran region seeks to demonstrate and advocate the benefits of this approach to the rest of the country.

Parking policy

It is recognised that while, as with EV charging tariffs, a consistent approach to parking costs associated with EVs across

[16] https://www.bloomberg.com/opinion/articles/2019-04-12/electric-vehicle-battery-shrinks-and-so-does-the-total-cost

the region would be ideal, this is not a realistic or pragmatic approach in the short to medium term. Instead it is proposed that a shared framework for parking policy and management in conjunction with EV charging be agreed across the Tactran region. This would include a shared set of factors which parking policy needs to consider.

For example, Dundee currently offers free parking in any council-run car parks or on-street parking bays for EVs. This involves registering the vehicle with Dundee City Council in advance and to date around 700 users (680 public and 20 business) have signed up to this. Perth & Kinross Council are also considering implementing this approach to incentivise uptake but questions remain over how long such an approach should be in place given expected increase in EV uptake in coming years.

Other examples of how parking policy influences EV charging behaviour relate to:

- Approaches to parking in rapid charging bays to encourage turnover;
- Challenges with managing parking on sites such as university campuses;
- Methods for clearly communicating parking policies to users.

Integrated Parking & Charging Tariffs

The introduction of integrated parking and charging tariffs can encourage the EV user to park in the designated bays while at the same time reduce the amount of administration associated with the two processes at present.

A linked approach across the 4 local authorities would be extremely attractive to a prospective EV driver. This would give certainty to the EV driver that wherever they travelled in the Tactran region they would have access to a combined charging and parking solution. This is an opportunity to develop a best practice solution for the Tactran area which other regions could follow.

ACTION 1.1.1:	Adopt a shared set of principles that EV charging tariffs are based on across the Tactran region and coordinate their introduction.
ACTION 1.1.2:	Contribute to the national coordination of EV charging tariffs.
ACTION 1.1.3:	Agree a set of principles which parking policy and management should consider to support EV uptake, based on a shared evidence base and best practice across the region.
ACTION 1.1.4:	Pilot integrated parking and charging payments through an integrated mobility platform.

Shared mobility

At present, most vehicles are privately owned, however, in the long term it is expected that shared ownership of vehicles will become more prevalent. On this basis it is important that shared vehicles are considered as a distinct class. The promotion of car sharing is seen as vital to addressing the current barriers of lack of access to electric vehicles for communities as well as the prohibitively high vehicle ownership costs for lower income groups.

Mobility as a Service (MaaS) will play an increasingly important role in enabling this shift away from vehicle ownership and Transport Scotland are supporting this transition through a £2 million MaaS Investment Fund to help develop innovative solutions to reduce reliance on private cars.

There are a number of actions that can be taken by the Tactran region that will help promote the use of car sharing while ensuring that they contribute towards vehicle electrification. Local authorities have control over the procurement of car clubs within their area. Overarching guidelines which can facilitate this include:

- To address issues around user interoperability between car club platforms used across the region. This again will make the customer experience in the region far simpler with the customer having the confidence that they can gain easy access to an electric car club vehicle anywhere across the Tactran region;
- To agree a minimum percentage of electric car clubs across the region that must be introduced when procuring a new service provider;
- To ensure that there is the inclusion of an electric car sharing vehicle at the site of any significant charging infrastructure, i.e. there is an electric car club vehicle at every charging hub.

Not only do the above interventions ensure continuing electrification of the vehicle fleet along with increased access for communities across all income groups but these measures can vastly increase the first-time drivers of electric vehicles, which is likely to influence their future car purchasing decisions.

ACTION 1.2.1:	Support user interoperability between car club platforms
ACTION 1.2.2:	Explore with local planning authorities the provision of electric car club vehicles (and associated charging infrastructure) as part of new housing developments.
ACTION 1.2.3:	Work with car club operators to address some of the barriers to greater levels of uptake, e.g. dependence on a back-to-base model
ACTION 1.2.4:	Work with car club operators to improve information (including in-vehicle information) on using electric car club vehicles
ACTION 1.2.5:	Agree a minimum percentage of electric vehicles that must be introduced when procuring a new car club service.

ACTION 1.2.6:	Ensure that there is the inclusion of an electric car sharing vehicle at the site of any significant charging infrastructure, i.e. there is an electric car club vehicle at every charging hub.
ACTION 1.2.7:	Promote the inclusion of EVs and electric mobility services as part of Mobility as a Service initiatives in the region *This would build on the work of The MILL and Dundee City Council's Switched On Towns and Cities project which seeks to build on existing incentives through an integrated app for booking EV parking bays, electric car club vehicles and electric cycle hire.*

Public sector fleets

Alongside encouraging and supporting the public to make the switch to EVs, it is vital for the public sector organisations in the region to lead by example in areas of direct control if they wish to be seen to be an exemplar. While there has been a lot of progress to date in the electrification of vehicles in public sector fleets, there is still a significant opportunity to replace ICE vehicles with EVs. The Scottish Government has committed to work with public bodies to achieve this, and aims to phase out the need for any new petrol and diesel light commercial vehicles from public sector fleets by 2025.

To this end there are a number of region-wide collaborations that can accelerate the transitions to fully electric fleets.

