Urban Foresight

HI TRANS
THE HIGHLANDS AND ISLANDS TRANSPORT PARTNERSHIP

# HITRANS ELECTRIC VEHICLE STRATEGY

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# EXECUTIVE SUMMARY

The strategy sets out a vision that the HITRANS region will be at the forefront of achieving national commitments for low emission transport, delivering social, economic and environmental benefits to communities across the region. It will become an exemplar for how a transition to a low carbon transport system can be achieved in rural communities.

The region has already made good progress towards this vision. The early use of electric buses, hybrid ferries and electric car club vehicles has demonstrated how low emission transport can provide valuable solutions for both residents and visitors to the region. However, to realise the vision will require a bold transformation that reflects the diverse range of social, economic and geographical factors that exist across the region.

This strategy draws upon consultation with a wide range of regional stakeholders to identify the key challenges facing the region and the opportunities that exist to further increase the adoption of electric vehicles. A series of actions have been identified across four key themes that are essential components to achieving the transformation to a low carbon transport system. These themes and actions are summarised on the right.

| Theme | Actions |
|---|---|
| **Regional Planning** | • Increase Levels of EVs in Public Sector Fleets |
| | • Increase the Resilience of the Rural Rapid Charging Network |
| | • Provide Rapid EV Charging Clusters |
| | • Targeted Expansion of the Strategic Rapid Charging Network |
| | • Capture the Costs of Regional Maintenance and Operation of Charging Infrastructure |
| | • Create a Co-ordinated and Open Data EV Charging Infrastructure Platform |
| | • Continue to Develop Regional Maintenance Skills |
| | • Introduce a Framework for Payment Mechanism for Charging within the Region |
| | • Introduce Developer Requirements to Provide Charging Infrastructure |
| | • Develop and Publish Regional Best Practice in EV Mobility |
| | • Maximise Existing Communication, Education and Outreach Channels |
| | • Subsidise EV Accreditation for Mechanics |
| | • Explore the Potential for Early Use of Electric Aircraft in the Region |
| | • Establish a Regional EV Stakeholder Group |
| | |
| **Modal Integration** | • Continue to Invest in EV Charging Facilities at Regional Airports |
| | • Support Car Club Vehicles at Regional Entry Points |
| | • Support the Establishment of Community Car Clubs |
| | • Make it Easy to Book EV Connections to / from Regional Entry Points |
| | • Work with Taxi Operators to Introduce Electric Taxis in Inverness and Other Key Regional Centres |
| | • Work with Bus Operators to Identify Routes Appropriate for Electric Buses |
| | • Develop Regional Mobility as a Service (MaaS) App |
| | • Engage with Regional Freight Organisations |
| | • Invest in eBike Charging Facilities |
| | • Work with Ferry Operators to Provide Appropriate Charging Infrastructure |
| | |
| **Tourism** | • Work with Visit Scotland to Develop a Zero Emission Tourism Offering |
| | • Work with Ferry Operators to Increase EV Use and Reduce Pressures on Transport Network |
| | • Work with Small businesses, Hoteliers and Tourist Sites to Encourage Provision of EV Infrastructure |
| | • Encourage Investment in Smart Tourism Offering |
| | |
| **Renewable Energy** | • Investigate Off-Grid and Battery Backed Charging Solutions |
| | • Trial Smart Charging |
| | • Coordinate Planning of the Electricity Network |
| | • Engage SSE Early in Planning Charging Infrastructure |

# CONTENTS

# 1. INTRODUCTION

This strategy and action plan establishes a vision for increasing the use of battery electric and plug-in hybrid vehicles (EVs) within the HITRANS Highlands and Islands Transport Partnership region. It highlights the key challenges facing the region and identifies a series of measures that can help bring about widespread uptake of EVs.

The HITRANS EV Strategy will form an important component to the overarching Regional Transport Strategy which will underpin the development of the transport network in the region over the next 10 years.

The strategy starts by establishing a statement of ambition for the region, articulating the value that increasing levels of use can bring, and highlighting what role the partnership can play in demonstrating global leadership in the use of EVs in rural areas The strategy also considers the current patterns of use of EVs within the region, while examining other key facets of transport use and regional behaviours that will need to be considered when identifying appropriate interventions.

Four key themes have been identified that will underpin increasing use of EVs in the region. Under each of these themes a series of relevant actions has been identified that will deliver positive change and increase uptake of EVs. Potential sources of funding that may support the delivery of these actions have also been highlighted. It is expected that these actions will be considered by the local authorities in the region with the most appropriate actions to those organisations adopted.

The final chapter presents a prioritised list of actions that can be undertaken by HITRANS to best support the local authorities in increasing use of EVs across the region.

# 2. AMBITION

The following statement articulates the ultimate aim for the HITRANS EV Strategy. It builds on the commitments made in the Regional Transport Strategy and acknowledges the region's responsibility to contribute to Scottish Government targets to decarbonise road transport by 2050.

Electric vehicle uptake will be accelerated by a strategic regional approach to infrastructure and incentives. This will enable a lower emission transport system that is more cost effective, accessible and connected, and supports sustainable economic growth.

By deploying a comprehensive package of support across a range of different types of vehicles and applications, the Highlands and Islands will become an exemplar of how this transformation can be achieved in rural communities. It will be at the forefront of achieving national commitments for low emission transport and this leadership will deliver social, economic and environmental benefits to communities across the region.

The above ambition will be realised by the achievement of a number of key regional objectives. The following sections explain these objectives and articulates what success will look like in the HITRANS region.

## 2.1 OBJECTIVE 1: REMOVING BARRIERS TO LOW EMISSION TRANSPORT

In September 2017, the First Minister set out an ambition to phase out the need for new petrol and diesel cars and vans in Scotland by 2032. This aim is linked to Scotland's world leading climate change commitments and recognises that transport is responsible for 28% of greenhouse gas emissions, with road transport contributing 73% of all those emissions[1].

The HITRANS region is one of the most challenging areas in which to provide a connected and accessible transport system. Despite only serving 9% of Scotland's resident population, the HITRANS region covers an area of around 50% of Scotland's land mass and contains over 70 inhabited islands. There is a reliance on air services and ferries to connect the most remote parts of the region and an extensive road network that makes up 60% of all Scotland's roads.

With a high number of dispersed smaller communities, providing public transport services is challenging. As a result, there is an increased reliance on private cars to move around the region and to access employment and services. Vehicle ownership in the HITRANS region is 18% higher[2], and average distances travelled by road are estimated to be around 20% higher than the Scottish average[3].

Achieving the transformation to lower emission transport requires that people and organisations in the region have the opportunity to choose low emission transport. It requires infrastructure that enables drivers to achieve the journeys that they wish to make. It demands incentives that encourage the use of low emission vehicles and it needs concerted efforts to phase out fossil fuelled transport. Underpinning all of this are communication activities, which raise awareness of the opportunities to choose low emission transport and explain the imperatives for rapidly moving away from fossil fuels.

## 2.2 OBJECTIVE 2: A BETTER CONNECTED REGION

Investing in EVs provides an opportunity to enhance the connectivity of people to each other and remove barriers to accessing employment, education, leisure activities and essential services.

The low population densities in the region mean that private car use will remain a necessary mode of transport for many people and businesses. These individuals should be given the opportunity to make these journeys in EVs alongside continued work to enable more journeys to be achievable by public transport and active modes.

1 Draft Climate Change Plan, Scottish Government, Jan 2017

2 Vehicle Licensing Statistics 2016, GOV.UK, April 2017

3 Analysis of Traffic by local authority, GOV.UK, April 2017

Investment in low emission transport also offers an opportunity to improve the quality and accessibility of public and shared transport. New investments in buses, ferries, taxis and car club vehicles should mandate upgrades to low emission solutions.

Integration between different transport modes is also an overarching aim. With a complex multi-modal network, consideration needs to be given to how charging infrastructure and low carbon public and shared systems are provided to maximise access and enable convenient connected journeys across the region.

## 2.3 OBJECTIVE 3: SUPPORTING SUSTAINABLE ECONOMIC GROWTH

EVs have the potential to deliver a range of economic benefits. These include lower running costs, increased efficiency in the management and use of energy, and broader health benefits achieved through lower vehicle emissions.

EVs are around a fifth of the cost of an internal combustion engine (ICE) vehicle to operate[4], and with less moving parts, maintenance costs are typically 35% lower[5]. They provide an opportunity to develop a more cost-effective transport system that supports a vibrant economy and results in a more equitable region.

The low operation and maintenance costs of EVs are likely to be more significant in some of the more remote and rural regions. Low volumes of sales and high transportation costs for fuels can mean petrol and diesel prices are significantly higher than in more urban areas of Scotland and the wider UK[6]. Furthermore, fuel poverty, where a household is required to spend more than 10% of its disposable income on fuel, is a significant issue in the region. Eilean Siar, Highland and Orkney Islands have fuel poverty rates of over 50% compared to the Scottish average of 35%[7].

While there is only one air quality management area in the HITRANS region[8], there is increasing evidence that exposure to emissions from diesel and petrol vehicles can have a significant impact on health and wellbeing. Recent work by Edinburgh University has shown that even low-level exposure to vehicle fumes can have an impact on cardiovascular health and function[9], with fine particles remaining in the blood stream for up to 3 months after exposure[10].

EVs also have an important role in supporting growth in the region's renewables sector. Smart charging of EVs provides an important opportunity to more intelligently manage the abundant renewable energy generation capacity in the region and to realise further economic opportunities in this important sector.

A further motivation for accelerating the uptake of low emission vehicles is that the economy of the Highlands and Islands is strongly reliant on the natural environment. This is especially the case with tourism, which is contributes over £1.2bn to the economy each year[11].

4 Energy Saving Trust website, accessed 18th October 2017
5 Total Cost of Ownership of an Electric Car, plugincars.com, Nov 2016
6 August 2017 fuel price review, PetrolPrices.com, 6th September 2017
7 SPICe, 18th Feb 2016, SPICe, 18th Feb 2016
8 Air Quality Management Area declared in Inverness, Air Quality News, 3rd September 2014
9 Toxic diesel particles penetrate right through to the heart, scientists warn, The Telegraph, 26th April 2017
10 How do diesel exhaust particles damage your heart and blood vessels, Dr. Mark Miller, University of Edinburgh, Edinburgh Napier Electric Vehicle Event, 11th October 2017
11 Tourism Scotland 2020, 2017 Yearly Review, Scottish Tourism Alliance, 2017

# 3. ADVANCING ELECTRIC VEHICLES

This chapter provides an overview of the use of EVs and the development of charging infrastructure in the region. It also provides a brief summary of key trends impacting EVs and EV charging infrastructure.

## 3.1 PROGRESS TO DATE

### 3.1.1 General EV Usage

By the end of Q2 2017, the HITRANS region had 422 registered plug-in cars, vans and quadricycles, a figure of around 0.9 vehicles per thousand inhabitants. This is slightly behind the Scottish average of 1.0. The level of ownership by local authority is presented in Table 1.

Table 1 - Number of plug-in cars, vans and quadricycles registered across the HITRANS region[12]

| Local Authority District | 2017 Q2: No. of Plug-in cars, vans and quadricycles | Per thousand inhabitants (2015) | Percentage increase in No. of plug-in cars, vans and quadricycles from 2016 Q2 | 2017 Q2: Percentage of Total Vehicles Registered in Scotland |
|---|---|---|---|---|
| Argyll and Bute | 72 | 0.82 | 50% (48) | 1.29% |
| Na h-Eileanan Siar | 20 | 0.74 | 43% (14) | 0.36% |
| Highland Council | 148 | 0.63 | 57% (94) | 2.65% |
| Moray Council | 46 | 0.48 | 64% (28) | 0.82% |
| Orkney Islands | 136 | 6.3 | 51% (85) | 2.43% |
| **Total** | **422** | **0.91** | **57% (269)** | **7.54%** |
| Scotland | **5,595** | **1.03** | **55% (1985)** | **100%** |
| UK | **105,763** | **1.62** | **36% (37,958)** | **n.a.** |

The Orkney Islands has one of the highest levels of EV ownership per head of population in the UK, with 136 registered vehicles. The example below highlights that a number of factors have contributed to this, including a high level of local community involvement. Orkney

12 Vehicle Licensing Statistics: April to June 2017, Department for Transport (2017)

## EV ADOPTION

The Orkney Islands have one of the highest levels of EV adoption in the UK. Discussion with regional stakeholders has highlighted a number of factors that have contributed to this success, this includes:

- The limited island road network means most daily trips for residents are short. Travel distances were well within the range of that offered by early EVs.
- There is a high level of domestic energy generation using renewable sources. With limited opportunities to sell energy back to the grid, making use of excess domestic energy generation to charge EVs dramatically reduced already low operating costs. This is perhaps more significant given petrol prices on the islands can be higher than those on the mainland.
- Passionate local advocates for EV technology raised local awareness and knowledge of EVs and their potential benefits to users. Through a range of different community events and by providing ongoing advice and support they helped break down false perceptions and generate interest in the technology.
- A local second hand car dealer helped provide EVs at a lower price point for the local community, sourcing used vehicles from the mainland.
- A local garage owner sought out training and accreditation in the maintenance of EVs. This provided confidence to locals that vehicles could be maintained in a convenient and cost effective manner.
- Orkney Council provided early investment in public charging infrastructure.

Growth in EVs registered in the HITRANS region has been steady, with registered numbers in 2017 representing a 57% increase over the same period in the preceding year. This is a similar picture to Scotland, where a 55% increase was seen. A graph of the ULEV registration growth across the Highlands and Islands is shown in Figure 1.

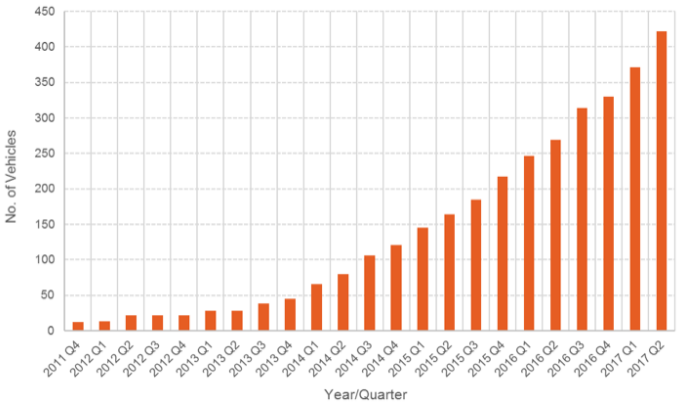



Figure 1 – Growth in Ultra Low Emission Vehicle (ULEV) registrations within the Highlands and Islands

### 3.1.2 Cars and Vans

The rural nature of the region means that private car use is a necessary mode of transport for many people and businesses. This is seen in vehicle usage data which shows typical distances that are travelled by road in the region are around 20% higher than the national average.

While the majority of the EVs registered in the HITRANS region are cars and vans, the limited range of vehicles continues to be viewed as a barrier to adoption. However, with a number of new vehicles entering the market able to achieve longer distances between charges, this is likely to less of a barrier in the near future.

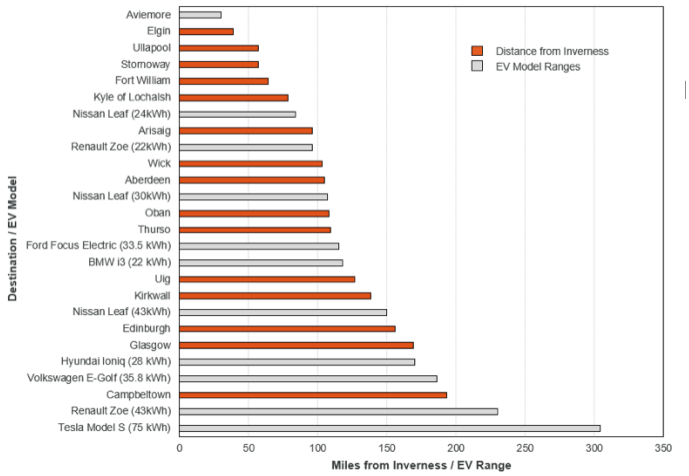



Figure 2 – Driving distances between Inverness and other regional destinations alongside real world ranges of common battery electric vehicle (BEV) models

### 3.1.3 Bus Services

The HITRANS region was the first in Scotland to deploy fully electric buses, with Stagecoach Highlands introducing electric buses in Inverness to service their routes 7 and 9 which link the city centre to the outer edges of Inverness[13]. The initiative which was funded by HITRANS, The Highland Council and Stagecoach also includes a dedicated rapid charging unit at Inverness bus station to allow the buses to be recharged during layover periods between timetabled end and start times.

An electric bus also operates in Orkney between Kirkwall and Kirkwall Airport[14]. A rapid charging unit has been installed at Kirkwall bus station to maximise the use of the electric bus.

Moray Council and HITRANS have recently secured funding from the Scottish Government Green Bus Fund and the European Union Interreg North Sea Region programme. The work will see an electric bus deployed in the region.

### 3.1.4 Taxis

There are no known electric taxis in the HITRANS region. Discussions with taxi operators highlighted that a lack of access to rapid charging infrastructure in towns, and concerns over reliability of access to charging infrastructure along major routes, are strong barriers to adoption.

HITRANS, as part of the SPARA 2020 (Smart Peripheral and Remote Airports) is working with HIAL to install rapid charging units at Inverness Airport with the intention of enabling local taxi firms to feasibly add EVs to their fleets.

### 3.1.5 Freight and Delivery

The region's geography, and the limitations of other modes of transport, make heavy goods vehicles (HGVs) crucially important in the distribution and delivery of goods[15]. There are opportunities to develop EVs amongst heavy goods vehicles, as models are beginning to emerge on the market, such as Tesla's Semi-truck[16], currently available for UK pre-order. With a high level of jobs in the region linked to forestry, food and drink, and manufacturing, freight is also essential to the economy and these industries can reduce their costs and environmental impact with adoption of EV HGVs.