ACTION 1.3.1:	Develop a shared procurement strategy to aim to drive down the overall costs of vehicles *Utilising the current vehicle and plant frameworks in place to try and drive down the overall costs of vehicles. Using a shared procurement approach can attract funding to deliver larger scale projects.*
ACTION 1.3.2:	Deliver a forum for the public sector fleets to share data and learning from EV deployment to accelerate the transition and identify barriers to adoption. *This may include a cross-region working group to deliver significant change in all fleet areas.*
ACTION 1.3.3:	Set up the region as a recognised testing ground for new vehicles with the mix of urban and rural settings being ideal to prove technology *This has already been evidenced in the work undertaken by Dundee City Council and Stirling Council for larger electric vehicles and offers the opportunity to be built upon across vehicle types.*

Taxi & Private Hire Fleets

As well as full control over their own fleet of vehicles each local authority has direct control over the taxis and private hire vehicles operating in its region through the licensing conditions attached to the issuing of a taxi plate. At present there is a different regime in each of the local authorities with different organisations operating across the region. However, there are a number of changes that could be made to encourage or incentivise the trade to make the switch to electric vehicles.

ACTION 1.4.1:	Identify current best practice across the region and share with other authorities to give consistent and progressive approach.
ACTION 1.4.2:	Consider a regional set of conditions to the vehicle rules to try and encourage the switch to electric vehicles while retaining any local variations that are required by each individual authority
ACTION 1.4.3:	Deliver a consistent approach to the procurement of local services from the authorities which encourages the use of electric vehicles to deliver the tendered services.

Business fleets

Business users working across the region can be more challenging to influence than other segments identified. Business users tend to be less restricted by boundaries but are again a significant proportion of the daily movements in the area. A number of the actions required to encourage these users will be covered in the infrastructure and promotions sections of this strategy document, however, it is recognised that there are some initial actions that could be implemented to directly support the vehicle owners in switching to electric.

ACTION 1.5.1:	Introduce a scheme to directly support local businesses to help them understand and consider the financial and environmental benefits of driving an electric vehicle.

HGVs and Large Service Vehicles

The HGV and large service vehicles are a key component in any transport strategy and the switch to low carbon vehicles of this sector will have a significant impact on the overarching strategies of national, regional and local bodies. The Scottish Government has committed to work with public bodies, the automotive sector and Scotland's innovation community to create the conditions to phase out the need for all new petrol and diesel vehicles in Scotland's public sector fleet by 2030.

To date, however, this industry has not seen the same momentum in the switch to new technologies as the light vehicles sector has. There are a number of possible long-term solutions for this industry including hydrogen-based vehicles but as yet there does not seem to be a

consensus on the best route forward for this group of vehicles, this does provide the opportunity for a regional approach to any required infrastructure to support these vehicles and it is proposed that the current regional groups associated are used to support progress of any strategy.

Irrespective of the final technologies adopted large scale charging infrastructure will be a requirement for HGVs, buses and other large vehicles. Public charging hubs are unlikely to be fit for purpose due to vehicles requiring pass through bays, etc. Internationally, charging for these type of vehicles has been showing a focus toward en route opportunity charging using technologies such as pantograph systems. Tactran's Freight Quality Partnership (FQP) brings stakeholders, with an interest in freight movements, together at a regional level. It aims to achieve a mutual understanding of stakeholder positions and problems by sharing issues of concern and identifying possible courses of action to resolve them. The FQP meets every six months and includes representation of the major organisations located within this region.

Transport Scotland are looking at developing more of a focus on large vehicles in the years to come as they see this switch as key to achieving their targets. This year Dundee City Council have put a proposal to switch 5 large vehicles to electric in the coming year, with Stirling also looking at introducing 2 electric minibuses later this year. The infrastructure required to support these vehicles tends to require significant power outputs and so is more expensive. To support the business case for the introduction of larger vehicles a shared infrastructure should be delivered at a scale to support the introduction of a significant number of larger vehicles.

ACTION 1.6.1:	Undertake a pilot of plug-in electric refuse collection vehicles within an urban area (Dundee)
ACTION 1.6.2:	Ensure activity taken to support EV adoption in the region complements and integrates with a Regional Framework for the Development of Hydrogen Refueling Infrastructure
ACTION 1.6.3:	Support the development of showcase project for utilising hydrogen infrastructure on a multi-use basis a key development sites within the region, such as the Michelin Scotland Innovation Parc and the Perth West Eco Innovation Park

Buses and coaches

Local bus companies have a significant impact on every community in the area and have a significant role to play in the provision of a smart, integrated, sustainable mobility system. The introduction of hybrid buses throughout the Tactran region is having an impact, particularly in

terms of improving local air quality. However, beyond a single trial service undertaken by Xplore Dundee, there have yet to be any plug-in electric buses deployed in the region.

The Scottish Government's Green Bus Fund has supported the introduction of mainly hybrid buses to date. However, earlier in the year an additional subsidy was introduced which is weighted to the lowest emitting buses which could further support the uptake of ultra-low and zero emission buses.

While internationally in cities such as Shenzhen and Eindhoven battery electric buses are now the norm, the UK market is relatively immature. This coupled with the challenges of the traditional business models associated with bus operations make this a challenging area in which to progress.

As with HGVs, hydrogen may play in enabling low emission buses in the Tactran region going forward. Dundee City Council is a partner in the JIVE2 (Joint Initiative for hydrogen Vehicles across Europe) project which seeks to deploy 152 new zero emission fuel cell buses and associated refuelling infrastructure across 14 European cities throughout France, Germany, Iceland, Norway, Sweden, the Netherlands and the UK.

It is hoped that by taking a regional approach to the outcomes required that the authorities may increase their ability to influence the bus companies in the region. There are a number of immediate steps the authorities can undertake to provide more weight to the future discussions with the bus operators, such as the actions set out below.

ACTION 1.7.1:	Collectively learn lessons from Xplore Dundee's electric bus pilot as well as international best practice.
ACTION 1.7.2:	Explore potential use cases for electric buses (e.g. as part of a Park & Ride service) and the potential for pilot projects in the region.
ACTION 1.7.3:	Define and produce a clear direction of development for the region in relation to future zero emission buses.
ACTION 1.7.4:	Create an opportunity to share best practice concerning electrification across bus operators regionally, and ensure a consistent approach to local discussions.
ACTION 1.7.5:	Share learnings from JIVE2 project to date and engage with Aberdeen City Council to understand challenges and opportunities arising from their work in this area.

The actions detailed in this section are specifically related to increasing the uptake of electric vehicles in the region across different vehicle and ownership types. Many opportunities have been identified that can support different types of users from different income groups to move towards electric vehicle adoption. However, reliable, convenient and substantial infrastructure is essential to support EV uptake. This is true across all the vehicle segments identified, the next section in this strategy document will look at the various solutions for continuing to improve on the current regional infrastructure provision.

6.3 Actions: Developing Infrastructure

In addition to looking at some of the specific actions that can be takien to enhance the infrastructure in the region it is important to understand how the current and future ownerships models in the region will be addressed and how this will affect the long term strategy for the region.

Long term management of public charging assets

One of the most significant challenges facing the local authorities involved in the deployment of electric vehicle charging infrastructure is the long-term ownership and management of the assets. To date the majority of the infrastructure has been funded by government grants and the ownership remains with the local authority, with a small number of additional chargers managed by private network operators.

While to date the delivery of infrastructure in the Tactran region has been significantly more developed than other regions in the UK is it recognised that to meet the challenges of the 2032 targets a step-change in the pace of delivery is required. To ensure that the whole of the Tactran region is covered equitably and maintains the region as an exemplar it is vital that long term strategies are considered and targets set.

There are a number of choices available to the local authorities from retaining ownership on a local level, creating a regional ownership model, or selling/third party management. A feasibility study needs to be carried out into the future delivery models available to the local authorities and an agreed approach to any regional ownership model.

It is accepted that a feasibility study into the long-term future management may identify a number of suitable stepping-stones towards the ultimate goal and these will help the councils to realise the full potential from the evidence to date.

ACTION 2.1.1:	Develop an infrastructure roadmap to 2032 consisting of a set of key targets and milestones for regional wide infrastructure delivery. *To ensure that the region delivers the required infrastructure to meet the number of vehicles identified in the demand forecast. It is vital that the region sets a number of interim milestones and goals to allow for progress to be measured. that rural areas that are not commercially viable are covered under the offering.*
ACTION 2.1.2:	Assess the feasibility of future delivery models available to local authorities. *This would include understanding how these options will support consistency in regional tariffs. This will remove the burden from local authority teams involved in the management of the infrastructure and ensure*

Deploying public charging infrastructure

The key challenges in deploying EV infrastructure include choosing the correct location, the correct mix of infrastructure, and understanding the current and future requirements at the site considering the overarching Transport Scotland Policy.

The Distribution Network Operators (DNOs) will have an increasingly important role in addressing these challenges. Both SSE and Scottish Power are represented in the Tactran region and both have recently formed a new strategic partnership with Transport Scotland to improve the delivery and integration of EV charging infrastructure and electricity networks in Scotland.

The actions outlined below will lead to a consistent and defined approach to the regional infrastructure.

ACTION 2.2.1:	Create a tool kit for use by the local authorities that gives guidance on best practice for where infrastructure should be situated *The toolkit will also give guidance on the quantity and mix of the infrastructure at that site based on geographic and demographic attributes. The toolkit will deliver a standard approach to infrastructure deployment with a consistent but not prescriptive approach with the users having the ability to pick and mix a variety of options. This will help to accelerate the delivery of key projects.*
ACTION 2.2.2:	Develop a checklist to assess and support the site selection process as well as the choice of infrastructure *This would build on the work already undertaken at Stirling Council. This standardised approach can also be used to reflect the current national and local government approach to deploying EV infrastructure to ensure the most effective use of available funds and support scare resources available.*
ACTION 2.2.3:	Adopt a standardised approach to utilise all available data to create an evidence base for best practice infrastructure provision *This will ensure that the available data on demographics, travel to work studies, and current charging data are all used to support the decision-making process by the local authority.*
ACTION 2.2.4:	Develop a GIS based map of the EV infrastructure in the region that includes future proposed additions to allow for a comprehensive overview of all the chargers in the region. *This is to include all known infrastructure that may not be included on the Charge Place Scotland site. It should also include a layer for chargers that are not currently available*

	to the public but may be shared by the authorities within Tactran to support operational requirements.

The development of charging hubs

It is recognised that charging hubs such as those delivered in Dundee will form a key strategic role in the future of charging infrastructure in the region and will support the majority of vehicle and ownership types identified in section 3.1 of this strategy.

To support Transport Scotland's vision for the future of mobility it is vital that the development of any charging hub no matter the size is considered alongside the various alternative transport modes. An example of this is the Queen Street charging hub in Dundee, which is situated at a local train station and adjacent to the local bus services. To further develop this hub, a space has been identified to support a local electric car club and an e-bike docking station.