Though there are examples of smaller businesses (including plumbing and engineering companies) using EVs for deliveries and operations, there are few companies using EVs for distribution and delivery of goods and no large haulage companies with EV fleets in the region. Discussions with the Road Haulage Association identified that a challenging market for hauliers, high purchase price of vehicles and a lack of incentives targeted towards the industry is limiting EV adoption.

### 3.1.6 Car Clubs

Within the HITRANS area there are two commercial operators of car club vehicles, E-Car and Enterprise, and a further four community run car clubs in Rothesay, Findhorn & Forres, Rousay and Mallaig.

The majority of commercial car club vehicles are located in Inverness, with E-Car Club and Enterprise providing a combined 13 vehicles within the town as shown in Figure 3. Both organisations highlight that there is a strong uptake of vehicles both by local residents and visitors to the region, particularly those arriving by rail. Usage levels of vehicles is typically higher than that experienced in the rest of the UK with hiring durations in Inverness averaging around 8 hours, compared to an average UK figure of around 4 hours.

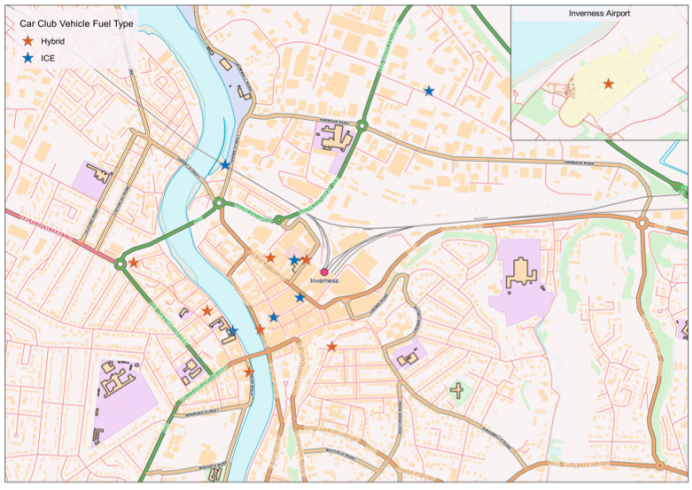
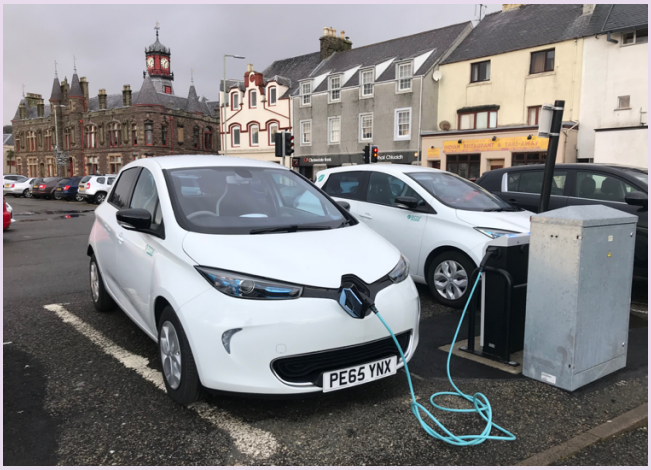



Figure 3 - Inverness Car club vehicle locations and their fuel type (E-Car and Enterprise)

13 Inverness Goes Green with First Fully Electric Buses in Scotland, HITRANS, 2015
14 Step aboard Orkney's first electric bus Orkney Islands Council, 2015
15 Significant volumes of high value exports rely on these vehicles, acting as well as the equivalent of a pipeline as gas is supplied to places like Wick, Oban and Campbeltown by road. Source: HITRANS 2014/15 Annual Report.
16 Tesla (2018) Tesla Semi

E-Car Club also has 10 EVs in Lewis and Harris, centred on Stornoway. They have worked with the local community on the island to identify the opportunities and benefits that car club vehicles may present, seeking to identify locations that are accessible to both residents and visitors to the region (see example below).

## E-CAR CLUB: ISLE OF LEWIS AND HARRIS




E-Car Club has recently deployed 10 EVs in Stornoway, situated on the Isle of Lewis and Harris. The island is well placed to take advantage of EVs. It has a number of charging points in local centres, is expected to generate surplus energy from renewable sources and has a limited road network with relatively short distances between destinations.

Initial deployment of vehicles has focussed on the island's airport and ferry terminals, seeking to capture users travelling to the islands. To increase levels of use, E-Car have been working with the island's community to raise potential benefits and interest. They have found after discussion there is increasing uptake by the community and they are currently looking at deploying vehicles in and around the island's community centres.

All car club vehicles provided by Enterprise in the region are internal combustion engine or hybrid vehicles, with the car club operators suggesting that this allows their customers greater flexibility and reduces concerns over the availability of recharging infrastructure.

All of E-Car Club's fleet in the region are hybrid or EVs. They are seeking to expand their EV car club fleet where possible and have been working with local authorities to ensure they are located near appropriate charging infrastructure. E-Car Club are also involved in the deployment of electric car club vehicles at regional airports as part of the SPARA 2020 project.

The Findhorn & Forres community car club (Moray Carshare) makes use of two Nissan Leaf EVs which are well used. Stakeholders have highlighted that the car club operators have helped make the scheme highly successful through strong community engagement.

### 3.1.7 eBikes

There are a number of private sector organisations in the HITRANS region that provide rental of e-bikes to customers.

Moray Carshare also provide an electric bike for club members to rent alongside their current range of cars. In addition, HITRANS, through the SPARA project are currently looking to trial the deployment of eBikes for hire at Barra airport.

### 3.1.8 Ferry Services

Ferry operators in the region have been keen to embrace EV technology. The region has seen the deployment of first-of-their kind hybrid ferries[17] and the inclusion of charging infrastructure at a number of ferry terminals.

### 3.1.9 Rail

The ScotRail Alliance is installing one hundred 22kW charge points at 50 of their stations that will be free to use[18]. Installation began in September 2017 and all charge points are due to be operational by November 2017. Stations in HITRANS region planned for the installation of charge points are in Inverness, Elgin, Oban and Wick.

HITRANS have also identified the electrification of the Highland Main Line and Inverness to Aberdeen as a priority within the draft Regional Transport Strategy. They are also undertaking a business case study on fuel-cell and battery hybrid trains as part of the European Interreg G-PATRA project.

### 3.1.10 Aviation

In 2015, HITRANS launched the rural airports project SPARA 2020, funded by the ERDF. The project aims to decarbonise transport links to Highland and Islands Airports (HIAL), through the implementation of electric

17 Ferries approach 50% milestone, Transport Scotland, 12th December 2016
18 It's electrifying – ScotRail Alliance roll out free electric car chargers, ScotRail, 2017

buses, plug-in vehicle hires and taxis. It also considers the business case for offering jet biofuel[19] to aircraft at the region's airports[20].

### 3.1.11 Recharging Infrastructure

There are currently 109 ChargePlace Scotland active charging points in the HITRANS region[21]. Out of these, 36 are slow-standard (3kW-7kW) chargers, 24 are fast (22kW) chargers and 49 are rapid (43-50kW) chargers. The locations of these charging points are shown in Figure 4. Further information on different charger types is included in Appendix G.

The rapid charging units are the most used in the region, averaging just over one charging session per day at each unit, with an average of 9.99 kWh of energy consumed in each session. Fast and slow charging units are used on average once every two to three days with an average of just over 6 kWh of energy consumed in each session. Table 2 provides a summary of the different powered charging units and their usage. Appendix A provides a more detailed summary of charging unit use for the region.

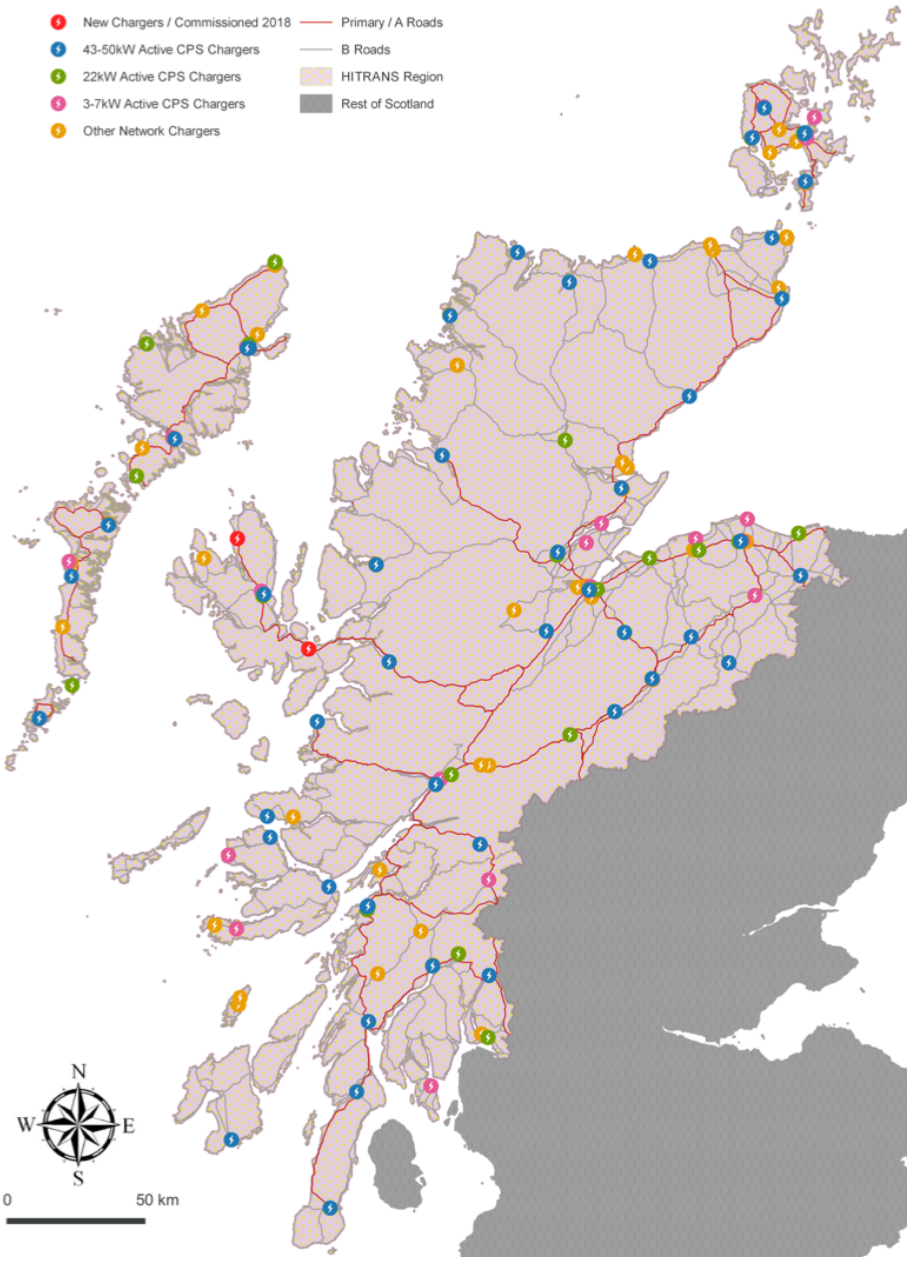



Figure 4 - HITRANS electric vehicle public charger locations by type. Analysis by Urban Foresight with data obtained from Zap-Map and ChargePlace Scotland (1st September 2017)

19 Jet biofuel is a blend between sustainable natural waste feedstock and 50% regular fossil fuel kerosene.
20 Minister launches HITRANS rural airports project, HITRANS, 2015
21 Data obtained from the National Chargepoint Registry and ChargePlace Scotland, September 2017.

Table 2 - HITRANS ChargePlace Scotland Network chargers and usage statistics by power output type[22]

| Charger Unit Type | No. of Active CPS Charger units | Total kWh (rounded) | Total No. of Sessions | Average No. of Sessions per day (rounded) | Average kWh per session (2 d.p) | Average Duration per session (hrs) (2 d.p) |
|---|---|---|---|---|---|---|
| Slow-Standard (3-7kW) | 36 | 28,072 | 4,394 | 17 | 6.39 | 8.66 |
| Fast (22kW) | 24 | 34,011 | 4,808 | 19 | 7.07 | 3 |
| Rapid (43-50kW) | 49 | 142,195 | 14,239 | 56 | 9.99 | 0.72 |
| All Units | 109 | 204,278 | 23,441 | 92 | 8.71 | 2.62 |

Table 3 summarises charging units and usage by each local authority area. As can be seen the level of usage with Orkney is significantly higher than elsewhere in the region, with an average of 1.7 sessions per day at each charging unit.

Table 3 - Charger usage statistics by local authority

| Local Authority | No. of Active Charger units | No. of 3-7 kW | No. of 22kW | No. of 43-50kW | Total kWh | Average kWh per day (kWh) | Total No. of Sessions | Average No. of Sessions per day |
|---|---|---|---|---|---|---|---|---|
| Argyll and Bute | 19 | 6 | 4 | 9 | 21,197 | 4.37 | 2,429 | 0.5 |
| Eilean Siar | 17 | 5 | 6 | 6 | 16,668 | 3.85 | 2,128 | 0.5 |
| Highland | 42 | 10 | 7 | 25 | 84,771 | 7.23 | 8,060 | 0.7 |
| Orkney Islands | 18 | 9 | 4 | 5 | 70,609 | 12.59 | 9,249 | 1.7 |
| Moray | 13 | 7 | 3 | 3 | 11,059 | 3.33 | 1,577 | 0.5 |

## 3.2 ANTICIPATING THE FUTURE

### 3.2.1 General EV Usage

With the Scottish Government ambition to phase out the need for new ICE vehicles by 2032, it is expected that sales and use of EVs will grow rapidly over the next ten years. These rates of growth also have the potential to significantly increase the electricity consumed across the regions charging infrastructure.

To indicate the scale of the change anticipated, Figure 5 provides a representation of the level of sales of different vehicle fuel types expected up to 2040. These use targets set by the Committee on Climate Change (CCC) "Pathways to High Penetration of Electric Vehicles"[23] and the Office for Low Emission Vehicles' (OLEV). These stipulate that every new car and van sold in UK by 2040 is an Ultra Low Emission Vehicle (ULEV)[24], a statement consistent with the ambition outlined in Switched-on-

22 ChargePlace Scotland usage data of active units between 1st January 2017 and 12th September 2017.

23 Pathways to high penetration of electric vehicles, The Committee on Climate Change, 2013

24 £40 million to drive green car revolution across UK cities, Office for Low Emission Vehicles, 2016

Scotland: A Roadmap for Widespread EV Adoption of Plug-in Vehicles.

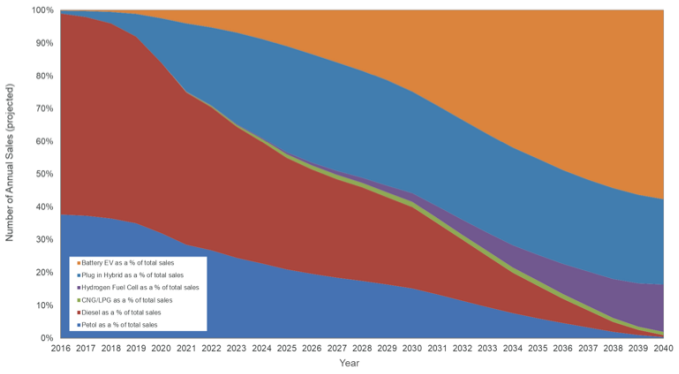



Figure 5 - Committee on Climate Change Forecast of Annual Sales of Different Fuel Types

### 3.2.2 Electric Vehicle Performance

It is expected that the trends of lower battery costs, higher energy density and faster recharging capability will continue[25]. This will continue to lower the costs of vehicles, increase ranges between charges and quicken charging speeds.

Improvements in battery technology will also continue to increase the range of electric commercial, agricultural, construction and maintenance vehicles. With BYD already producing an electric coach, John Deere releasing its first electric tractor, and a number of manufacturers offering electric street cleaning and refuse vehicles, there will be a growing ability to use EVs to deliver a wider range of services.

### 3.2.3 Charging Infrastructure

Access to charging is a key requirement for drivers of EVs. An important aspect of this is reducing the time taken to charge en-route to support longer distance trips. The EV sector is continuing to pursue faster recharge times that will increase convenience for users, particularly as larger capacity batteries become more common.

There has been large scale deployment of 50kW 'rapid' charging units across the UK, enabling most vehicles to recharge in 20-30 minutes. At present, outside of the Tesla proprietary network, these are the most powerful units that can be utilised by most modern plug-in vehicles. The next step expected in the industry is the adoption of 150kW 'ultra-rapid' charging infrastructure[26], with the first vehicles able to utilise this level of power expected to be released by manufacturers in 2018. Further increases in power are being pursued with a number of major vehicle manufacturers targeting 300kW[27] charging by the early 2020s.

However, a key challenge of accommodating higher powered charging units will be the cost of supplying electrical connection and power demands, which is already a challenging and costly exercise with 50kW powered units.

There are a number of manufacturers who believe the most viable way of providing higher powered charging units is to remove the need to connect to the electricity grid, instead seeking to use renewable energy generation and battery storage. EV manufacturer Tesla plans to remove almost all of its Supercharger network from the grid, by converting them to solar and integrated battery powered charging stations[28]. Standalone EV charging solutions, that generate their own energy or minimise the power drawn from the grid, are also currently being developed by companies such as Envision Solar, Powerstar and InnoVentum.

### 3.2.4 Smart Charging and Vehicle-to-Grid

Electrical grids need to be managed second-by-second in real time to maintain a balance between system demand and total generation. This is referred to as system frequency, whereby if demand is greater than generation, the frequency falls. While, if generation is greater than demand, the frequency rises.

Research has shown that most EV users plug in their vehicles to recharge at times that correspond to daily peak electricity demands[29], contributing additional load and placing a significant strain on the grid. Charging at peak times also potentially erodes the environmental benefits of EVs, as peak demands are often supplied with the most carbon intensive generation[30].

25 Global EV Outlook 2017, International Energy Agency, 2017
26 DBT unveils the 1st 150 kW universal ultra-fast charging station at the Paris Motor Show, DBT, September 2016
27 BMW Group, Daimler AG, Ford Motor Company and Volkswagen Group with Audi & Porsche Plan a Joint Venture for Ultra-Fast, High-Power Charging Along Major Highways in Europe, Daimler, Daimler, 19th November 2016.
28 Tesla plans to disconnect 'almost all' Superchargers from the grid and go solar + battery, says Elon Musk, Electrek, 9th June 2017
29 Analysis of electric vehicle driver recharging demand profiles and subsequent impacts on the carbon content of electric vehicle trips, A.P. Robinson et al, October 2013
30 Demand Side Response in the domestic sector – a literature review of major trials, Department of Energy and Climate Change, August 2012.

However, while vehicles are typically plugged in at peak times, this has more to do with typical trip patterns, with vehicles plugged in as a user reaches work or arrives home. Often the vehicle does not require power immediately and there are opportunities to defer power consumption to off-peak periods.

One strategy to achieve this is smart charging, whereby an active management system remotely controls EV charging to match the need of the system operators. The technology to enable Smart Charging is already available, with organisations such as Scottish Southern Energy expressing a desire to identify opportunities to utilise it in the HITRANS region.

With a significant onboard power source, EVs can also help to maintain system frequency of electrical grids by exporting energy from a vehicle's battery back to the grid. This is referred to as vehicle-to-grid (V2G) and is facilitated by advanced metering infrastructure and associated software with automated monitoring and decision-making.

While vehicles could be connected individually by V2G, it is expected that real benefits will be derived from vehicles grouped by aggregators to create larger, more manageable loads. These will act as distributed energy resources or spinning reserves (the extra capacity, that is otherwise provided by increasing the output of power plants).

V2G technology is being trialled in a number of locations around Europe with a need to further develop the technology and understand its impact on vehicle batteries and on the operation of the electricity network in greater detail.

Both of the above approaches will also assist with increasing the use of renewable sources of energy generation, with the ability to flex demands for energy to help manage fluctuations in energy generation.

### 3.2.5 eBikes

With lowering costs and the advent of more efficient motors and battery technologies electric bikes are becoming an increasingly practical transport option. Current eBikes provide power assisted pedalling for around a 30 – 150 mile range, dependent on riding style and speed. This assisted pedalling is increasing accessibility to cycling as a mode, allowing users with a wider array of fitness and abilities to cycle, and even to support users in tackling more demanding journeys and terrain.

While no definitive sales data is available in the UK, other countries in Europe have reported a sharp increase in sales of eBikes over the last few years. Germany has experienced an 11.5% rise in e-bike sales between 2014 and 2015 and the Netherlands saw a 25% rise over the same period.

With growing public awareness of eBikes and improvements in battery technology expected to continue to reduce costs and increase performance, it is expected that eBike use in the UK will grow significantly over the next 10 years[31].

31 Electric Bicycles Research Report, Navigant Research, Q2 2016

# 4. OUR APPROACH

The following chapters set out a series of actions that could be taken to increase the uptake of EVs across the HITRANS region.

These actions are grouped into four themes:

1. Regional Planning –working across local government boundaries to plan and deliver positive change for EVs;
2. Modal Integration – ensuring EVs are able to be used as part of multi-modal journeys;
3. Supporting Tourism – enabling visitors to the region to use EVs to move easily around the Highlands and Islands; and
4. Renewable Energy – exploiting the region's capabilities in renewable energy generation.

Figure 6 provides a representation as to how the actions have been grouped to achieve the overarching objectives and ambition of this strategy.

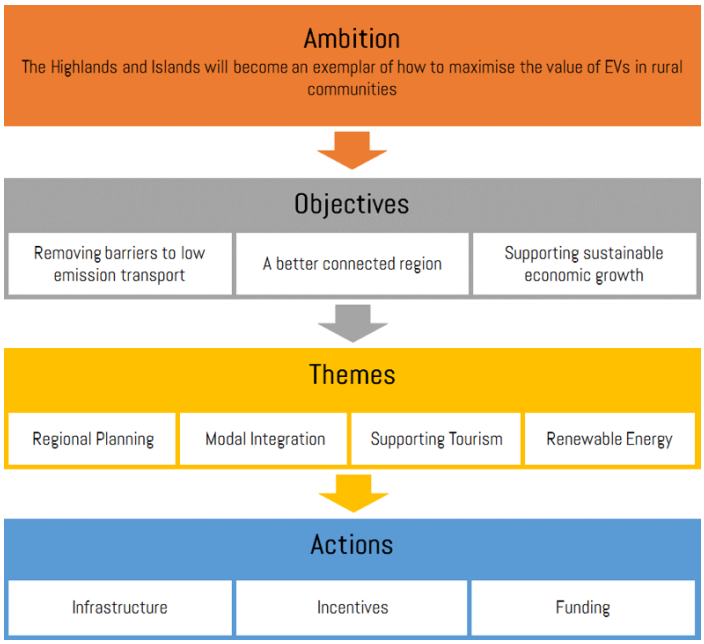



Figure 6 – Structure of HITRANS EV Strategy

Recognising the diverse range of social, economic and geographical factors that exist across the region, it is expected that the list of actions represents a menu of potential options that local authorities and other stakeholder organisations can consider and implement to suit their circumstances. The actions have been broken down into infrastructure and incentives that will be required to enable or deliver a positive change.

In addition, where appropriate, potential funding sources to deliver the action have been identified. A list of potential funding sources that may be appropriate has also been included in Appendix B. These actions have been informed by a series of discussions with a wide range of regional stakeholders. These discussions have examined some of the challenges of providing transport services within the region while exploring the potential applications and broader opportunities that EVs can present.

# 5. REGIONAL PLANNING

The HITRANS region is unique within the UK. Its general remoteness from major population centres is one of its defining features. However, it is also diverse, containing a mixture of islands, remote mainland, rural and urban areas.

Successful integration of electric vehicles into regional transport cannot be achieved in isolation but requires cooperation between all relevant stakeholders in the towns, cities and communities in the region.

The HITRANS region is made up of five local authority areas, all with distinct geographical, economic and social characteristics. However, the nature of the regions transport systems means that residents and visitors regularly travel across local government boundaries. Providing a consistent experience for EV users will help simplify their use and support widespread adoption.

The remote nature of the region also increases the cost to move goods and people. With lower operational costs, the use of EVs represents a significant opportunity to increase the competitiveness of local businesses and reduce fuel poverty in regional communities. However, this will only be achieved if the infrastructure and services that facilitate this change reflect regional transport patterns. This will require coordinated planning and operation between local authority regions.

The Scottish Government target to phase out the need for new petrol and diesel vehicles by 2032 will bring mainstream EV usage into a fairly short-term planning horizon. There is need to ensure that all new infrastructure, which will mostly have a lifespan in excess of 15 years, makes due consideration of the need to accommodate ULEVs.

The HITRANS region already has a number of examples where EVs are being used to deliver positive benefits and outcomes for residents and visitors. These examples have wider applicability to other parts of the region, and to other rural settings around the world. There is a need to improve the way in which experiences and successes are communicated and shared across the region, enabling others to realise the potential benefits that they may bring, and raising the profile of the skills and expertise that exist in the region.

The following identifies a number of actions that could be taken to improve the level of EV adoption through a Regional Planning approach

## 5.1 ACTION RP1 – INCREASE LEVELS OF EVS WITHIN PUBLIC SECTOR FLEETS

Increasing public sector use of EVs will provide visible public leadership in the uptake of EVs and help demonstrate the viability of EV usage in the region. This could be through replacing existing ICE fleet vehicles with EVs or through converting grey fleet mileage to car club vehicles.

With EVs having lower operational costs than ICEs, there is the potential to achieve cost savings. Furthermore, with the public sector being a major regional employer, increasing work related access to EVs helps users to experience the practicalities of ownership and overcome incorrect perceptions.

**Potential Funding Sources**

Transport Scotland, through the Energy Saving Trust offer a free sustainable transport review which can help highlight the measures and tools available to improve grey fleet usage.

Transport Scotland has continued to provide periodic funding opportunities to enable local authorities to buy or lease plug-in vehicles through their Switched-on-Fleets initiative.

## 5.2 ACTION RP2 – INCREASING THE RESILIENCE OF THE RURAL RAPID CHARGING NETWORK

Discussion with stakeholders across the region highlighted that, due to the increased need to undertake longer distance trips, increasing confidence in the availability of rural charging infrastructure was key to increasing the uptake of EVs in the region.

A number of factors were identified as contributing to a lack of confidence with charging units, with faults caused

by poor mobile signal, and occupied charging infrastructure the two main concerns.

At present the operation of charging units requires a communications connection, typically made via the mobile network. This presents challenges in remote parts of the region that lack coverage or have a highly variable quality of signal. In particular, the latter issue is leading to failed use of charging units, false reporting of faults and difficulties in accurate reporting of charging point availability.

Work is ongoing to address existing communication issues. Transport Scotland is investigating alternative communication systems, Orkney are examining firmware changes that allow charging without a communications signal and there are plans to further roll-out upgrades to the mobile communication network across the HITRANS region.

Working with its partners HITRANS should continue to work towards resolving communication issues on existing EV charging units in the region. Planning of new charging infrastructure should also consider the strength and variability of mobile signal at proposed site locations early in the design process. This will improve the cost and reliability of infrastructure allowing for the requirement and cost of additional communication equipment to be considered or for alternative sites to be examined.

Providing additional charging units at existing locations is also viewed as a high priority with stakeholders suggesting this is prioritised above further expansion. This would help to improve availability and convenience of charging, with less chance of arriving and having to wait for another EV to finish charging. It would also add a level of redundancy to help manage maintenance and repairs.

While providing a further rapid charging unit at existing sites would be the most convenient alternative for users, it is recognised that the cost of units and availability of power at certain locations may be prohibitive. It may be more cost effective to provide a lower powered unit that could allow users to add enough charge and make their way to the next rapid charging unit on the network.

It is suggested that roll out of further units is prioritised by considering levels of average daily energy consumption.

**Potential Funding Sources**

Transport Scotland continues to support local authorities in the roll-out of charging points and has also committed to a number of upgrades of the trunk road network (including the electrification of the A9)[32]. With most of the rapid charging locations on the strategic network, HITRANS and local partners should continue to work with Transport Scotland to identify opportunities to expand and supplement the charging network in the region.

On the 22nd January 2018, the Scottish Government announced a £60m fund to support the delivery of low carbon heating solutions, integrated energy systems and ULEV charging infrastructure. Funding of up to £100,000 will be made available for the development of business cases and financial support of 50% of the total capital value of the project can be applied for, up to the maximum of £10m per project.

On the 20th June 2018, the Scottish Government announced the Switched on Towns and Cities Challenge Fund targeted at local authorities who are well positioned to deliver the infrastructure and local incentives to support EV uptake.

Run as an annual competition, it is expected that up to 5 awards will be made through the first round of funding with eligible costs per project in the range of £1.5 million to £2.5 million with up to 100% of eligible costs may be supported by Transport Scotland funding. Extra credit will also be given to bids that can bring match-funding from non-Transport Scotland sources.

In addition, for local authorities who are not in a position to submit an application to Round 1 of the Switched on Towns and Cities Challenge Fund, Transport Scotland has made available a limited amount of funding to support up to 10 in-depth feasibility studies, each up to the value of £40K and to be delivered over the course of 2018/19.

There is increasing interest from the private sector in deploying and operating charging infrastructure. This includes major service station operators including BP, Shell, Texaco, JET and Murco who have all announced plans to roll out charging infrastructure across the UK[33].

32 Electric A9, ChargePlace Scotland, June 2018

33 Petrol Stations to Get Geniepoint Rapid EV Charge Points, Zap-map, 31st August 2017

Consideration should be given to how the private sector is engaged to explore opportunities for privately led deployment of infrastructure.

Similarly, there could be opportunities for community ownership of charging infrastructure. Potentially integrating charging infrastructure with local renewable energy generation and / or ancillary services such as restaurants and cafes. This may be an option for the A9 corridor where previous commitments have been made to encourage passing traffic to use facilities and services in adjacent local communities.

Innovate UK offer a variety of funding opportunities for the development of novel technologies or services. These are often linked to particular themes where the UK government believes there is a longer-term market for skills and product. There are opportunities for HITRANS to work with local partners and the private sector to apply for and receive funding that could assist in addressing challenges associated with EVs and charging infrastructure.

It could be beneficial to publish some of the technical challenges that HITRANS are keen to address or explore and invite proposals from private sector organisations keen to work with HITRANS to explore EU, UK and Scottish Government funding opportunities.

## 5.3 ACTION RP3 – PROVIDE RAPID EV CHARGING CLUSTERS

Providing clustered EV charging units is an efficient way of providing charging infrastructure in an area of high demand. Rather than move between individual charging unit sites, users can travel to a single location where there is a high probability of available charging equipment.

Clustered rapid charging infrastructure will further increase the convenience of charging for EV users, allowing journeys to continue after a typical 20-30 minute charge. This type of infrastructure could be particularly beneficial in supporting the use of electric taxis, serving locations of high periodic demand (e.g. close to ferry terminals or airports), providing charging opportunities at key points on the strategic road network, supporting major tourist centres or providing convenient charging infrastructure where there is a high proportion of properties with no off-street parking.

Charging clusters should be located at a site that can be easily accessed by the target user group/s expected to make use of facilities. It is also suggested that, to increase attractiveness to users, complimentary retail and services be located alongside to provide an activity commensurate with the time taken to charge.

Clustered infrastructure is scalable and at many sites it may be cost effective to provide an initial lower number of charging units, but with the capacity to expand as demand and charging power levels increase.

Given the range of situations where clusters may provide benefit, and the ability to provide a scalable solution, there is no easy mechanism to identify and prioritise sites. It is suggested that a multicriteria analysis be used to consider potential sites at a high level, with favourable sites requiring more detailed work to identify the level of infrastructure required both now and in the future. This is discussed in further detail in Appendix C.

An initial sieve of sites across the region identified Inverness as a clear priority for investment in clustered charging infrastructure, with further work to consider charging hubs suggested in Oban, Fort William and Kirkwall.

**Potential Funding Sources**

The funding sources identified for Action RP1 (section 5.1) are also applicable to the rapid charging clusters.

As use of EVs grows across the region, clustered charging infrastructure has the potential to generate revenue, not only from charging activity, but from the complementary facilities and services located alongside. Consideration should be given to how the private sector could be engaged, or how planning conditions could be adapted, to encourage privately sector involvement.

## 5.4 ACTION RP4 – TARGETED EXPANSION OF THE STRATEGIC RAPID CHARGING NETWORK

The rapid charging network is key to facilitating movements across the region. While the region's road network has reasonably well spaced rapid charging units, there are a number of gaps, where further investment would be beneficial.

To accommodate the ranges of most EVs used on roads at present, and to provide confidence to drivers moving across the network, recent work in Norway has suggested that rapid chargers be provided every 25-40 miles[34]. Given that Norway has a similar rural road network to the HITRANS region and experiences challenging weather conditions that effect vehicle range it is suggested that adopting a similar approach would be appropriate.

Using the above approach Table 4 highlights the current network gaps in the HITRANS network and identifies ideal suggested locations where additional units would be of most benefit. Sites have also been prioritised by the level of traffic likely to be passing the proposed site.[35]

A workshop with key stakeholders held on 1st November 2017 considered network gaps identifying similar locations in the network.

Table 4 – Summary of Rapid Charger Network Gaps in HITRANS Region

| Network Gap | Proposed Location | Estimated Traffic Levels (Annual Average Daily Flow) | Priority |
|---|---|---|---|
| Fort William to Oban (44 miles)<br>Glencoe Mountain Sports to Oban (46 miles) | A82 / A828 Ballachulish | c. 5000 - 7000 | High |
| Pitlochry to Kingussie (45 miles) | A9 / A889 Dalwhinnie | c. 7000 | High |
| Annat to Ullapool (67 miles)<br>Annat to Conon Bridge (49 miles) | A832 / A835 Garve | c. 4000 | Medium |
| Roybridge to Shiel Bridge (52 miles)<br>Drumnadrochit to Shiel Bridge (48 miles)<br>Drumnadrochit to Roybridge (45 miles) | A82 / A87 Invergarry and/or<br>A82 / A887 Invermoriston | c. 2000 – 4000 | Medium |
| Portree to Shiel Bridge (50 miles) | A 87 Kyle of Lochaish | c. 3000 - 5000 | Medium |
| Helmsdale to Thurso (42 miles)<br>Helmsdale to Wick (35 miles) | A9 / A99 Latheron | c. 2000 | Low |
| Scourie to Ullapool (42 miles)<br>Scourie to Lairg (44 miles) | A835 / A837 Ledmore | c. 300 | Low |
| Mallaig to Fort William (43 miles)<br>Mallaig to Kilchoan (57 miles) | A830 / A861 Lochailort | c. 1500 | Low |

34 Taking Charge – Introducing Fast Chargers in Norway, Zero Emission Resource Organisation, 2016

35 Department of Transport Traffic Counts, Department of Transport, 2016 Data

**Potential Funding Sources**
The funding sources identified for Action RP1 (section 5.1) are also applicable to the rapid charging clusters.

## 5.5 ACTION RP5 – CAPTURE THE COSTS OF REGIONAL MAINTENANCE AND OPERATION OF CHARGING INFRASTRUCTURE

There is a lack of publicly available data on the true costs of ownership and maintenance of charging infrastructure. This is partly due to the relatively recent timeframe of infrastructure deployment and the historic challenges around maintaining appropriate maintenance support for older units.

Many charging units have been installed recently and are still under manufacturer warranty, reducing the understanding of longer term maintenance and replacement costs. Manufacturers have also historically been unable to provide a suitably prompt maintenance response, with difficulties in both accessing the units and resolving faults associated with communication issues.