ACTION 2.3.1:	Create a toolkit to ensure that all the future developments of charging hubs have fully considered how this integrates with the current public transport and active travel provision. *An assessment around the integration of electric car club vehicles in the hub should also be considered and documented.*
ACTION 2.3.2:	Engage with local communities when identifying where to place charging infrastructure. *Following the identification of a suitable site for electric vehicle charging infrastructure it is important that a strategy is implemented to fully engage with the local community. This ensures they have full buy in to the site, but also this should support them with the switch to electric vehicles.*
ACTION 2.3.3:	Formulate a regional off the shelf "shopping list" for the development of charging hubs in the region, allowing for quick and easy pricing of projects at development stage. *A number of standard options need to be identified and costed to support the streamlined approach to delivery. This will include options for on-site solar generation, battery storage, dynamic load management. This will allow for more streamlined decision-making processes when deciding on the allocation of grant funding.*

On-street charging solutions

Charging hubs are seen as an integral part of any charging network due to their ability to support a number of the different ownership and vehicle types. It is key to understand that they only form part of the charging solution for a region and to fully support the expected uptake of electric vehicles in the future intelligent and design led solutions for residential parking is needed. There

are a number of specific actions related to the on-street solution that can be developed for the region building on current work being undertaken.

ACTION 2.4.1:	Introduce the on-street charging toolkit to include feeder pillar design and support large scale adoption *This would be delivered through the Clean Streets project being developed by Urban Foresight and Dundee City Council. This toolkit is to include a design element regarding the feeder pillars required to support the large-scale adoption of on-street infrastructure.*
ACTION 2.4.2:	Develop a region wide approach to supporting the trials of new technologies in this area and a formal process for sharing the learning with all other partners.
ACTION 2.4.3:	Develop a region wide framework for the use of council owned car parks to support EV adoption *Would explore how this means could introduce substantial residential charging for electric vehicles and how this can be integrated into local parking permits and tariffs.*
ACTION 2.4.4:	Engage in a project to identify the most suitable places to introduce on-street charging infrastructure *This project should aim to go beyond the current level of thinking to fully integrate with the lifestyles of the future electric vehicle owners to ensure that the ease of home charging.*

Home charging

While the public charging network will play a significant role in future charging behaviour it is recognised that home charging will offer a significant opportunity for those individuals with access to off street parking to charge their vehicles. To date there has been some integration of home EV charging into local and regional planning policy, but it is recognised that this is not yet fully developed. Support and guidance is required for each local authority to make this process simpler while removing the opportunity for significant variance between council to council. A number of immediate actions have been identified to help ensure that electric vehicle infrastructure becomes ingrained in all aspects of future housing developments.

It is recognised that any recommendations must consider both local and regional Planning policy and be in line with the National Building Standards as well as feeding into the Local Developments Plans. There is the significant challenge to complete this in such a way that recognises the speed of technological advances in relation to the 5-10 year timescales associated with new planning guidance.

ACTION 2.5.1:	Develop a guidance document for local authorities to deploy when faced with any new housing developments

	This is to look at the full integration of solar generation, individual and shared battery storage facilities, EV charging and the integration of electric car club vehicles within any new developments.
ACTION 2.5.2:	Develop a business case for local authorities for the inclusion of electric vehicle charging and associated renewable technology with any new developments *This would be based on the full life costs rather than the upfront capital costs associated with the project.*

EVs in relation to other emerging technologies

It is vital that electric vehicles are seen as part of the solution to future energy problems rather than part of the problem. A number of these technologies are still in the research and development stages and if the Tactran region wishes to become an exemplar region in this sector it must help support the ongoing large-scale trials of these technologies.

While electric vehicles are set to play a substantial role in the future of mobility in the region for some time to come, Connected Autonomous Vehicles (CAVs) are likely to become prevalent on the roads by 2050. The Scottish Government's Programme for Government indicates the ambition for Scotland to be at the forefront of developments in CAV technology and offer high quality test and demonstrator opportunities to developers and industry.

The Tactran region has the opportunity to open itself up to become a test bed for this new technology. In this way it can be fully understood how these vehicles will interact with the local environment as well as what technology is required to support the deployment of these vehicles in the future. To this end there are a number of areas that could be developed to ensure that the region is not only ready but at the forefront of the deployment of this technology.

ACTION 2.6.1:	Engage with industry to identify and attract large scale trials of technologies such as V2G and V2X, in the region. *This would involve defining the opportunities in the area and identify work required to ensure the region is fully prepared.*
ACTION 2.6.2:	Develop a regional strategy to link these new technologies to energy production within the region and how this may support Community Energy projects.
ACTION 2.6.3:	Develop a roadmap for the region to ensure that it has the infrastructure in place to support the deployment of CAVs and to ensure the correct strategic decisions are taken when rolling out new infrastructure projects in the region.
ACTION 2.6.4:	Identify a number of specific projects in the Tactran area that would be suitable to support CAV's deployment and market the area as a test bed.

6.4 Actions: Promoting Electric Mobility

Short-term engagement strategies

At present there is some excellent work being undertaken in the region with the aim of providing guidance and information for EV users and those wishing to make that switch to electric vehicles. This includes the Drive Dundee Electric brand which has its own webpage and twitter account and has proved a very popular way of engaging with the local users and creating a focal point in the city for the dissemination of information and the promotion of any future developments. It is recognised, however, that a significant proportion of travel takes place across a wider area than a city and a wider approach to the region offering would be extremely advantageous. Additionally, Tactran - as a name - is not highly visible to the general public and that any future promotion must have an easily identifiable brand.

The promotion of the benefits of electric vehicles will play a significant role in persuading people to make the switch to electric vehicles. The workshop run as part of this process identified that a consistent approach to communication including a unified approach to signage and data provided would be a significant benefit to the customers.