Work should be undertaken to build a more accurate understanding of the true costs of operation and maintenance of regional charging units. This will assist in improved decision making around investment in new infrastructure, with greater clarity on the potential financial cost incurred by asset owners, and an improved understanding of the whole of life costs of different charging units available on the market.

## 5.6 ACTION RP6 – CREATE A CO-ORDINATED AND OPEN DATA EV CHARGING INFRASTRUCTURE PLATFORM

Desk-based research, stakeholder engagement and acknowledgement from Transport Scotland have identified systemic issues surrounding the ChargePlace Scotland IT and back-office software.

A well-functioning back-office system would provide data policy makers and EV owners can trust and rely on to inform decision making.

Currently the system is inadequate, with lack of information available on charging unit faults and maintenance issues. This seriously hinders the ability of local authorities and/or charging network owners to efficiently identify faults and track repairs.

The knock-on effect is inaccurate data on charger availability, charger status, and charger electricity use, creating a lack of confidence amongst users.

As the ChargePlace Scotland network, the range of charger types, and number of EV users grows it is important that a co-ordinated back office system is established which provides live (or near-live) information to charger users, charger owners and policy makers.

Making this data open source and collecting appropriate metrics (i.e. downtime, cause and type of faults being recorded) will further add functionality, with users able to report faults and policy makers able to access data for research and analysis purposes. This will enable better promotion and communication of the Scottish EV charging network and EV usage.

This will be achieved by working closely with Transport Scotland, ChargePlace Scotland, the regional EV stakeholder group (Action RP14), local authorities and data service providers.

## 5.7 ACTION RP7 – CONTINUE TO DEVELOP REGIONAL MAINTENANCE SKILLS

The remote nature of the region presents challenges to manufacturers and suppliers in maintaining infrastructure. This has reduced the ability to quickly respond to faults, which in turn has lowered user confidence in availability of regional charging units.

To address this The Highland Council, working with charge point manufacturers, is training members of its electrical team to undertake common repairs to charging infrastructure. This approach will reduce downtime of infrastructure in the region and could be adopted elsewhere.

In the long term it is expected that demand for charging infrastructure will grow to levels where maintenance and operation of charging infrastructure will become an

attractive proposition to the private sector, reducing the need for local authority intervention.

**Potential Funding Sources**

The shorter distances of travel to attend faulty charging units mean that there are opportunities to generate revenue by providing maintenance services on behalf of manufacturers who have equipment that is under warranty.

The operator of the ChargePlace Scotland back office has highlighted that there is a lack of competition for maintenance of charging infrastructure in parts of Scotland. There may be opportunities to provide maintenance services for charging infrastructure beyond the immediate local government regions.

## 5.8 ACTION RP8 – INTRODUCE A CONSIDERED PAYMENT MECHANISM FOR CHARGING WITHIN THE REGION

With pressures on local government operational budgets and rising levels of EV use, local authorities are considering introducing fees for using public charging infrastructure in the HITRANS region.

It is recognised that free / low cost charging acts an incentive to support increased adoption of EVs. Equally, there is also a growing recognition from stakeholders in the region, including from the Electrical Vehicle Association Scotland (EVAS), that payment for use of public charging is fair and appropriate. However, the cost to charge a vehicle must remain significantly lower than to refuel a petrol or diesel equivalent in order to maintain the incentive for drivers to switch to EVs.

A stakeholder workshop on 1st November 2017 suggested that a payment structure should be established to cover operational costs of the infrastructure only. This would help to ensure those without off-street parking are not significantly disadvantaged in comparison to other EV owners. The workshop also highlighted that payment levels should be set to those incurred by users charging their vehicles at home (approximately 12-15p / kWh) to encourage home charging where possible, and to help maintain public charger availability for users without access to home charging.

In an update to local authority officers held in May 2018, Transport Scotland announced the development of forthcoming national guidance for local authorities on implementing tariffs to fund the operational costs of chargers. It is likely that this will be released in Autumn 2018 and suggest an initial tariff comprising of a £1 minimum fee and a rate of 15p / kWh. This reflects a similar tariff to that suggested by the stakeholder workshop held on 1st November. Notably, the energy consumption afforded by a minimum charge of £1 is lower than the regional average energy consumption per session of all charger types, which is 8.71 kWh (and would cost £1.30 at 15p/kWh). Therefore, a minimum charge of £1 may not encourage the average user to stay longer than they would normally require.

However, there is a concern that maintaining this fee for all charger types may discourage use of slower units and encourage use of faster units as more users may want to use faster chargers if there is no price premium attached. This may also result in longer stays at faster units, thus restricting access to other users who may need it. As the EV market grows and demand for public charging increases, it is important that there is a clear distinction been charger types so that slower chargers are most used by those drivers able to leave their vehicles for longer periods (e.g. whilst at work), and higher-powered units preserved for those who need them.

One approach to address this would be to introduce an overstay charge - an automatic payment that is made when a vehicle is connected to a charging unit but not drawing energy. Identifying ways to encourage vehicles to vacate charging bays as soon as their charging activity is complete will help to increase vehicle turnover and maximise the use of charging assets. This is particularly important for the rapid charging units as most vehicles can reach an 80% charge within 20-30 minutes. However, at present limitations in the technology of some charging units and in the back office software mean that imposing overstay charges consistently could be challenging.

Work should be undertaken with ChargePlace Scotland and the local authorities' parking infrastructure teams to consider how best to implement overstay charges. Based on analysis of other operators in the UK it is suggested that a £5 overstay charge could be levied on rapid charging units to be applied after a vehicle has been connected for more than 1 hour. Consideration should

also be given to applying overstay charges on 7kW and 22kW fast charging units after 4 hours. However, such charges must be balanced with the need to make chargers convenient to use and to minimise disruption to EV users.

Guidance from Transport Scotland is welcome and reflects suggestions from the stakeholder workshop. Given that the EV market is in its nascent stages, applying this fee (£1 minimum at a rate of 15p / kWh) across the region as an initial tariff may be appropriate, and may also help integration with a national-wide scheme. However, it is recommended that local authorities review their existing priorities for EVs and consider how this will affect their current levels of demand and policy goals. Appendix D contains some of the questions local authorities may wish to consider before imposing a tariff.

As the EV market grows and there is an increase in investment in EV chargers across the region, it is inevitable that tariffs will be required to adapt and evolve. Therefore, it is recommended that reviews with the EV stakeholder group, users and other key industry stakeholders are scheduled regularly to consider the behavioural impacts and develop tariffs appropriate for all parties.

Appendix D provides a summary of the current charging regimes within the UK and further high-level analysis and questions local authorities may wish to consider when applying a tariff within their districts.

## 5.9 ACTION RP9 – INTRODUCE DEVELOPER REQUIREMENTS TO PROVIDE CHARGING INFRASTRUCTURE

Residential, retail, commercial and industrial developments will generate vehicle trips. They will also be the locations where vehicles are parked when not in use. Considering how charging infrastructure can be incorporated into new developments is essential and represents a significant opportunity to increase the convenience of charging for occupiers/users of the development and by those that might service it.

It is suggested that HITRANS maintain an understanding of current UK best practice associated with EV provision for different development types. This can be shared with local authorities to assist them in developing suitable planning policies and guidelines.

Appendix E provides a summary of several UK local authority development guidelines / requirements that make specific reference to EV provision. It also provides recommendations for what may be a reasonable approach to apply within the HITRANS region.

The Orkney Renewable Energy Forum have developed an EV Charging Infrastructure Design Guide to assist those planning and delivering charging infrastructure.

## 5.10 ACTION RP10 – DEVELOP AND PUBLISH REGIONAL BEST PRACTICE IN EV MOBILITY

There are a number of strong examples across the HITRANS region where EVs are providing a highly effective community services in remote and rural areas. Ensuring that the outcomes, processes and learnings from their planning, deployment and operation are captured and disseminated would allow others to realise similar solutions more effectively.

## 5.11 ACTION RP11 – MAXIMISE EXISTING COMMUNICATION, EDUCATION AND OUTREACH CHANNELS

There are a number of communication channels and education programmes in Scotland that seek to raise the profile of EVs and promote sharing of best practice. A summary of the key programmes is included in Appendix F.

Working with relevant organisations to identify opportunities to host events in the region would help to ensure that relevant users and practitioners in the region have increased opportunity to attend and share their experiences.

## 5.12 ACTION RP12 – SUBSIDISE EV ACCREDITATION FOR MECHANICS

At present, a number of EV models can only be serviced outside of the HITRANS region, significantly decreasing the convenience of ownership. Subsidising EV training and accreditation schemes for local mechanics would help to ensure that the region has sufficient skills to support regional uptake of vehicles.

## 5.13 ACTION RP13 – EXPLORE THE POTENTIAL FOR EARLY USE OF ELECTRIC AIRCRAFT IN THE REGION

There are a number of major organisations that are investing in research and development activity targeted at the development of hybrid and electric only aircraft. Much of the research is at present, focussed on the development of small to medium sized aircraft to serve short-haul routes. Airbus, Rolls Royce and Siemens[36] expect to start flying hybrid aircraft by 2020, EasyJet and Wright Electric[37] expect to offer short haul electric flights in 10-20 years, and Boeing, JetBlue, Zunnum Aero have announced they will deliver a 12 person hybrid electric aircraft by 2022[38].

With the region making significant use of small commercial planes to serve relatively short distance air routes, there is an opportunity to capitalise on expected development in electric aircraft technology. Establishing early contact with organisations currently developing hybrid and electric aircraft will help to understand more accurate timeframes for delivery, and for any supporting or enabling infrastructure to be incorporated early into future planning for the regions airports.

## 5.14 ACTION RP14 – ESTABLISH A REGIONAL EV STAKEHOLDER GROUP

Increasing the use and adoption of electric mobility solutions across the HITRANS region will be best achieved through the coordination and collaboration of stakeholders from local groups, local authorities, transport operators and national bodies.

HITRANS have previously achieved such collaboration through the establishment of Stakeholder Advisory Groups. These have brought together relevant individuals from different organisations to discuss, agree and champion the delivery of meaningful change focussed on a particular subject matter. It is suggested that an EV Stakeholder Advisory is established to advance the actions outlined within this strategy document.

36 Rolls Royce, Airbus and Siemens join forces to develop electric planes, The Times, 29th November 2017
37 EasyJet says it could be flying electric planes within a decade, The Guardian, 27th September 2017
38 7 electric aircraft you could be flying in soon, CNN, 21st November 2017

# 6. MODAL INTEGRATION

Moving to, from and around the HITRANS region is more challenging than other parts of Scotland. With a reliance on ferry and air services to reach more remote parts of the region and less direct rail and air services to other parts of Scotland, the UK, and Europe, there is an increased reliance on multi-modal trips, particularly when undertaking longer journeys.

Increasing the use of EVs will require consideration of the interface arrangements between different modes, identifying ways to maximise the convenience and benefits of electric mobility services to users making connecting journeys.

There has already been significant work undertaken by HITRANS to embed EV use as part of multi-modal trips.

In 2015 HITRANS launched the rural airports project SPARA 2020 (Smart Peripheral and Remote Airports) funded by the European Regional Development Fund. The project aims to decarbonise transport links to Highland and Islands Airports (HIAL), through the implementation of electric buses, plug-in vehicle hires and taxis. Early successes include an electric bus connecting passengers arriving and departing at Kirkwall Airport with Kirkwall town centre in Orkney, and the deployment of electric car club vehicles at Stornoway Airport.

Ferry operators have also been quick to support EV technology. Operators have supported the deployment of charging infrastructure at ferry terminals and make use of hybrid ferries on a number of routes within the region.

Car club operators are also recognising an increasing trend in visitors linking rail travel into the region with vehicle rental, particularly within Inverness, which has seen the deployment of electric and hybrid car club vehicles.

There are also a number of EV car club vehicles that have been successfully deployed in rural communities. While, these schemes are still at relatively early stage, early feedback has highlighted increased levels of use have been achieved where high levels of community engagement have accompanied conveniently located vehicles and charging infrastructure.

The following actions reflect on the experiences and successes achieved and highlight further opportunities to integrate EVs into the regions transport system.

## 6.1 ACTION MI1 – CONTINUE TO INVEST IN EV CHARGING FACILITIES AT REGIONAL AIRPORTS

Airports have a key role in connecting the region with Scotland and the rest of the UK. The availability of charging infrastructure will support the use of EVs for travel to and from airports.

The frequency of air services in the region will mean that most trips undertaken by air will involve someone being away from home for a day or longer. As a result, lower powered charging units provided in airport car parking would be appropriate and would perhaps be the most cost-effective option. A guide to choosing power of units and locating charging units is included in Appendix G.

For those picking up, dropping off, or parking for a period of more than a couple of days, a higher powered rapid charging unit is likely to be a more appropriate investment. Where possible this should be located away from parking areas, to ensure the unit is not accidently blocked by someone seeking a parking space.

For more major hubs, such as Inverness, it may be appropriate to provide specific charging units for taxi services (and potentially public transport), ensuring that electric taxis are able to recharge quickly, and are not disadvantaged compared to equivalent ICE vehicles. Furthermore, it may be useful to consider a separate, more prominent rank for waiting electric taxis to encourage their adoption by the industry.

With new EV models being released into the market in 2018 able to accept a 150kW charge, it may be worthwhile planning for rapid charging infrastructure that can be upgraded

There are emerging charging products on the market, such as ChargePoint's Express Plus, that make use of load

management technology to share power over multiple charging points. Such products may be worth considering for regional airports, allowing for multiple vehicles to be connected to a single power sources, and with the potential to minimise the load demands on the electricity grid and reduce grid connection costs.

**Potential Funding Opportunities**

Managed charging solutions are likely to become more important for EV charging and grid management as levels of EV use increase. There may be opportunities to work with the private sector and distribution network operator and / or seek innovation funding from UK and EU funds to trial solutions that may have wider applicability.

## 6.2 ACTION MI2 – SUPPORT CAR CLUB VEHICLES AT REGIONAL ENTRY POINTS

Discussion with car club operators have highlighted a growing demand for car club vehicles around key long distance transport nodes, such as rail and air services. Working with operators to provide electric vehicles in these locations may help the adoption of EVs by those travelling to the region, and also provide a resource for the local community that reduces the need for vehicle ownership.

**Potential Funding Opportunities**

Car club operators will often be keen to invest in locations where they can gain commitment from organisations to use their vehicles. This can provide a base level of use which can help make the service financially viable. There may be opportunities to consider whether it is practical for public sector bodies, or other organisations close to regional entry points, to use car clubs instead of owning their own fleet vehicles.

## 6.3 ACTION MI3 – SUPPORT THE ESTABLISHMENT OF COMMUNITY CAR CLUBS

Car club vehicles are a potential opportunity to provide low cost convenient transport in rural communities, particularly where public transport services are challenging to provide in a cost-effective manner. Electric car club vehicles can further lower these costs by reducing maintenance and fuel costs.

Supporting local community members keen to implement car clubs is a valuable approach to the further expansion of car club schemes in less populated areas. This has proven successful in a number of areas, with greater buy-in often being achieved through more targeted and effective communication with the broader community.

Support could range from helping to fund and deliver infrastructure, financial support for vehicle purchase, through to information about how to establish and run car clubs. There may also be opportunities to work with car cub operators to incorporate incentives into car club rental that may help to address broader issues such as social isolation, reducing rental costs for those willing to collect or drop off an elderly member of the community at a medical appointment.

**Potential Funding Opportunities**

SSE has a community benefit fund and sustainable development fund and invite applications for funding on a periodic basis to support local and regional projects or initiatives. Projects that increase the use of EVs or provide a community benefit would fall in the remit of the funds purpose.

There continues to be opportunities from the UK and EU government to investigate innovative mechanisms to reduce ICE vehicle usage or address societal challenges. These may provide opportunity to trial and deploy EV related solutions within local communities.

## 6.4 ACTION MI4 – MAKE IT EASY TO BOOK EV CONNECTIONS TO AND FROM REGIONAL ENTRY POINTS

Information on EV options available to travel to and from key regional entry and exit points is fragmented and difficult to find. Work should be undertaken with relevant operators to improve access to information and, where appropriate, integrate the ability to book connecting EV services. For example, working with Logan Airways to introduce an add-on EV car club rental or bus ticket to air fares.

**Potential Funding Opportunities**

Future franchise contracts to operate regional transport services/infrastructure could include obligations to promote low carbon transport connections and improve the booking of such services.

## 6.5 ACTION MI5 – WORK WITH TAXI OPERATORS TO INTRODUCE ELECTRIC TAXIS IN INVERNESS AND OTHER KEY REGIONAL CENTRES

Taxis are some of the heaviest used vehicles on the roads (Scottish taxi drivers typically drive 27,000 miles per year[39]). Increasing the levels of EV taxis within the region has the potential to make a significant contribution towards vehicle emissions.

EV taxis also have broader benefits to increasing levels of adoption. They provide an opportunity for people to experience an EV and talk to a professional driver about their experience of owning one. This can help to address false perceptions and raise awareness of the technology.

Discussion with taxi operators has highlighted access to rapid charging infrastructure as being essential to the uptake of EVs by taxi drivers. There is a perception from drivers that fares will be lost through time required to stop and recharge their vehicles. There is also further concern about the reliability and availability of regional rapid charging infrastructure and the ability to accommodate longer distance fares with EVs (Actions RP2, RP3, RP4).

Work should be undertaken with regional taxi operators to explore and resolve specific barriers to EV adoption within the local area. This should include promoting the potential financial benefits of use that have been experienced in other parts of Scotland and facilitating discussion with operators who have already adopted the technology.

With Inverness the largest population centre and major entry point to the region for both air and rail services, numbers of taxis and levels of use are higher than in other parts of the region. An early focus on engaging with operators in the city and increasing availability of rapid charging infrastructure would be beneficial.

Should EV and electric taxi levels start to grow significantly work should be undertaken with operators to establish dedicated rapid charging facilities for taxis, to minimise delays in accessing charging infrastructure.

**Potential Funding Opportunities**

The funding sources identified for Action RP1 (section 5.1) would be applicable to supporting charging infrastructure that could benefit electric taxi use.
The UK Government Office of Low Emission Vehicles has on previous occasions provided funding to deliver infrastructure that supports the uptake of low emission taxis. There may be similar opportunities in the future.

## 6.6 ACTION MI6 – WORK WITH BUS OPERATORS TO IDENTIFY ROUTES APPROPRIATE FOR ELECTRIC BUSES

Electric buses on the market have smaller range that their ICE counterparts. As a result, when considering their deployment on routes, a direct swop of vehicles is often not possible.

Discussion with bus operators should occur to understand the detail of how their current fleet of buses are scheduled. This would allow for the identification of what vehicles could be easily replaced with electric alternatives, or where charging infrastructure would need to be provided to extend the operational range.

This would help to exploit future funding opportunities, such as the Scottish Government Green Bus Fund.
It would also help to ensure that planning of other infrastructure considers the potential needs of buses and helps to enable the cost-effective provision of charging infrastructure where possible.

**Potential Funding Opportunities**

The Transport Scotland Green Bus Fund has provided funding to support the purchase of low emission buses on a number of occasions. There may be further opportunities to bid for more funding in the future.

## 6.7 ACTION MI7 – DEVELOP REGIONAL MOBILITY AS A SERVICE APP

Serving a geographically large area, made up of a high number of remote, rural and island communities, the HITRANS region has a complex transport system. With limited frequency of public transport services, ferries and air services identifying realistic transport options to complete multi-modal journeys is challenging, with a need to refer to multiple sources to gather information and book transport.

39 Taxi Driver Survey 2016, insure Taxi, 25th August 2016

The development of a Mobility as a Service (MaaS) tool for the region could be beneficial for both residents and visitors. Such a tool could allow for the inclusion of a variety of low emission transport modes into a journey planning function and improve the ease of booking more complex journeys. It could also include ride sharing, seasonal or demand responsive services which may help address periodic capacity challenges felt across the network.

## 6.8 ACTION MI8 – ENGAGE WITH REGIONAL FREIGHT ORGANISATIONS

With the region highly reliant on road freight for goods and deliveries, identifying opportunities to support the logistics industry to adopt low emission solutions could help to improve emissions and could help to increase the competitiveness of local businesses.

Viable EV solutions for the logistics sector have recently started to emerge, particularly as options to replace smaller delivery vehicles. Continuing to invest in the regional rapid charging network (actions RP1, RP2 & RP3) will help increase the viability of using EVs for logistics companies.

Establishing dialogue with key members of the freight industry in the region will also be beneficial, allowing for early consideration of how HITRANS can support the uptake of emerging technologies that may increase the viability of larger electric freight vehicles.

## 6.9 ACTION MI9 – INVEST IN EBIKE CHARGING FACILITIES

Increasing the convenience and opportunities for users to recharge bike batteries will be needed to support the growth of eBike use expected to occur over the next decade.

The use of eBikes will be supported by charging facilities in key employment centres and ensuring that new developments consider their needs. This particularly applied for commuting. Charging facilities will also need to be provided along major cycling routes and at key tourist sites to support recreational use and a growing cycle tourism sector.

Locating eBike charging facilities alongside EV charging units should be considered. This would create recognisable electric mobility hubs across the region.

## 6.10 ACTION MI10 – WORK WITH FERRY OPERATORS TO PROVIDE APPROPRIATE CHARGING INFRASTRUCTURE

Building on the good early work delivered in the region, HITRANS should continue to work with Ferry Operators to identify appropriate EV infrastructure for deployment at ferry terminals and on car ferry services. This should consider the volumes of vehicles that are likely to require charging, their likely duration of dwell and the ability to provide more cost effective charging infrastructure in towns close to Ferry Terminals.

# 7. SUPPORTING TOURISM

Tourism is an extremely important part of the regional economy. An estimated 2.5m visitors travel to the HITRANS region each year. Tourism also accounts for 13% of all employment in the region which is significantly higher than the national average of 9%[40].

Tourism is also one of the most pollution sensitive economic sectors. Failure to reduce noise and emissions from road transport could have a profound consequence for tourism flows and the associated economic opportunities that this brings. This is particularly apparent in the Highlands and Islands region, which is globally renowned for the pristine, remote, and rugged natural environment and historic sites.

Tourism is also a highly competitive global industry. Visitors are increasingly looking for a deeper and wider experience when they travel, seeking to feel a real connection with the areas that they visit, and actively look for fulfilling life experiences. It is no longer enough to be just to be a nice place to stay[24]. Allowing easy access to, and use of, EVs by tourists visiting the region has the potential to add to the environmental experience of the region and generate an activity that may not yet be familiar to visitors.

## NORTH COAST 500

The North Coast 500 is marketed as Scotland's equivalent of Route 66. A 500 mile road route around the coastal areas of the North Highlands, that capitalises on stunning scenery of the North Highlands. The Route is supported by a dedicated website and app, which allows easy generation of travel itineraries with locally based accommodation, restaurants and activities.

A study undertaken by the Highlands and Islands Enterprise has highlighted how the route has played a significant role in increasing tourism to the region, attracting 29,000 additional visitors and £9 million additional spend in its first year.[41]

The initiative has demonstrated the appetite for a more immersive experience. The marketing of the route has built on the region's reputation for spectacular and wild landscapes, while increasing tourism in less visited parts. The ability to complete the route by EV has also captured the imagination, with the value of minimising the environmental impact of travel to this remote region recognised by visitors.

While there is a strong desire to increase visitor numbers to the Highlands and Islands, it is recognised that there are number of capacity bottlenecks in the region, particularly ferry services and road connections to the more remote parts of the region. There are opportunities to integrate EVs into key parts of the transport systems to help make more efficient use of transport services and to minimise the need to travel around the region by private car. The latter will also help to reduce the visual impact of transport across the region, helping to meet visitor's expectation of a remote and spectacular environment.

The following provides a summary of the actions that could be taken to increase the use of electric vehicles by tourists.

40 Seeing Ourselves as Others See Us: Promoting the Benefits of Holidaying in Scotland, Visit Scotland, 2016

41 Impact of NC500 Route, Highlands and Islands Enterprise, 19th June 2017

## 7.1 ACTION ST1 – WORK WITH VISIT SCOTLAND TO DEVELOP A ZERO EMISSION TOURISM OFFERING

The Highlands and Islands have a global reputation for their natural environment, which is cited as the major draw for tourists visiting the region[42]. Developing a regional reputation for the use of low or zero emission vehicle use will help to sustain and build on this reputation.

There are immediate opportunities to work with Visit Scotland, and other regional tourism bodies to improve the communication and marketing of travel options that help to minimise the impact on the environment. This could be further developed by establishing specific EV related tourism offerings. For example: building further touring routes around regional charging infrastructure, highlighting hoteliers with charging facilities, or working with a local business to offer electric campervans, such as the eDub in Yorkshire.

## 7.2 ACTION ST2 – WORK WITH FERRY OPERATORS TO INCREASE EV USE AND REDUCE PRESSURES ON TRANSPORT NETWORK

High levels of visitor numbers, particularly in the summertime, often result in vehicle berths on ferry services being booked out well in advance of the date of sailing. This limits access to / from island for both local communities and tourists. While vehicle carrying capacity is often reached, there continues to be scope for significant increases in walk-on / walk-off passengers.

Work should be undertaken with ferry operators to consider how EVs and associated infrastructure could be integrated into ferry terminals to reduce the need to bring vehicles on ferry crossings. For example, investing in electric car club vehicles at ferry terminals and providing free parking for those willing to leave their vehicle and be a foot passenger.

There may be initial opportunities to work with ferry operators to publicise locations where electric car club vehicles already exist close to ferry terminals, such as Stornoway.

## 7.3 ACTION ST3 – WORK WITH SMALL BUSINESSES, HOTELIERS AND TOURIST ATTRACTIONS TO ENCOURAGE PROVISION OF EV INFRASTRUCTURE

Encouraging small businesses, local hoteliers and tourist attractions to invest in EV infrastructure would help to develop a charging network that could support the use of EVs by tourists, tour group operators and those travelling across the region.

Stakeholder discussions highlighted that there is often strong interest by local businesses in investing in charging infrastructure. However, access to information, advice and uncertainty over grant funding has proved a barrier to investment.

There are opportunities to address this by working with organisations such as Energy Saving Trust, Visit Scotland, OREF and the North Coast 500 Working Group to provide clear guidance to local businesses on the potential benefits, practicalities and costs of providing charging infrastructure for patrons.

In addition, there are opportunities for groups such as the EV Stakeholder group to encourage more engagement and publicity from funding bodies, such as Energy Saving Trust and Transport Scotland for electric vehicle infrastructure funding specifically for the tourism industry.

**Potential Funding Opportunities**

Transport Scotland provide funding to Energy Saving Trust to undertake education and outreach work on EVs.

## 7.4 ACTION ST4 – INVEST IN A SMART TOURISM OFFERING

Initiatives such as the NC500 have demonstrated the interest in integrating travel with tourist sites, local accommodation, and restaurants. Working with Visit Scotland consideration should be given to further develop the regional smart tourism offering. For example, this could blend a MaaS product with accommodation, restaurant and attraction booking, enabling the scheduling of EV or other low emission alternatives and the generation of individual itineraries to move through the region.

42 Scotland Visitor Survey 2015 & 2016, Visit Scotland, April 2017

# 8. RENEWABLE ENERGY

The Highlands and Islands are a major contributor to Scotland's renewable energy generation. With some of the UK's highest mean annual wind speeds[43] and an extensive coastal area, the region has an abundant natural resource for renewable energy generation. Scotland's island communities total practical resource potential is estimated at 12.9GW[44]. The region will play a key role in reaching the Scottish Government's target of 100% renewable energy generation by 2020.

A key challenge with renewables is managing the intermittent nature of their generation. Improvements in battery technology are of growing interest for the energy sector and present opportunities to help manage peaks and troughs in both energy generation and supply. With an increasing number of EVs expected to be connected to the grid, there is a clear opportunity to use the onboard battery storage to help support increases in renewable energy supply and to make more efficient use of generation and distribution resources.

The level of renewable generation in the HITRANS region and limitations with the supply network is such that at peak times not all energy generated can be used. This is a more significant issue for island communities where connections back to the mainland grid may be limited. For example, despite having the world's first active network management system, Orkney's network is heavily constrained, and it is estimated that there is approximately 5MW of renewable energy that cannot be absorbed at peak times[45].

There are opportunities to consider the role that EVs and charging infrastructure may play in making more efficient use of energy generated in the region. This could help to further reduce the cost of transport, particularly in more remote areas where petrol and diesel costs are typically higher. For example, some EV owners in Orkney are using their vehicles to circumvent the moratorium on grid connections and are charging their vehicles directly from non-grid connected wind turbines[46].

The following provides a summary of actions where there are opportunities to use renewable energy generation to support the uptake of EVs.

43 Where are the windiest parts of the UK, Met Office, 2015
44 Scottish Islands Renewable Project: Final Report, Baringa, 2013
45 Orkney's Electric Vehicle Infrastructure Strategy, Orkney Islands Council, May 2014
46 Innovations, Orkney Renewable Energy Forum, 2017

## 8.1 ACTION RE1 – INVESTIGATE OFF-GRID AND BATTERY BACKED CHARGING SOLUTIONS

Increasing capabilities of both EVs and recharging infrastructure are leading to greater use of, and demand for, higher powered charging units. However, finding locations where the existing electricity supply network can accommodate these power demands without significant and costly upgrade is challenging. This challenge is generally increased within rural and remote areas where grid connections may be limited.

There are a number of manufacturers that are offering grid managed or off-grid vehicle charging solutions. These are making use of renewable energy generation and / or battery storage to provide cost effective and higher-powered charging units. Consideration should be given to trialling their use in the HITRANS region to establish whether they will provide a cost-effective solution to expanding the rapid charging network.

**Potential Funding Opportunities**

Both the UK and EU government have provided funding for the trial and demonstration of technologies that could support low emission vehicle adoption. There may be further funding competitions in the future.

## 8.2 ACTION RE2 – TRIAL SMART CHARGING

Discussion with SSE has highlighted that there are several locations on the electricity network where demand exceeds capacity. This exceedance may only occur for a few hours a year, however there is a need for SSE to upgrade the grid to accommodate this peak demand.

Smart charging technology for vehicles could help lower peak demands by delaying when the charging activity may occur. With the technology available for use, there are opportunities to work with SSE to consider locations where the technology could be of benefit. This could be of

particular interest where there are a number of vehicles connected to the same part of the grid (e.g. corporate fleets).

**Potential Funding Opportunities**

SSE has indicated that they would be willing to pay to enable smart charging technology at key locations. This could generate revenue that could offset electricity costs for the organisation where the technology is enabled.

Both the UK and EU government recognise that Smart Charging and Vehicle to Grid technology could generate significant benefits in energy management and distribution. There have been a number of calls for funding already that have been relevant to trials and demonstration of the technology and further opportunities may be available.

## 8.3 ACTION RE3 – COORDINATE PLANNING OF THE ELECTRICITY NETWORK

Working with SSE to plan charging infrastructure alongside electricity grid upgrades may help to generate efficiencies that could reduce the costs of infrastructure for both local authorities and SSE. This may have particular benefits for infrastructure on islands where the distribution network may be limited.

## 8.4 ACTION RE4 – ENGAGE SSE EARLY IN PLANNING CHARGING INFRASTRUCTURE

The cost of an electricity connection for high powered EV charging infrastructure can be significant. Early discussion with the distribution network operator could help to identify locations where sufficient power supply may be available and reduce abortive work. SSE have offered a key client contact for the HITRANS region to assist with planning of charging infrastructure and have a special projects team to assist with design activities where there may be limitations in grid capacity.

# 9. SUMMARY OF ACTIONS

The following tables provides a summary of actions identified in the previous section and relates them back to the overarching objectives of the strategy. It also identifies a series of quick wins which HITRANS could deliver in the short term that are likely to make a strong positive impact in the region.

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **REGIONAL PLANNING** | | | | |
| Increase Levels of EVs in Public Sector Fleets<br>Public sector use of EVs will demonstrate commitment and practicality of EV use within the HITRANS region. | ✓ - Will increase organisational access to EVs | | | Encourage public sector organisations to obtain a free sustainable transport review from Energy Saving Trust. |
| **Increase the Resilience of the Rural Rapid Charger Network**<br>Reliability of access to regional rapid charging infrastructure is viewed as key to encouraging uptake of EVs. Addressing communication challenges and duplicating existing infrastructure has been identified as key mechanisms to address this. | ✓ - Identified as a key barrier to adoption of EVs within the region | ✓ - Enables EVs to be used to undertake journey to / from and across the region | ✓ - EVs could decrease operational costs for regional businesses. | Work with ChargePlace Scotland to understand the results of the current trials of alternative communication mechanisms in the region and plans for further roll-out.<br><br>Work with SSE to understand what current sites have sufficient grid capacity to accommodate duplication of rapid infrastructure. |
| **Provide Rapid EV Charging Clusters**<br>Clustered charging infrastructure will increase the convenience of charging for users, particularly in areas of high demand. | ✓ - Increases accessibility to charging infrastructure, identified as a key barrier to adoption of EVs within the region. Will support uptake of EV taxis | ✓ - Will support EVs use to undertake journeys to / from and across the region. Clusters will help support charging around modal hubs. | | Providing a rapid charging cluster in Inverness will have a number of benefits. Located at the confluence of a number of major roads rapid charging infrastructure will help to facilitate regional movement by EVs, support the uptake of EVs by taxi operators, and allow expansion of EV car club vehicles. |

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **Targeted Expansion of the Rapid Charging Network**<br>Ensuring that there is sufficient infrastructure to enable convenient movement through the region by EVs is essential to supporting the uptake of EVs. | ✓ - Increases accessibility to charging infrastructure, identified as a key barrier to adoption of EVs within the region. | ✓ - Will support EVs use to undertake journeys to / from and across the region | | Work with SSE to understand potential sites that may have sufficient grid capacity to accommodate new rapid charger infrastructure.<br><br>Work with Transport Scotland to identify how best to electrify the A9 corridor. |
| **Capture the Cost of the Operation and Maintenance of Regional Charging Infrastructure**<br>Improving the understanding of operational and maintenance costs will improve decision making around further investment in charging infrastructure | ✓ - Will allow for more considered planning of infrastructure. | | ✓ - Will allow for an improved understanding of operational costs that could inform future investment by public and private sector. | Work with local authority leads to understand the current maintenance approach and costs across the region. |
| **Create a co-ordinated and open data EV charging infrastructure platform**<br>Systemic issues surrounding the ChargePlace Scotland IT and back-office software have been identified. Currently the system is inadequate, with lack of information available on charging unit faults and maintenance issues. This seriously hinders the ability of local authorities and/or charging network owners to efficiently identify faults and track repairs. A well-functioning back-office system would provide data policy makers and EV owners can trust and rely on to inform decision making. | ✓ - Will improve reliability of information for users, policy makers and maintenance providers. | ✓ - Improved fault monitoring and reporting will improve maintenance of chargers – thus improving user experience. | ✓ - Will significantly improve the accuracy of charger performance analysis. | Work with Transport Scotland and ChargePlace Scotland to understand and implement short-term solutions to the issues raised. |