ACTION 3.1.1:	Develop a region wide communication strategy *This would build on the work already undertaken in this area. The strategy would include either a regional branding approach or look to expand the branding already used for each authority.*
ACTION 3.1.2:	Identify the appropriate body to deliver the communication strategy and to fully integrate with Transport Scotland's engagement strategy as well as other back office providers engagement strategies.
ACTION 3.1.3:	Create and maintain a list of the key benefits and incentives available across the region to support the uptake of electric vehicles.
ACTION 3.1.4:	Fully integrate any communication strategy with existing promotional activities in the region, such as the Electric A9.
ACTION 3.1.5:	Develop a promotional strategy for e-tourism in the region

Long term engagement strategies

While the need for a regional approach to engagement with vehicle users has been identified as a key part of this strategy it is important to account for long-term changes in mobility. It is widely recognised that there will be a shift in how people view and interact with mobility in the future and that electric vehicles will play as substantial role in the future models. It is vital that Tactran acknowledge the key role that young people in the region will play in the transition to future mobility models and mass adoption of electric vehicles. It is important to develop strategies and programmes that begin to inform and inspire this generation.

ACTION 3.2.1:	Develop the tools and resources to deliver a programme of support to all the primary and secondary schools in the region. *To include electric vehicles as part of a wider programme of sustainable transport and introduce concepts of future mobility models such as a Mobility as a Service. Additionally, it is imperative to build on the work already undertaken by Zero Waste Scotland in delivering school support and link this into the established Eco Schools programme. This could be carried out with the support of EVAS.*
ACTION 3.2.2:	Deliver a region wide programme to install charging infrastructure at all educational premises *To provide a visible demonstration of the regions commitment to the change as well as having the practical application of supporting staff to make the transition to electric vehicles.*

Promotion for business

Section 3.1 of this strategy document identified local businesses as a key group of vehicle users that may have a unique set of requirements and considerations when considering making the switch to electric vehicles. A focussed programme of support will be required for this group while remaining in line with any regional or local approach taken. The Tactran region already has engaged with a number of businesses through the "Travelknowhow Scotland" website, which is currently piloting an app with a reward scheme and so any direct engagement could build on this work.

ACTION 3.3.1:	Fully integrate a scheme to directly support local businesses to help them understand and consider the benefits of driving an electric vehicle with the "Travelknowhow Scotland" scheme. *This support should include tailored information on suitable vehicles and infrastructure required to transition their fleet. An example of this is "Fleet Revolution" run by Urban Foresight in the North East of England which provides 12 hours of dedicated resource to support a business make the transition to electric vehicles.*
ACTION 3.3.2:	Undertake a feasibility study into the creation of a region wide vehicle sharing system *This would be specifically designed for businesses in the region, focussed around the electrification of fleets while at the same time reducing the overall number of vehicles on the roads.*
ACTION 3.3.3:	Build a network of champions from across the business community to promote the benefits of fleet electrification.

Second-hand market

The majority of vehicle purchases in Scotland are through the second-hand car market (646,671 changed hands in Scotland in 2018[17]). The Scottish Government's Low Carbon Transport Loan is going to be expanded to include used EVs in recognition of the vitally important role that this market segment has in widespread EV adoption.

As with all the promotion activities detailed so far it is important to fully understand how used-vehicle customers engage with the EV purchasing process and to recognise that many of the reasons affecting the decision to switch to electric are dependent on local factors. Therefore, it is

[17] https://www.smmt.co.uk/2019/02/uk-used-car-market-finishes-2018-moderately-down-with-7-9m-sales/

a key to provide the main players in vehicles sales with the information and tools to help convince customers to make that change.

ACTION 3.4.1:	Provide new and used car dealers with the knowledge, information and resources on the local benefits of transitioning to electric vehicles *This could contribute to the material already generated by the EVAS by adding information specific to the region.*
ACTION 3.4.2:	Understand the changing nature of vehicle purchasing and ownership in the longer term *To ensure the region is fully engaged with all parties involved in this area. Identify a more accurate method for calculating EV ownership across the region to support future decision making.*

Creating an exemplar region

This strategy recognises the significant work that has been completed to date across the region in low carbon transport and in particular the adoption of electric vehicles. The aim of the section is to build on the international reputation of the region and set up the Tactran region as an exemplar region to help support future activities and funding opportunities. To ensure this is formally recognised and that support is from appropriate organisations, it is recognised that a formal governance process is developed. Therefore, actions include:

ACTION 3.5.1:	Consider agreeing a Memorandum of Understanding across all appropriate organisation in the region and nationally to commit to promoting the region as an international exemplar region in the deployment and promotion of electric vehicles.
ACTION 3.5.2:	Identify the requirements to formally create an exemplar region and create a road map with detailed action plan to support the delivery of this ambition.
ACTION 3.5.3:	Deliver a programme of events and productions to support the status as an international exemplar in the Tactran region.

6.5 Meeting the objectives

Tables 3, 4 and 5 below illustrates how each of the actions described here address the stated objectives and, therefore, help to achieve the vision.

Table 3: Mapping actions to objectives: Supporting Vehicle Uptake

			Economy				People & Place				Holistic & Integrated					
			1. To establish a financially sustainable public charging network, scalable to growth in demand and flexible to changes in type of demand	2. To attract private sector investment in charging infrastructure and manage a smooth transition from public management of infrastructure	3. To achieve a notable increase in economic activity in the region directly attributable to electric mobility	4. To be an internationally recognised e-tourism destination	5. To ensure that electric mobility services are equitably accessible across urban, sub-urban and rural geographies in the region, and those with and without access to off-street parking	6. To ensure that electric mobility services are equitably accessible across the full range of demographic groups and income levels present in the region	7. To ensure the citizens and businesses of the region are engaged and appropriately educated in regard to the benefits and use of electric mobility	8. To support public health outcomes through improving air quality in the region	9. To support the uptake of EVs across all vehicle types and uses – from private cars to buses	10. To ensure EVs are supported by – and contribute to - a resilient and decarbonised energy network	11. To normalise the provision of EV infrastructure and electric mobility services within new or developed property	12. To support the convenient and reliable journey planning, booking, payment and access of shared and public electric mobility services as part of multimodal journeys in the region	13. To direct the development of connectivity and automation of EVs in the region towards the aims of a smart, integrated, low carbon mobility system
Supporting Vehicle Uptake	1.1.1	Adopt a shared set of principles that EV charging tariffs are based on across the Tactran region and coordinate their introduction.	■	■			■	■								
	1.1.2	Contribute to the national coordination of EV charging tariffs.	■	■												
	1.1.3	Agree a set of principles which parking policy and management should consider to support EV uptake									■					
	1.1.4	Pilot integrated parking and charging payments through a shared platform									■					
	1.2.1	Support user interoperability between car club platforms												■		
	1.2.2	Explore with local planning authorities the provision of electric car club vehicles (and associated charging infrastructure) as part of new housing developments.								■			■			
	1.2.3	Work with car club operators to address some the barriers to greater levels of uptake, e.g. dependence on a back-to-base model					■	■		■				■		
	1.2.4	Work with car club operators to improve information (including in-vehicle information) on using electric car club vehicles							■					■		
	1.2.5	Agree a minimum percentage of electric car clubs across the region that must be introduced when procuring a new service provider.			■					■	■					
	1.2.6	Ensure that there is the inclusion of an electric car sharing vehicle at the site of any significant charging infrastructure, i.e. there is an electric car club vehicle at every charging hub.								■	■		■			
	1.2.7	Promote the inclusion of EVs and electric mobility services as part of Mobility as a Service initiatives in the region												■		
	1.3.1	Develop a shared procurement strategy to try and drive down the overall costs of vehicles									■			■		
	1.3.2	Deliver a forum for the public authority fleets to share data and learning from EV deployment to accelerate the transition and identify barriers to adoption.									■					
	1.3.3	Set up the region as a recognised testing ground for new vehicles with the mix of urban and rural settings being ideal to prove technology									■					
	1.4.1	Identify current best practice across the region and share with other authorities to again give consistent and progressive approach.									■					
	1.4.2	Consider a regional set of conditions to the vehicle rules to try and encourage the switch to electric vehicles			■						■					
	1.4.3	Deliver a consistent approach to the procurement of local services from the authorities which encourages the use of electric vehicles to deliver the tendered services.			■						■					
	1.5.1	Introduce a scheme to directly support local businesses to help them understand and consider the benefits of driving an electric vehicle.			■						■					
	1.6.1	Undertake a pilot of plug-in electric refuse collection vehicles within an urban area (Dundee)								■	■					
	1.6.2	Ensure activity taken to support EV adoption in the region complements and integrates with a Regional Framework for the Development of Hydrogen Refueling Infrastructure	■													
	1.6.3	Support the development of showcase project for utilising hydrogen infrastructure on a multi-use basis a key development sites within the region, such as the Michelin Scotland Innovation Parc and the Perth West Eco Innovation Park	■													
	1.7.1	Collectively learn lessons from Xplore Dundee's electric bus pilot as well as international best practice.					■	■			■					
	1.7.2	Explore potential use cases for electric buses (e.g. as part of a Park & Ride service) and the potential for pilot projects in the region.			■						■					
	1.7.3	Define and produce a clear direction of development for the region in relation to future zero emission buses									■					
	1.7.4	Create an opportunity to share best practice concerning electrification across bus operators regionally and ensure a consisitent approach to local discussions.									■					
	1.7.5	Share learnings from JIVE2 project to date and engage with Aberdeen City Council to understand challenges and opportunities arising from their work in this area.									■					