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **Continue to Develop Regional Maintenance Skills**<br>A fast response to fault resolution will help improve confidence in the availability of charging infrastructure. | ✓ - Will improve reliability of infrastructure. | | | Work with The Highland Council to understand the costs, practicalities and benefits of this approach. |
| **Introduce a Considered Payment Mechanism for Charging in the region**<br>Pressure on public sector budgets and increasing EV usage means offering free charging is no longer viable. It is recommended that local authorities consider Transport Scotland's forthcoming tariff guidance and their options for introducing payment mechanisms suitable for their local EV market and maturity level. It is suggested that tariffs are continually reviewed regularly between the EV stakeholder group, users and industry stakeholders as the EV market develops. | ✓ - Gives users confidence they can travel to new places in their EV and be able to access charging facilities | ✓ - Will provide a consistent user experience when using infrastructure across the region. | ✓ - Will increase equity of access to infrastructure across HITRANS region. | Consider Transport Scotland's forthcoming guidance and recommendations for implementing a region-wide charging tariff. Full guidance is due to be released in Autumn 2018. |
| **Introduce Developer Requirements to Provide Charging Infrastructure**<br>New development should be enabled to support the adoption and use of EVs. | | ✓ - Will increase convenience of using EVs to make a greater number of journeys across the region. | | HITRANS collating and sharing best practice in EV infrastructure guidelines for different development types will assist local authorities in considering how best to structure local planning requirements to include for EVs. |
| **Develop and Publish Regional Best Practice in EV Mobility**<br>Sharing of best practice within region could allow other local authorities to implement schemes that utilise EVs to deliver strong community benefits. | ✓ - Will allow for others to learn from successes and failures of activity. | | | Sharing current experience of delivering car clubs in both Moray and Stornoway could help to identify further locations where similar schemes could be delivered. |

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **Maximise Existing Communication, Education and Outreach Channels**<br>There are a number of existing communication and outreach programmes that support the uptake of EVs. Working with organisers to arrange for sessions to be held in the region will help to raise the profile of EVs and enable greater consideration of regional challenges. | ✓ - Will help to increase knowledge of EVs and overcome incorrect perceptions. | | | There are immediate opportunities to work with Transport Scotland and Urban Foresight to arrange an E-cosse forum in the region. This could provide wider industry thought on regional challenges and demonstrate leadership in EV provision in rural areas. Support from HITRANS and other regional stakeholders to publicise the event would assist in increasing attendance. |
| **Subsidise EV Accreditation for Mechanics**<br>Ensuring that EVs can be serviced and maintained within region is necessary to increase convenience for users. Subsidising training courses | ✓ - Will allow for cost effective and convenient maintenance of EVs. | | ✓ - Will support early development of skill that will have broader economic value. | Work with local mechanics in Inverness to understand the benefits derived from early accreditation as EV mechanic. |
| **Explore the Potential for Early Use of Electric Aircraft in the Region**<br>The nature of air travel routes within the HITRANS region is expected to lend itself to early electric aircraft use. | | ✓ - Potential to lower cost of air travel across region. | ✓ - Early knowledge and skills in sector likely to have global value | Establish contact with UK manufacturers currently developing technology to understand timelines for deployment in greater detail. |
| **Establish a Regional EV Stakeholder Group**<br>Meaningful change will be best delivered through a coordinated approach between different public and private sector organisations. | ✓ - Improved co-ordination between organisations to deliver change across region. | ✓ - Improved co-ordination between organisations to deliver change across region. | | Establish terms of reference for group and initial membership. |

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **MODAL INTEGRATION** | | | | |
| **Continue to Invest in EV Charging Facilities at Regional Airports** Air travel is essential to the region. Enabling both residents and visitors to travel to / from airports by EVs will help to minimise emissions. | | ✓ - Will increase the opportunity to use EVs to access airports. | ✓ - Potential to lower the cost of access to regional airports. | Continue work with HIAL and EV users to identify what infrastructure is most appropriate for each of the regional airports. |
| **Support EV Car Club Vehicles at Regional Entry Points** Car club operators have highlighted increasing use of car club vehicles by those travelling to the region by rail and air. Providing EV car club options will help minimise emissions for those visiting the region. | ✓ - Will provide cost effective access to EVs for those that only require periodic vehicle use. | ✓ - Will support the use of multi-modal trips into the region utilising EVs as part of low carbon trip. | | Work with local authorities to consider whether there are benefits for them to support regional deployment by utilising car club vehicles in locations close to major rail stations and regional airports. |
| **Support the Establishment of Community Car Clubs** Community led car club schemes, containing EVs have proven successful within region. | ✓ - Will provide cost effective access to EVs for those that only require periodic vehicle use. | ✓ - Will provide a cost-effective transport option in areas where there may be limited public transport options. | ✓ - Potential to increase access to services and employment. | Work with local authorities to identify appetite for schemes, and support applications to the SSE Community Funding. |
| **Make it Easy to Book EV Connections to / from Regional Entry Points** There are a number of existing EV transport options that connect to major rail stations and airports. Maximising awareness of these options. | ✓ - Will raise awareness of regional opportunities to use EVs. | ✓ - Will help enable EV use as part of multi-modal regional trips. | | Work with Abellio and HIAL to increase prominence of EV options on existing communication channels. |

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **Work with Taxi Operators to Introduce Electric Taxis in Inverness and Other Major Regional Centres**<br>Increasing the use of EVs by taxi operators will minimise emissions from some of the highest mileage vehicles in the region. It will also increase public awareness of EVs. | ✓ - Will help to identify and overcome barriers to electric taxi use. Will help address public perceptions of EVs | ✓ - Will help enable EV use as part of multi-modal regional trips. | | Investing in a rapid charging cluster in Inverness would increase accessibility to vehicle charging and reduce downtime for taxi operators choosing to utilise EVs. |
| **Work with Bus Operators to Identify Routes Appropriate for Electric Buses**<br>Electric buses are able to provide a reliable service for a number of routes in the region. This could help to reduce emissions, particularly within regional centres. | | ✓ - Potential to lower costs of bus operation within region and increase viability of new services. | | Work with operators to identify what services and routes might be most appropriate for the use of electric buses. |
| **Develop Regional Mobility as a Service App**<br>A regional MaaS product would increase accessibility to multi-modal trips and allow the use of available EV options. | ✓ - Will increase awareness of EV options in the region. | ✓ - Will help enable EV use as part of multi-modal regional trips. | ✓ - Will help enable consideration of a wider range of modes to move around region. Potential to deliver lower cost trips. | Discuss potential of MaaS platform with potential suppliers to understand commercial appetite and the need for funding / subsidy. |
| **Engage with Regional Freight Organisations**<br>Freight is essential to the region. Supporting the industry to capitalise on emerging EV options will reduce emissions and has the potential to improve competitiveness of regional businesses. | ✓ - Will identify early barriers for adoption of EVs by industry. | | ✓ - Potential for freight and logistics sector to capitalise on lower vehicle operational costs. | Establish regular discussion with local representatives of the Road Haulage Association |

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **Invest in eBike Charging Facilities** eBike use is expected to grow significantly over the next 10 years. Providing opportunities to charge eBikes in major employment centres and along major bike routes will help encourage their use for commuting and leisure/tourism. | ✓ - Will help eBike use to become a more feasible option for travel within region. | ✓ - Will increase ability to integrate eBikes with other modes of transport. | ✓ - Help to capitalise on growing leisure and cycling tourism industry. | Work with Visit Scotland to consider the potential for eBikes as part of a regional tourism offering. |
| **Work with Ferry Operators to Provide Appropriate Charging Infrastructure** Continuing to provide appropriate charging infrastructure at ferry terminals and on car ferry services will support regional movement by EVs. | | ✓ - Will increase convenience of EV use when undertaking trip on ferries. | ✓ - Will help to ensure strategic EV infrastructure planning is appropriate. | Consider the potential for charging hubs in towns close to major regional ports.<br><br>Work with ferry operators to include onboard charging on appropriate routes. |

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **TOURISM** | | | | |
| **Work with Visit Scotland to Develop a Zero Emission Tourism Offering** EV options in the region could be attractive to those visiting the region and help to increase their use. | ✓ - Will increase awareness of EV options within region. | ✓ - Will enable greater use of EVs to move around region. | ✓ - Tourism is major employment sector for region and EV will align with core tourist offering of natural environment. | Work with Visit Scotland to map out a potential offering. Identify a champion for EVs within Visit Scotland. |
| **Work with Ferry Operators to Increase EV Use and Reduce Pressures on Transport Networks** Investing in and encouraging the use of EV options at ferry terminals may help to reduce pressure on ferry services and island traffic. | ✓ - Will increase travel choices by EVs when using ferries. | ✓ - Will provide additional travel options for those moving around region. | ✓ - Potential to increase efficiency of ferry vehicles and reduce cost of travel for individuals and businesses. | Work with ferry operators to publicise locations where electric car club vehicles already exist close to ferry terminals, such as Stornoway. |
| **Work with small businesses, Hoteliers and Tourist Attractions to Encourage Provision of EV Infrastructure** Increasing the number of hotels and tourist attractions with charging facilities will generate a network of infrastructure that could support the use of EVs by those travelling across the region. | ✓ - Will increase availability of charging infrastructure for those visiting the region by EV. | | ✓ - Tourism is major employment sector for the region and EVs align with core tourist offering of natural environment | Work with Energy Saving Trust to arrange an information session and self-guided information sources for hoteliers interested in understanding more about EV charging infrastructure. |
| **Invest in a Smart Tourism Offering** Building a Smart Tourism platform that allows the development of personalised trips by EVs could provide an attractive tourist product and help local businesses. | ✓ - Will increase availability of information. | ✓ - Will help to accommodate wider regional tourism by EV. | ✓ - Tourism is major employment sector for region and EV will align with core tourist offering of natural environment. | Work with Visit Scotland to develop a number of itineraries (in addition to the NC500) that facilitates movement around the regions tourist sites by EVs. |

| Actions | Objective 1 – Removing Barriers to Low Emission Transport | Objective 2 – A Better Connected Region | Objective 3 – Supporting Sustainable Economic Growth | Short Term Actions / Quick Wins |
|---|---|---|---|---|
| **RENEWABLE ENERGY** | | | | |
| **Investigate Off-Grid & Battery Backed Charging Solutions** Early trials of off-grid and battery backed charging solutions could help identify whether they will provide a cost-effective solution for expansion of the charging network, particularly within sites where limited grid capacity exists. | ✓ - Potential to provide charging infrastructure in areas where electricity grid may be limited. | | ✓ - Will increase regional experience, skills and capability within emerging charging solutions. | Consider whether battery backed solutions can form part of funding bids for charging infrastructure. |
| **Trial Smart Charging** Smart charging has the potential to help manage the impact of EVs on the electricity grid. | | | ✓ - Will increase regional experience, skills and capability in emerging charging solutions. Potential to lower cost of charging and infrastructure provision. | Work with SSE to identify locations where smart charging may be of most benefit. |
| **Coordinate Planning of the Electricity Network** Planning EV charging infrastructure with upgrades to the electricity grid will help maximise renewable energy generation and reduce grid upgrade costs | ✓ - Will help to ensure electricity grid can accommodate EV charging needs. | | ✓ - Will lower cost of charging and electricity infrastructure provision. | Work with SSE to understand their proposed programme of upgrades. |
| **Engage SSE Early in Planning Charging Infrastructure** Working with SSE to identify appropriate locations for rapid charging infrastructure will help to reduce the cost of investing in further charging infrastructure. | ✓ - Will help to ensure electricity grid can accommodate EV charging needs | | ✓ - Will lower cost of charging and electricity infrastructure provision | Hold initial discussion with SSE to agree protocols for infrastructure planning. |

# APPENDIX A: SUMMARY OF CHARGING INFRASTRUCTURE AND USAGE

## 1. HITRANS REGION – CHARGING NETWORK SUMMARY

The following section provides an overview of the region's EV charging network and its levels of use.

### i. Charge point locations

There are currently 109 actively used ChargePlace Scotland charging points within the HITRANS area.[47] Out of these, 36 are slow-standard (3kW-7kW) chargers,
24 are fast (22kW) chargers and 49 are rapid chargers (43-50kW). This equates to there being 1 charging point for every 3 EVs registered in the region. The locations of these chargers is shown in Figure 4.

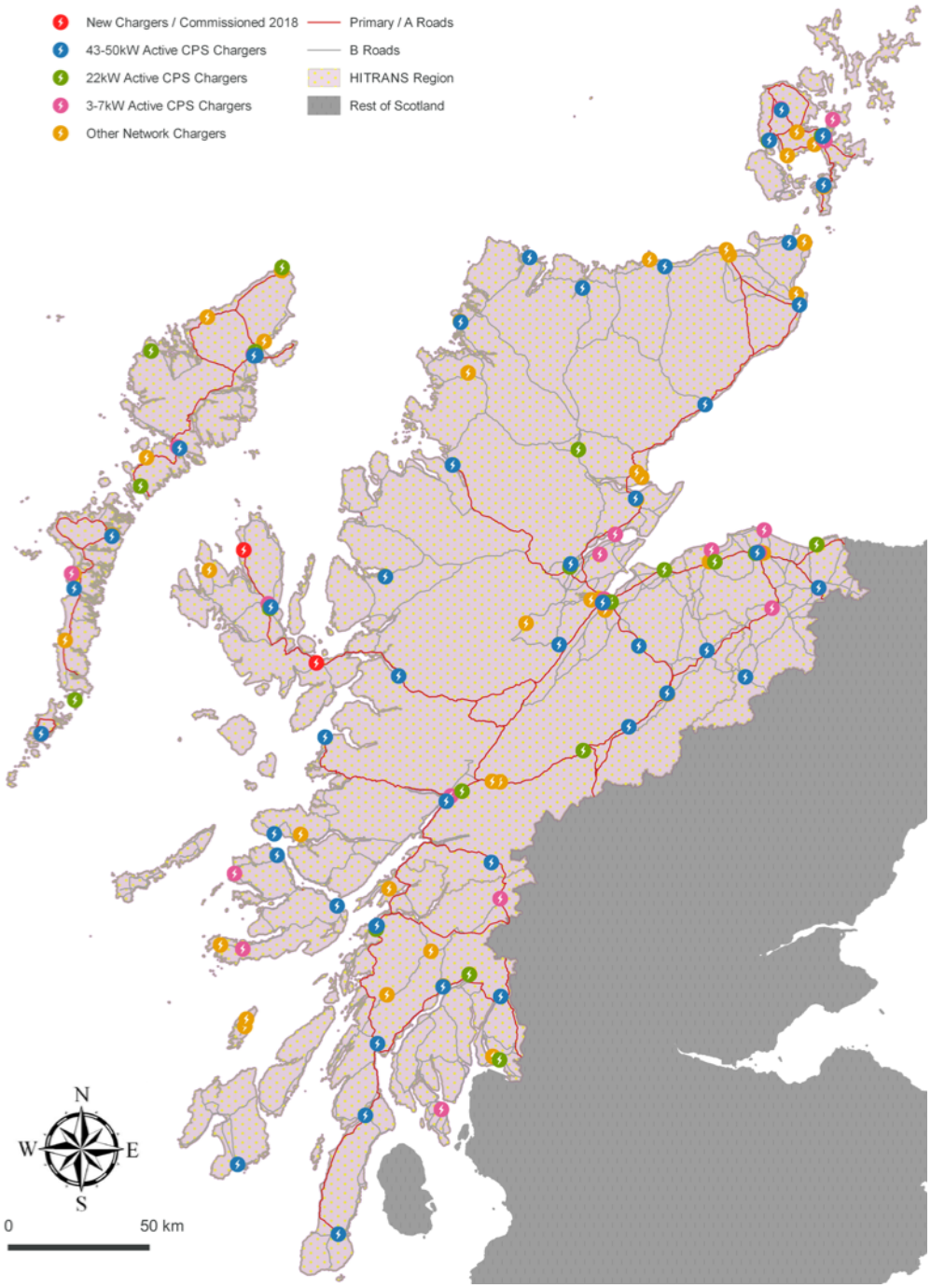



Figure 7 - HITRANS electric vehicle public charger locations by type. Data obtained from Zap-Map and ChargePlace Scotland (1st September 2017)

47 Data obtained from the National Chargepoint Registry and ChargePlace Scotland.

### ii. Charge point usage

To determine the usage of the charging points within the region, data was obtained from ChargePlace Scotland for the period of 1st January 2017 to 12th September 2017. The composition of these chargers and the usage statistics, are conveyed by power output in Table 5.

Table 5 - HITRANS chargers and usage statistics by power output type

| Charger Unit Type | No. of Active CPS Charger units | Total kWh (rounded) | Total No. of Sessions | Average No. of Sessions per day (rounded) | Average kWh per session (2 d.p) | Average Duration per session (hrs) (2 d.p) |
|---|---|---|---|---|---|---|
| Slow-Standard (3-7kW) | 36 | 28,072 | 4,394 | 17 | 6.39 | 8.66 |
| Fast (22kW) | 24 | 34,011 | 4,808 | 19 | 7.07 | 3 |
| Rapid (43-50kW) | 49 | 142,195 | 14,239 | 56 | 9.99 | 0.72 |
| **All Units** | **109** | **204,278** | **23,441** | **92** | **8.71** | **2.62** |

As shown in Table 6, the Highland Council area has the greatest number of EV charging points, including the most rapid charging units. Orkney, with 22 units, are showing the greatest levels of use, with the most charging sessions per day and the highest average energy consumption per session.

Table 6 - Charger usage statistics by local authority

| Local Authority | No. of Charger units | No. of 3-7 kW | No. of 22kW | No. of 43-50kW | Total kWh | Average kWh per day (kWh) | Total No. of Sessions | Average No. of Sessions per day |
|---|---|---|---|---|---|---|---|---|
| Argyll and Bute | 19 | 6 | 4 | 9 | 21,197 | 4.37 | 2,429 | 0.5 |
| Eilean Siar | 17 | 5 | 6 | 6 | 16,668 | 3.85 | 2,128 | 0.5 |
| Highland | 42 | 10 | 7 | 25 | 84,771 | 7.23 | 8,060 | 0.7 |
| Orkney Islands | 18 | 9 | 4 | 5 | 70,609 | 12.59 | 9,249 | 1.7 |
| Moray | 13 | 7 | 3 | 3 | 11,059 | 3.33 | 1,577 | 0.5 |

Table 7, Table 8 and Table 7 provide a summary of the five most used charging units in the region for each power level.