Table 4: Mapping actions to objectives: Developing Infrastructure

			Economy					People and Place					Holistic & Integrated				
			1. To establish a financially sustainable public charging network, scalable to growth in demand and flexible to changes in type of demand	2. To attract private sector investment in charging infrastructure and manage a smooth transition from public management of infrastructure	3. To achieve a notable increase in economic activity in the region directly attributable to electric mobility	4. To be an internationally recognised e-tourism destination	5. To ensure that electric mobility services are equitably accessible across urban, sub-urban and rural geographies in the region, and those with and without access to off-street parking	6. To ensure that electric mobility services are equitably accessible across the full range of demographic groups and income levels present in the region	7. To ensure the citizens and businesses of the region are engaged and appropriately educated in regard to the benefits and use of electric mobility	8. To support public health outcomes through improving air quality in the region	9. To support the uptake of EVs across all vehicle types and uses – from private cars to buses	10. To ensure EVs are supported by – and contribute to a resilient and decarbonised energy network	11. To normalise the provision of EV infrastructure and electric mobility services within new or developed property	12. To support the convenient and reliable journey planning, booking, payment and access of shared and public electric mobility services as part of multimodal journeys in the region	13. To direct the development of connectivity and automation of EVs in the region towards the aims of a smart, integrated, low carbon mobility system
Developing Infrastructure	2.1.1	Develop an infrastructure roadmap to 2032 consisting of a set of key targets and milestones for regional wide infrastructure delivery.			■											
	2.1.2	Assess the feasibility of future delivery models available to local authorities.			■											
	2.2.1	Create a tool kit for use by the local authorities that gives guidance on best practice for where infrastructure should be situated				■	■									
	2.2.2	Develop a checklist to assess and support the site selection process as well as the choice of infrastructure				■	■									
	2.2.3	Adopt a standardised approach to utilise all available data to create an evidence base for best practice infrastructure provision		■												
	2.2.4	Develop a GIS based map of the EV infrastructure in the region that includes future proposed additions to allow for a comprehensive overview of all the chargers in the region.					■	■								
	2.3.1	Create a toolkit to ensure that all the future developments of charging hubs have fully considered how this integrates with the current public transport and active travel provision.													■	
	2.3.2	Engage with local communities when identifying where to place charging infrastructure.							■							
	2.3.3	Formulate a regional off the shelf “shopping list” for the development of charging hubs in the region, allowing for quick and easy pricing of projects at development stage.	■	■												
	2.4.1	Introduce the on-street charging toolkit to include feeder pillar design and support large scale adoption					■	■								
	2.4.2	Develop a region wide approach to supporting the trials of new technologies in this area and a formal process for sharing the learning with all other partners.									■	■				
	2.4.3	Develop a region wide framework for the use of council owned car parks to support EV adoption	■											■		
	2.4.4	Engage in a project to identify the most suitable places to introduce on-street charging infrastructure		■												
	2.5.1	Develop a guidance document for local authorities to deploy when faced with any new housing developments											■			
	2.5.2	Develop a business case for local authorities for the inclusion of electric vehicle charging and associated renewable technology with any new developments											■			
	2.6.1	Engage with industry to identify and attract large scale trials of technologies such as V2G and V2X in the region										■				
	2.6.2	Develop a regional strategy to link these new technologies to energy production within the region and how this may support community Energy Projects										■				
	2.6.3	Develop a roadmap for the region to ensure that it has the infrastructure in place to support the deployment of CAVs and to ensure the correct strategic decisions are taken when rolling out new infrastructure projects in the region.														■
	2.6.4	Identify a number of specific projects in the Tactran area that would be suitable to support CAV’s deployment and market the area as a test bed.														■

Table 5: Mapping actions to objectives: Promoting Electric Mobility

			Economy				People and Place				Holistic & Integrated				
			1. To establish a financially sustainable public charging network, scalable to growth in demand and flexible to changes in type of demand	2. To attract private sector investment in charging infrastructure and manage a smooth transition from public management of infrastructure	3. To achieve a notable increase in economic activity in the region directly attributable to electric mobility	4. To be an internationally recognised e-tourism destination	5. To ensure that electric mobility services are equitably accessible across urban, sub-urban and rural geographies in the region, and those with and without access to off-street parking	6. To ensure that electric mobility services are equitably accessible across the full range of demographic groups and income levels present in the region	7. To ensure the citizens and businesses of the region are engaged and appropriately educated in regard to the benefits and use of electric mobility	8. To support public health outcomes through improving air quality in the region	9. To support the uptake of EVs across all vehicle types and uses – from private cars to buses	10. To ensure EVs are supported by – and contribute to a resilient and decarbonised energy network	11. To normalise the provision of EV infrastructure and electric mobility services within new or developed property	12. To support the convenient and reliable journey planning, booking, payment and access of shared and public electric mobility services as part of multimodal journeys in the region	13. To direct the development of connectivity and automation of EVs in the region towards the aims of a smart, integrated, low carbon mobility system
Promoting electro Mobility	3.1.1	Develop a region wide communication strategy							■						
	3.1.2	Identify the appropriate body to deliver the communication strategy and to fully integrate with Transport Scotland's engagement strategy as well as other back office providers engagement strategies.							■						
	3.1.3	Create and maintain a list of the key benefits and incentives available across the region to support the uptake of electric vehicles.							■						
	3.1.4	Fully integrate any communication strategy with existing promotional activities in the region, such as the Electric A9.							■						
	3.1.5	Develop a promotional strategy for e-tourism in the region				■									
	3.2.1	Develop the tools and resources to deliver a programme of support to all the primary and secondary schools in the region.							■						
	3.2.2	Deliver a region wide programme to install charging infrastructure at all educational premises	■												
	3.3.1	Fully integrate a scheme to directly support local businesses to help them understand and consider the benefits of driving an electric vehicle with the "Travel Know How" scheme.							■		■				
	3.3.2	Undertake a feasibility study into the creation of a region wide vehicle sharing system												■	
	3.3.3	Build a network of champions from across the business community to promote the benefits of fleet electrification.							■						
	3.4.1	Provide new and used car dealers with the knowledge, information and resources on the local benefits of transitioning to electric vehicles							■		■				
	3.4.2	Understand the changing nature of vehicle purchasing and ownership in the longer term									■				
	3.5.1	Consider agreeing a Memorandum of Understanding across all appropriate organisation in the region and nationally to commit to promoting the region as an international exemplar region in the deployment and promotion of electric vehicles.				■			■		■				
	3.5.2	Identify the requirements to formally create an exemplar region and create a road map with detailed action plan to support the delivery of this ambition.			■				■		■				
	3.5.3	Deliver a programme of events and productions to support the status as an international exemplar in the Tactran region.							■						

7.Delivery Mechanisms

Effective implementation of this strategy requires three main elements:

- A team consisting of key individuals from across the Tactran region with ownership for implementing the strategy and Delivery Programme. The prospect of a Regional EV Forum is discussed in below.
- A clear programme of activity for implementing the actions described above. Following the approval of this strategy, a detailed Delivery Programme will be prepared. This will determine ownership, timescales and approach for the delivering the agreed actions.
- Funding to implement the Delivery Programme in a timely and meaningful way. To date the majority of the funding that has supported the uptake of electric vehicles has been applied for by each local authority individually, however this strategy identifies the need for a much broader regional approach. Opportunities for funding are also discussed below.

7.1 Regional EV Forum

Effective implementation of this strategy will strengthen the region's collective progress in delivering EV growth, by building on the excellent work already being undertaken by partners and maximising the benefits across the region. To do this it is important that clear ownership of this strategy and the detailed Delivery Programme to follow is established. This will ensure not only that the actions are delivered but also that the programme is maintained as a live document that reflects any future changes to policy, funding and keeps up with changes in technologies in this area.

A short term well-structured and focused group has been created in delivering this strategy consisting of key individuals from across the four local authorities and Tactran. It is proposed that the group brought together to support the delivery of this strategy is formed together to form the basis of an official Regional EV forum. This group would take full ownership of the actions detailed in this strategy, and subsequent Delivery Programme, and ensure that the region meets the vision and objectives detailed in the strategy.

This group will also be required to ensure that any work undertaken by each individual authority is shared across the region to encourage the continued use of best practice. and give a vehicle for the collaboration of the local authorities on funding bids both nationally and internationally.

This strategy has identified a number of actions and funding opportunities that can be taken forward by all parties in the near future to achieve the significant objectives. It has also identified that there are a number of key long-term decisions to be taken by the region to ensure that they support the regional and national targets for 2032. The creation of a Regional EV forum will ensure that the 4 local authorities already have a structure in place that can support these strategic decisions around future management

7.2 Funding Opportunities

As detailed throughout this strategy document, there are a number of current projects taking place across the Tactran region that will significantly enhance the regions reputation in this area. With the key ones being the two Switched on Towns and Cities projects in Stirling and Dundee as well as the three Low Carbon Travel and Transport projects underway in Dundee, Angus and Perth. These significant funding opportunities enhance the annual support that local authorities in the region receive from Transport Scotland in the form of Switched on Fleets funding and Local Authority Infrastructure Funding.

This strategy has identified a number of actions that could be taken forward in relation to the 3 key elements of the strategy: supporting vehicle uptake, developing infrastructure and promoting electric mobility. It is proposed that the local authorities develop a number of projects that can be formed into bid submissions to some of the upcoming funding opportunities available.

- **LCTT Round 3** – Public, community and third sector organisations can apply for funding under the European Regional Development Fund 2014-2020 Programme to facilitate the delivery of active travel and low carbon transport hubs for projects over £250,000. A possible bid to this fund administered by Energy Savings Trust for Transport Scotland could be around supporting e-tourism in rural areas that also provide benefits to local communities around the transition to e-mobility and active travel. Match funding is required for this funding opportunity.
- **Switched on Towns & Cities 2** – The Challenge Fund aims to facilitate a step change in the uptake of plug-in EVs in Scotland's towns and cities. Its objective is to support intensive, high impact capital activity in order to incentivise, encourage and promote the use of plug-in EVs. This fund is administered directly by Transport Scotland. A regional bid could focus on a number of the key actions identified in the strategy to support the three key areas of focus identified, these could be packaged together to make a programme that will make a significant regional impact and build on the work to date.
- **OLEV On-Street Residential Chargepoint Scheme**[18] On Street Charging Fund - Local authorities can apply for funding to help with the costs of procurement and installation of on-street charging posts for residential use. This fund can either be used to support other opportunities or it can be used to enhance any projects that are currently being undertaken in relation to on-street charging solutions across the region.
- **Ad hoc funding opportunities i.e Innovate UK**. The strategy and action plan will ensure that the region has a ready-made pipeline of projects that are waiting for appropriate funding opportunities. This approach has proved extremely successful in securing significant last-minute funding as well as helping with early identification of appropriate matches of projects to funding opportunities.

[18] The UK government has recently added another £2.5 million to this fund– https://www.zap-map.com/funding-boost-for-on-street-residential-ev-charging/

Appendix 1 – Glossary of terms

Abbreviation	Description
AFI	Alternative Fuels Infrastructure
CAV	Connected and Autonomous Vehicle
CPS	ChargePlace Scotland
DfT	Department for Transport
EV	Electric Vehicle
EVAS	Electric Vehicle Association Scotland
EVHS	Electric Vehicle Homecharge Scheme
FQP	Freight Quality Partnership
HGV	Heavy Goods Vehicle
ICEV	Internal Combustion Engine Vehicle
JIVE	Joint Initiative for hydrogen Vehicles across Europe
LCTT	Low Carbon Travel and Transport
MaaS	Mobility as a Service
MILL	Mobility Innovation Living Lab
NAEI	National Atmospheric Emissions Inventory
NEV	New Energy Vehicle
OLEV	Office for Low Emission Vehicles
RTS	Regional Transport Strategy
SMMT	Society of Motor Manufacturers and Traders
SOTC	Switched On Towns and Cities
V2G	Vehicle-to-grid
V2X	Vehicle-to-everything

Flour Mill,
34 Commercial Street,
Dundee,
DD1 3EJ
Scotland

E: info@urbanforesight.org

T: +44 1382 549 946

W: http://urbanforesight.org

Registered in England & Wales No. 07705420

VAT No. 179 2207 93