Table 7 – Five most used Standard charging units within the HITRANS region

| Rank | CP IDs | Site | Local Authority Area | Total No. of Sessions | Average No. of sessions per day | Total kWh | Average kWh per session | Average kWh per day |
|---|---|---|---|---|---|---|---|---|
| 1 | 50561 | Moray Carshare | Moray | 955 | 3.75 | 4,820 | 5.05 | 18.90 |
| 2 | 50572 | Kirkwall Council Offices | Orkney Islands | 689 | 2.70 | 4,921 | 7.14 | 19.24 |
| 3 | 51219 | Raigmore Hospital, Inverness | Highland | 412 | 1.62 | 1,521 | 3.69 | 5.93 |
| 4 | 50573 | Great Western Road Car Park, Kirkwall | Orkney Islands | 303 | 1.19 | 1,221 | 4.03 | 4.78 |
| 5 | 51145 | Guildford Square, Rothesay | Argyll and Bute | 204 | 0.82 | 954 | 4.68 | 3.74 |

The most active 3kW-7kW chargers are situated at a mixture of locations including, car club, council offices, hospital, leisure and educational facilities. These locations are consistent with activities that longer-stay activities (2-10 hours).

Table 8 - Five most used fast charging units within the HITRANS region

| Rank | CP IDs | Site | Local Authority Area | Total No. of Sessions | Average No. of sessions per day | Total kWh | Average kWh per session | Average kWh per day |
|---|---|---|---|---|---|---|---|---|
| 1 | 51144 | West Clyde Street Car Park, Helensburgh | Argyll and Bute | 856 | 3.36 | 5,620 | 6.57 | 22.04 |
| 2 | 50899 | Great Western Road Car Park, Kirkwall | Orkney Islands | 848 | 3.33 | 5,124 | 6.04 | 20.09 |
| 3 | 50891 | The Pickaquoy Centre | Orkney Islands | 831 | 3.26 | 4,763 | 5.73 | 18.68 |
| 4 | 50889 | East Kirk Car Park | Orkney Islands | 692 | 2.71 | 5,180 | 7.49 | 20.31 |
| 5 | 50888 | Old Academy Business Centre | Orkney Islands | 516 | 2.02 | 4,347 | 8.42 | 17.05 |

Four out of the top five chargers are currently situated on the Orkney islands. The land use adjacent to these sites includes commercial, retail and leisure activities.

Table 9 - Five most used rapid charging units within the HITRANS region

| Rank | CP IDs | Site | Local Authority Area | Total No. of Sessions | Average No. of sessions per day | Total kWh | Average kWh per session | Average kWh per day |
|---|---|---|---|---|---|---|---|---|
| 1 | 50892 | Great Western Road Car Park, Kirkwall | Orkney Islands | 1,981 | 7.77 | 15,908 | 8.03 | 62.38 |
| 2 | 50728 | Camanachd Car Park, Fort William | Highland | 1,102 | 4.32 | 13,211 | 11.99 | 51.81 |
| 3 | 50895 | Church Road Car Park, Orkney | Orkney Islands | 1,045 | 4.10 | 9,968 | 9.54 | 39.09 |
| 4 | 50896 | Ferry Road Long Stay Car Park, Orkney | Orkney Islands | 925 | 3.63 | 7,566 | 8.18 | 29.67 |
| 5 | 51065 | Cathedral Car Park, Inverness | Highland | 919 | 3.60 | 12,166 | 13.24 | 47.71 |

The location of each of the above charging sites is in close proximity to retail facilities that may be suitable for 20-30 minute activities.

# APPENDIX B: FUNDING OPPORTUNITIES

The tables below summarise some of the potential funding sources that could be pursued for EV-related projects.

| | Fund | Description |
|---|---|---|
| UK/Scottish Funding | Scottish Green Bus Fund (SGBF) | The Scottish Green Bus Fund provides funding to cover the cost difference between a low carbon vehicle and a conventional one[48]. Now on its seventh round of funding, having invested £14.8m in low carbon buses, the SGBF funds a number of bids annually. £3m was available for the seventh round in 2017/18, for which bidding has now closed. |
| | Switched-on-Fleets | Transport Scotland have continued to provide funding to support local authorities in the purchase or lease of EVs. |
| | Switched on @Work | Switched on @work supports organisations interested in helping their employees to identify the benefits of switching to ultra-low emission vehicles (ULEVs). ULEVs range from pure electric, plug-in hybrids and extended range electric vehicles. |
| | Switched on Towns and Cities | Transport Scotland's new Switched on Towns and Cities Challenge Fund aims to facilitate a step increase in the uptake of plug-in electric vehicles (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.<br><br>The Challenge Fund is targeted at local authorities who are well positioned to deliver the infrastructure and local incentives to support EV uptake. Round 1 of the Challenge Fund opened on 20 June 2018. |
| | Low Carbon Infrastructure Transition Programme | On the 22nd January 2018 a £60m fund was announced by the Scottish Government to support the delivery of low-carbon heating solutions, integrated energy systems and ULEV charging infrastructure. Funding of up to £100,000 will be made available for the development of business cases, or financial support of up to 50% of the total capital value of a project up to a maximum of £10m per project for capital ready projects. |
| | Transport Scotland Plug-in Vehicle Interest Free Loan | Transport Scotland continues to provide interest free loans to support the purchase of EVs for both domestic and business use. |
| | Scottish Government Workplace EV Charge Point Grant | The Scottish Government has made grant funding available to help organisations to install EV charging infrastructure on their premises. Eligibility criteria apply. |
| | Innovation Fund | The Scottish Government has set aside a £60m Innovation Fund to accelerate the development and application of new technologies that help meet the Government's environmental ambitions. This includes low carbon transport and digital projects and is expected to run until 2020. |

48 Transport Scotland, Scottish Green Bus Fund

**UK/Scottish Funding**

| Fund | Description |
|---|---|
| Innovate UK Funding | Innovate UK are a non-executive public body sponsored by the Department for Business, Energy and Industrial Strategy. They host regular funding competitions where funding is made available to promote the development and application of new technologies. Competitions are often focussed on Government priorities, which continue to include increasing the use of low carbon transport. |
| Office for Low Emission Vehicles | The Office for Low Emission Vehicles has periodically run funding competitions aimed at stimulating the uptake of ULEVs across the UK. |
| Faraday Challenge | Part of the Industrial Strategy Challenge Fund, the Government will invest £246m in battery technology over 4 years for the design, development and manufacture of electric batteries. |
| SSE Local Community Funds | SSE establish local and regional funds for each onshore wind farm they build. The funds focus on sustainable development of local communities and since 2002 over 1000 projects have been funded with grants totalling over £13m. Applications for funding are reviewed periodically by local community members to decide on which projects to fund. |
| SSE Sustainable Development Fund | In addition to their Local Community Funds, SSE have also established a fund for more significant projects which seek to deliver transformational social, economic and/or environmental changes in the community and develop sustainable ventures for the future. Applications for funding are invited on a periodic basis. |
| SMART: SCOTLAND | Providing grants to Scotland-based SMEs for feasibility studies and R&D projects that have a commercial endpoint. |

**European Funding**

| Fund | Description |
|---|---|
| Connecting Europe Facility (CEF) | The CEF supports the development of high sustainable, efficient trans-European networks in transport (€22.4bn), telecoms (€0.3bn) and energy (€4.7bn). The fund is worth €27.4bn over 2014 and 2020; projects should incorporate work over 3 participating states. |
| Horizon 2020 (H2020) | H2020 is a 7-year programme running from 2014-2020. Calls are listed in work programmes, of which draft work programmes for 2018-2020 are currently available listing call criteria and total funding available. Once work programmes are adopted, they will also indicate the expected schedule of calls. Of particular interest will be Societal Challenge 4 which covers Smart, Green and Integrated Transport. |
| Interreg North-West Europe (NWE) | Interreg NWE is a Cohesion Policy instrument aimed at reducing disparities between regions within NWE. Projects involving partners from at least 3 different participating states will be funded. Call six was open between 16th October and 17th November 2017. |
| European Regional Development Fund (ERDF) | ERDF makes investments on key themes including: innovation & research; the digital agenda; SME support; and the low-carbon economy. The amount of money dedicated to low carbon resources ranges from 12% to 20%, dependent on the economic development of the region. All funds allocated to Scotland are administered locally by the Scottish Government. |

# APPENDIX C: RAPID CHARGING CLUSTERS - SITE IDENTIFICATION

Rapid charging clusters provide a highly convenient form of charging infrastructure that could assist in supporting EV use in a wide range of different situations. However, the approach is likely to provide most benefit in situations where the level of demand for EV charging is expected to be high, or where ensuring prompt, reliable access to charging infrastructure is necessary. This could include supporting the use of EV taxis, serving locations of high periodic demand (e.g. ferry terminals or airports), providing charging opportunities at key points on the strategic road network, supporting major tourist centres or providing convenient charging infrastructure where there is a high proportion of properties with no off-street parking.

Clustered infrastructure is scalable and at many sites it may be cost effective to provide an initial lower number of charging units, but with the capacity to expand as demand and charging power levels increase.

Given the range of situations where clusters may provide benefit, and the ability to provide a scalable solution, there is no easy mechanism to identify and prioritise sites. It is suggested that a multi-criteria analysis considering factors that generate high demands be used to consider potential sites at a high level, with favourable sites requiring more detailed work to identify the level of infrastructure required both now and in the future.

Table 10 provides an overview of the proposed multi-criteria analysis factors proposed to be used.

| Criteria | Assessment Range | Reason |
|---|---|---|
| Population | Low: 0 – 10,000<br>Medium: 10,000 – 50,000<br>High: 50,000+ | General population will be an indicator of demand for charging, both from the resident population but also as a result of businesses, services and retail located within the population centre. |
| Car Ferry Terminal nearby | Yes<br>No | Car Ferries are likely to generate small peaks in vehicle number as ferries arrive. These periodic peaks could generate a demand for vehicle charging, particularly when charging facilities are not provided at the port or on ferries. |
| Airport nearby | Yes<br>No | Airports are likely to generate trips private vehicle, taxi trips and increased demand for car clubs and car rental. |
| Rail Station nearby | Yes<br>No | Rail stations are likely to generate trips by private vehicles, taxis and increase demand for car clubs and car rental. |

| Criteria | Assessment Range | Reason |
|---|---|---|
| Proximity to strategic road network | Low: Not located near 'A' Road network<br>Medium: Located within 1 mile of 'A' Road network<br>High: Located within 1 mile of 'A' Road network and within 5 miles of confluence of 'A' Roads | The strategic road network is likely to carry longer distance trips that could generate a demand for quick charging. |
| Tourist Centre | Yes<br>No | Areas with high levels of tourist accommodation are likely to attract visitors traveling by car, or a demand for car rental, car club vehicles and taxis. Ensuring that there is easy access to charging infrastructure will encourage tourists to utilise EVs. |
| Housing stock with no off-street parking | Low: less than 10 % of housing stock without access to off-street parking<br>Medium: Between 10-25% of housing stock without access to off-street parking<br>High: More than 25% of housing stock without access to off-street parking.<br>NB. A high level estimate of this criteria using aerial mapping has been made. | To ensure equitable access to EVs for all, facilities will need to be provided to support those that are unable to charge their vehicle overnight at home. This is likely to be most conveniently achieved through the provision of rapid charging clusters that act in a similar fashion to service stations allowing users to quickly recharge their vehicles and then park on street. |

An assessment of major towns within the HITRANS region and regional towns with key transport assets has been made using the above methodology. This is presented in Table 11. As can be seen, the approach suggests that Inverness is the highest priority site for a charging hub within the region, with Fort William, Oban and Kirkwall all scoring relatively high.

Table 11 – Charging Cluster Multi-criteria Analysis of Major Towns and Transport Assets in the HITRANS Region

| Location | Population | Ferry Terminal | Airport | Rail Station | Proximity to Strategic Road Network | Tourist Centre | Housing without Off-Street Parking | Priority |
|---|---|---|---|---|---|---|---|---|
| Inverness | High | No | Yes | Yes | High | Yes | Medium | High |
| Aviemore | Low | No | No | Yes | Medium | Yes | Low | Low |
| Fort William | Medium | Yes | No | Yes | High | Yes | Medium | Medium |
| Elgin | Medium | No | No | Yes | High | No | Low | Low |
| Oban | Low | Yes | Yes | Yes | Medium | Yes | Medium | Medium |
| Thurso | Low | Yes | No | Yes | Medium | No | Medium | Low |
| Uig | Low | Low | No | No | Medium | Yes | Low | Low |
| Kirkwall | Low | Yes | Yes | No | Medium | Yes | Medium | Medium |
| Rothesay | Low | Yes | No | No | Low | Yes | High | Low |
| Helensburgh | Medium | No | No | Yes | Medium | Low | Low | Low |

# APPENDIX D: PAYMENT FEES

**i. Current UK & Ireland Charging Structures**

Table 12 presents the current pricing charges and structure used by different private and public-sector organisations within the UK.

Table 12 – Summary of pricing structures for different EV charge point operators within the UK and Ireland.

| Network | Connection fee | Minimum Fee | Price per kWh | Overstay Charge | Empty to Full 30kWh vehicle - Price for charging | Cost for Average Session in HITRANS region (8.71kWh) |
|---|---|---|---|---|---|---|
| ChargePlace Scotland | Free | - | Free | - | Free | Free |
| Moray Council | - | - | £3.80 per session | - | £3.80 | £3.80 |
| Highland Council (planned) | - | £1.50 | 15p/kWh | - | £4.50 | £1.50 |
| Shetland Council | - | £1.50 | 15p/kWh | - | £4.50 | £1.50 |
| ESB Ecars (ROI) | Free | - | Free | - | Free | Free |
| ECARNI (NI) | Free | - | Free | - | Free | Free |
| Charge Your Car (UK) | £1 | - | Varies: Free-£4.50 per hour+ | Varies: Some Rapids charged £5 after 1st hour | Varies (Minimum: £1) | Varies (Minimum: £1) |
| Shell | Free | - | 25p/kWh – increasing to 49p/kWh in June 2018 | - | £7.50; £15 (June 2018) | £2.18 £4.27 (Jun 2018) |
| Polar Plus | £1.20 | - | 10.8p/kWh | - | £4.44 | £2.14 |
| Polar Instant (non-members) | £1.20 | - | £1 per hour 13A 3kW units £1.50 per hour for type 2 units – 3.6kW, 7kW, 11kW, 22kW | - | 3kW: £11.20 3.6kW: £14.20 7kW: £8.20 11kW: £5.20 22kW: £3.20 | 3kW: £4.20 3.6kW: £5.20 7kW: £3.20 11kW: £2.20 22kW: £2.20 |
| Polar Instant (non-members) Rapids | £1.20 | - | £6 per 30 minutes | - | £7.20 | £7.20 |
| Ecotricity | £3 | - | 17p/kWh | - | £8.10 | £4.48 |
| Source London Rapids | £1.80 | - | 30p/kWh | - | £10.80 | £4.41 |

| Network | Connection fee | Minimum Fee | Price per kWh | Overstay Charge | Empty to Full 30kWh vehicle - Price for charging | Cost for Average Session in HITRANS region (8.71kWh) |
|---|---|---|---|---|---|---|
| Source London 3-7kW | Free | - | 3.6p/minute | - | 3kW: ~ £21.60<br>7kW: ~ £9.26 | 3kW: £6.27<br>7kW: £2.68 |
| Genie Point 7kW-22kW | £0.50 | - | 30p/kWh | £10 overstay charge over 4 hours | £9.50 | £3.11 |
| Genie Point Rapids | £1.80 | - | 30p/kWh | £10 overstay charge over 1 hour | £10.80 | £4.41 |
| Plugged-In Midlands | Free | - | 10.8p/kWh | - | £3.24 | £0.94 |
| GMEV (Manchester) | £1 | - | Free | - | £1 | £1 |
| Source West 3kW-7kW | £1 | - | Free | - | £1 | £1 |
| Source West Rapid | (£1 if no charging fee) | - | £4.50 for 1st hour | £5 after 1st hour | £1 / £4.50 | £1 / £4.50 |
| ChargerNet Rapid | Free | - | £4 for 1st hour | £12 after 1 st hour | £4 | £4 |
| Recharge (Liverpool) | £1 | - | Free | - | £1 | £1 |
| Energise | £1 | - | Free | - | £1 | £1 |
| Engenie (Rapids) (Cheshire & Hampshire) | - | 36p transaction fee | 36p/kWh | - | £11.16 | £3.50 |
| LiFe (North West) | - | £2 | 30p/kWh | - | £9 | £2.61 |
| EV Driver (Suffolk) | Free | - | 25p/kWh | - | £7.50 | £2.18 |

### ii. Estimation of payment for HITRANS region

The stakeholder workshop on 1st November 2017 highlighted that fair payment for charging infrastructure should seek to cover operational and maintenance costs. The following provides working to estimate approximately what payment would need to be to achieve that value.[49]

#### Electricity costs

Table 13 provides an estimate of the annual usage of current charging units across the HITRANS region. The data has been estimated using usage information obtained from ChargePlace Scotland for the period of 1st January 2017 to September 12th 2017.

49 This calculation is based on the assumption of "current usage data" across the entire region. This does not consider the implication of introducing new chargers, or an increase in use through EV uptake. Fees for individual local authorities may vary.

Table 13 - HITRANS chargers and usage statistics by power output type

| Charger Unit Type | No. of Active CPS Charger units | Total kWh (rounded) | Total No. of Sessions | Average No. of Sessions per day (rounded) | Average kWh per session (2 d.p) | Average Duration per session (hrs) (2 d.p) |
|---|---|---|---|---|---|---|
| Slow-Standard (3-7kW) | 36 | 28,072 | 4,394 | 17 | 6.39 | 8.66 |
| Fast (22kW) | 24 | 34,011 | 4,808 | 19 | 7.07 | 3 |
| Rapid (43-50kW) | 49 | 142,195 | 14,239 | 56 | 9.99 | 0.72 |
| **All Units** | **109** | **204,278** | **23,441** | **92** | **8.71** | **2.62** |

This highlights that annually around 292,246 kWh of electricity is expected to be used. Assuming the average cost of electricity for a service supplier is currently 10p/kWh (based upon Department for Business, Energy and Industrial Strategy estimates for services)[50], the cost to supply electricity to the regions charge points is approximately £29,246 per year, or £268 per charging unit

However, it should be noted that rapid charging units are more heavily utilised than lower powered alternatives. If the annual electricity cost is calculated by unit power type it would suggest that an annual cost for a slow-standard unit is £114, for a fast charging unit £207 and for a rapid charging unit £424.

**Maintenance costs**

Maintenance costs are more difficult to estimate. With the market for charging units being fairly new, there is limited publicly available information about maintenance costs or lifespan of equipment. The following sources provide an indication of the typical maintenance costs estimated in other countries:

- Maintenance costs for Public 2 chargers US (equivalent to 7kW UK fast charger): $300 per charger per year[51].
- Maintenance costs for Quick chargers in US (UK Rapid charger equivalent): $1,500 to $2,500 per charger per year.[52]
- Norway: Rapids: Maintenance around €3,750-€5,000 per year.[53]

Given exchange rates and differences in labour markets the following annual maintenance costs have been assumed for charging infrastructure within the HITRANS region.

- 3kW/7kW/22kW - £500 per annum
- 43kW/50kW - £2,000 per annum

It should be noted that most new infrastructure will be provided with a 3-5 year warranty agreement. This has not been accounted for in calculations.

**Back office support**

Data and payment communications require charging units to be connected through to a back office system. While this is provided by Transport Scotland at present, different sources estimate the cost to be approximately between £60[54] and £150[55] per charging unit per annum.

It has been assumed that back office support will be £100 a year for the HITRANS region.

**Estimated payment to cover costs – consistent payment for charging units**

Based on the above parameters the following provides an estimate of the average cost needed to cover operational and maintenance at present across all charging units in the HITRANS region each year:

50 Updated energy and emission projections 2016: Annex M: Growth assumptions and prices, Department for Business, Energy & Industrial Strategy Electricity, 2017. Prices taken from Reference Scenario and Services prices. Note, these electricity prices exclude VAT.

51 Financial Viability of Non-Residential Electric Vehicle Charging Stations, Chang, D. et al., August 2012

52 Take Charge: A Roadmap to Electric New York City Taxis, NYC Taxi & Limousine Commission, December 2013

53 Electromobility in Norway – Experiences and Opportunities with Electric Vehicles, TOI, November 2013

54 Vehicle Charging Infrastructure – A Buyers Guide, ESPO, Accessed on 24th November 2017

55 EV Charging Station Infrastructure Costs, Clean Technica, 3rd May 2014

Electricity cost = £29,246[56]
Maintenance cost = (£500 x 60) + (£2000 x 49) = £128,000
Back office cost = 109 x £100 = £10,900
Total cost (operation and maintenance) per annum = £168,146
Cost per session = £168,146 / 34,224 events = £4.91
Cost per kWh consumed = £168,146 / 292,246 = £0.58

This results in a 58p/kWh tariff to recover maintenance and operational costs. Given the market being in its nascent stages, this tariff would likely discourage further uptake of EVs and use of charging facilities.

**iii. Payment Fee mechanism Analysis**

A 58p/kWh tariff is likely to be too high a tariff set across the HITRANS region, given market immaturity. As shown in Table 12, there are multiple payment mechanisms currently adopted across the UK, which may be more suitable in short-term. This section considers the application of a selection of these scenarios for the HITRANS area. Table 14 presents an overview of example payment rates across the UK and their potential applications in the HITRANS region. Raw calculations for each of these tariffs has been included below from Table 15 - Table 23.

Table 14 - Examples of applying different payment mechanisms to the HITRANS region

| Scenario | | Example Tariff | Break-even point | Benefits & Risks |
|---|---|---|---|---|
| 1 | Fees slightly more expensive than domestic electricity prices – Fee suggested by stakeholder workshop group, November 2017 | Tariff applied as 10% more than residential electricity prices from 2018, increasing by an extra 1% each year (i.e. 17p/kWh in 2018) | 2032 | • Suitable for an immature market<br>• May not discourage EV uptake<br>• Longer payback period opposed to other options |
| 2 | Option 1: Fee priced per kWh consumed – Fee currently used by petrol-station operators that have recently introduced EV charging | 25p/kWh (index-linked fee)[57] | 2025 | • Balances incentivising of home charging, affordability and break-even point.<br>• 50% more expensive than charging at home |
| 3 | Option 2: Fee priced per kWh consumed – Fees currently used more widely across southern England | 30p/kWh (index-linked fee) | 2023 | • Designed to bring break-even point forward<br>• Disincentivises use of public chargers more than Scenario 2<br>• Twice as expensive as charging at home |
| 4 | Split tariff per power-types – A suggested mix of scenario 1 on lower power types and typically fee for rapid units across England. | 3-22 kW: Apply same fee as Scenario 1<br>43 -50kW: 30p/kWh (index-linked fee) | 2025 | • Provides low cost option for immature market.<br>• Provides more expensive option for users requiring rapid charge<br>• Brings break-even point forward compared to Scenario 1.<br>• Enables cost recovery for more expensive rapid units.<br>• Future-proofs against potential changes in demand for both types of charging. |

56 Note: These calculations do not consider 'Capacity Charge' which may otherwise be applied as regular fees for higher powered units. Charges will vary depending on local network capacity and usage of charge point locations.
57 Index-linked refers to a fee adjustment according to the value of the retail price index. In this instance, the retail price index for all years is adjusted from prices for 2017.

| Scenario | | Example Tariff | Break-even point | Benefits & Risks |
|---|---|---|---|---|
| 5 | Fee per hour – Fee to encourage turnover of vehicles and more representative of recouping equipment costs. | 3-22kW: £1.50 / hr<br>43-50kW: £4.50 / hr | 2018 | • May encourage hour-long stays for rapid units<br>• 7kW chargers will become proportionally more expensive than 22kW.<br>• May increase demand for 22kW+ more than 7kW – requiring upgrading of infrastructure or reducing cost of 7kW chargers.<br>• Shortest break-even point, enabling cost recovery for more expensive rapid units. |
| 6 | Fixed cost connection and applied fee per kWh consumed – Charge Your Car connection fee currently applied across England, and UK-rate per kWh | £1 connection fee + 30p/kWh | 2020 | • Connection fee may discourage users from charging.<br>• Connection fee may encourage greater length of stay as a significant proportion of the overall fee.<br>• 30p/kWh is double cost of charging at home.<br>• Chargers will need to be at optimal reliability for user satisfaction. i.e. >95%<br>• Stakeholders from the workshop held on the 1st November 2017, are strongly against the introduction of a connection fee.. |
| 7 | Minimum Fee and applied fee per kWh consumed – Fee currently applied by Highland Council | £1.50 minimum fee + 15p/kWh | 2032+ | • May encourage greater length of stay (minimum fee is equivalent to 10kWh)<br>• Fee is greater than the region's average session duration (8.71 kWh).<br>• Guaranteed return per charge – easier to review and forecast revenue.<br>• Can adjust per kWh price over time. |
| 8 | Fixed fee per session - Fee currently applied by Moray Council | £3.80 per session | 2021 | • May encourage greater length of stay - £3.80 is the equivalent to 27 kWh of charge at average 2017 residential electricity prices (14p/kWh).<br>• Equates to roughly 43.6p/kWh – the most expensive scenario<br>• Fee is three times greater than the region's average session duration.<br>• Chargers will need to be at optimal reliability for user satisfaction. i.e. >95%. |

The following assumptions have been considered for each of the different scenarios in calculating operational costs[58]:

- ULEV sales growth extrapolated from 2015 Q4-2017 Q4 growth – a 36.56% Compound Annual Growth Rate.
- Table 13 annual usage figures used to understand current levels of charger usage, annual sessions and annual sessions per ULEV.
- 10% annual growth in the number of electric vehicle chargers; thus 10% growth in maintenance costs.
- Electricity pricing forecasts derived from the Department for Business, Energy & industrial Strategy, energy and emission projections.[59]

58 Note: These calculations only consider application across the entire HITRANS region. Applying these scenarios across individual local authority areas, will vary.

59 Department for Business, Energy & Industrial Strategy (2017) Updated energy and emission projections 2016: Annex M: Growth assumptions and prices: Electricity costs taken from Reference Scenario and Services prices. Note, these electricity costs exclude VAT.

Table 15 - Forecasted Operational costs across the HITRANS region

| Variable | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| No. of ULEVs | 582 | 843 | 1,199 | 1,685 | 2,350 | 3,244 | 4,460 |
| Annual Sessions per ULEV | 58 | 58 | 58 | 58 | 58 | 58 | 58 |
| Annual Sessions | 33,556 | 48,594 | 69,130 | 97,175 | 135,473 | 187,021 | 257,119 |
| Annual kWh consumption | 292,417 | 423,466 | 602,428 | 846,819 | 1,180,559 | 1,629,770 | 2,240,627 |
| Electricity Prices - Services | £0.093 | £0.105 | £0.109 | £0.114 | £0.120 | £0.117 | £0.121 |
| Electricity index-factor | 1.000 | 1.129 | 1.172 | 1.226 | 1.290 | 1.258 | 1.301 |
| Electricity costs | £27,195 | £50,201 | £76,962 | £118,336 | £182,796 | £239,892 | £352,742 |
| Maintenance | £172,940 | £190,234.0 | £209,257.4 | £230,183.1 | £253,201.5 | £278,521.6 | £306,373.8 |
| Operational Costs | £200,135 | £240,435 | £286,219 | £348,519 | £435,998 | £518,413 | £659,116 |
| **Variable** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| No. of ULEVs | 6,113 | 8,361 | 11,419 | 15,577 | 21,214 | 28,844 | 39,154 |
| Annual Sessions per ULEV | 58 | 58 | 58 | 58 | 58 | 58 | 58 |
| Annual Sessions | 352,443 | 482,074 | 658,360 | 898,092 | 1,223,094 | 1,663,028 | 2,257,430 |
| Annual kWh consumption | 3,071,318 | 4,200,971 | 5,737,192 | 7,826,303 | 10,658,497 | 14,492,244 | 19,672,083 |
| Electricity Prices - Services | £0.124 | £0.129 | £0.128 | £0.130 | £0.134 | £0.131 | £0.132 |
| Electricity index-factor | 1.333 | 1.387 | 1.376 | 1.398 | 1.441 | 1.406 | 1.416 |
| Electricity costs | £507,791 | £751,703 | £1,010,733 | £1,422,199 | £2,057,892 | £2,665,234 | £3,666,141 |
| Maintenance | £337,011.1 | £370,712.2 | £407,783.5 | £448,561.8 | £493,418.0 | £542,759.8 | £597,035.8 |
| Operational Costs | £844,802 | £1,122,415 | £1,418,516 | £1,870,761 | £2,551,310 | £3,207,994 | £4,263,176 |

**Scenario 1: Fees slightly more expensive than domestic electricity prices**

- A tariff recommended by stakeholders of a workshop held on 1st November 2017.
- Tariff applied as 10% more than residential electricity prices from 2018, increasing by an extra 1% each year
- Break-even: 2032

Table 16 - Applying Scenario 1 across the HITRANS region

| Variable | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Proposed fee increase | 0% | 10% | 11% | 12% | 13% | 14% | 15% |
| Electricity Prices - Residential | £0.141 | £0.155 | £0.158 | £0.162 | £0.167 | £0.162 | £0.167 |
| Actual Electricity fee - Residential £ / kWh | £0.141 | £0.170 | £0.175 | £0.182 | £0.188 | £0.185 | £0.192 |
| Revenue +x% Residential electricity prices | £45,245 | £72,098 | £105,682 | £154,084 | £222,475 | £300,995 | £430,143 |
| Profit/Loss | -£154,889 | -£168,338 | -£180,539 | -£194,438 | -£213,526 | -£217,423 | -£228,981 |
| Net cash flow | -£154,889 | -£168,338 | -£348,877 | -£543,314 | -£756,841 | -£974,264 | -£1,203,245 |
| **Variable** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Proposed fee increase | 16% | 17% | 18% | 19% | 20% | 21% | 22% |
| Electricity Prices - Residential | £0.174 | £0.186 | £0.188 | £0.183 | £0.192 | £0.186 | £0.179 |
| Actual Electricity fee - Residential £ / kWh | £0.202 | £0.217 | £0.221 | £0.218 | £0.230 | £0.225 | £0.218 |
| Revenue +x% Residential electricity prices | £620,337 | £912,068 | £1,270,341 | £1,704,024 | £2,451,500 | £3,263,429 | £4,297,307 |
| Profit/Loss | -£224,476 | -£210,364 | -£148,197 | -£166,767 | -£99,854 | £55,378 | £34,051 |
| Net cash flow | -£1,427,721 | -£210,364 | -£1,786,282 | -£1,953,049 | -£2,052,904 | -£1,997,526 | £34,051 |

**Scenario 2: Option 1: Fee priced per kWh consumed**

- Fee currently used by petrol-station operators that have recently introduced EV charging
- 25p/kWh (index-linked fee)
- Break-even: 2025

Table 17 - Applying Scenario 2

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Revenue (25p/kWh) - index-linked | £73,099 | £119,529 | £176,522 | £259,515 | £380,834 | £512,600 | £728,822 |
| Profit/Loss | -£127,034 | -£120,907 | -£109,699 | -£89,007 | -£55,168 | -£5,818 | £69,698 |
| Net cash flow | -£127,034 | -£120,907 | -£230,606 | -£319,613 | -£374,781 | -£380,600 | -£310,901 |
| | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Revenue (25p/kWh) - index-linked | £1,023,795 | £1,456,820 | £1,974,130 | £2,735,058 | £3,839,434 | £5,094,991 | £6,962,059 |
| Profit/Loss | £178,981 | £334,389 | £555,592 | £864,266 | £1,288,079 | £1,886,940 | £2,698,803 |
| Net cash flow | -£131,920 | £202,469 | £758,061 | £1,622,327 | £2,910,406 | £4,797,346 | £7,496,148 |

**Scenario 3: Option 2: Fee priced per kWh consumed**

- Fees currently used more widely across southern England
- 30p/kWh (index-linked fee)
- Break-even: 2023

Table 18 - Applying Scenario 3

| Variable | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Revenue (30p/kWh) - index-linked | £87,719 | £143,435 | £211,826 | £311,417 | £457,000 | £615,120 | £874,586 |
| Profit/Loss | -£112,414 | -£97,001 | -£74,395 | -£37,104 | £20,999 | £96,702 | £215,463 |
| Net cash flow | -£112,414 | -£97,001 | -£171,396 | -£208,500 | -£187,501 | -£90,800 | £124,663 |
| **Variable** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Revenue (30p/kWh) - index-linked | £1,228,554 | £1,748,184 | £2,368,956 | £3,282,069 | £4,607,321 | £6,113,989 | £8,354,470 |
| Profit/Loss | £383,740 | £625,753 | £950,418 | £1,411,277 | £2,055,966 | £2,905,938 | £4,091,215 |
| Net cash flow | £508,403 | £1,134,156 | £2,084,574 | £3,495,851 | £5,551,818 | £8,457,755 | £12,548,970 |

**Scenario 4: Split tariff per power type**

- A suggested mix of scenario 1 on lower power types and typically fee for rapid units across England
- 3-22 kW chargers: Apply same fee as Scenario 1 - Tariff applied as 10% more than residential electricity prices from 2018, increasing by an extra 1% each year.
- 43-50kW chargers: 30p/kWh (index-linked fee)
- Break-even: 2025

Table 19 - Applying Scenario 4

| Variable | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Electricity consumption from 3-22kW units (kWh) | 88,864 | 128,700 | 183,090 | 257,366 | 358,796 | 495,321 | 680,973 |
| Electricity fee for 3-22kW units £/kWh | £0.141 | £0.170 | £0.175 | £0.182 | £0.188 | £0.185 | £0.192 |
| Revenue from 3-22kW units | £13,750 | £21,912 | £32,118 | £46,828 | £67,613 | £91,477 | £130,727 |
| Electricity consumption from 43-50kW units (kWh) | 203,534 | 294,775 | 419,351 | 589,471 | 821,788 | 1,134,484 | 1,559,702 |
| Revenue (index linked) from 43-50kW | £61,060 | £99,843 | £147,449 | £216,773 | £318,111 | £428,176 | £608,787 |
| Total revenue | £74,811 | £121,755 | £179,568 | £263,602 | £385,725 | £519,653 | £739,513 |
| Profit/Loss | -£125,322 | -£118,681 | -£106,653 | -£84,920 | -£50,277 | £1,235 | £80,390 |
| Net cash flow | -£125,322 | -£118,681 | -£225,335 | -£310,255 | -£360,532 | -£359,297 | -£278,907 |
| **Variable** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Electricity consumption from 3-22kW units (kWh) | 933,437 | 1,276,763 | 1,743,652 | 2,378,577 | 3,239,339 | 4,404,495 | 5,978,756 |
| Electricity fee for 3-22kW units £/kWh | £0.202 | £0.217 | £0.221 | £0.218 | £0.230 | £0.225 | £0.218 |
| Revenue from 3-22kW units | £188,529 | £277,190 | £386,075 | £517,877 | £745,046 | £991,803 | £1,306,013 |
| Electricity consumption from 43-50kW units (kWh) | 2,137,947 | 2,924,300 | 3,993,664 | 5,447,896 | 7,419,388 | 10,088,063 | 13,693,753 |
| Revenue (index linked) from 43-50kW | £855,179 | £1,216,886 | £1,648,997 | £2,284,601 | £3,207,090 | £4,255,861 | £5,815,428 |
| Total revenue | £1,043,708 | £1,494,076 | £2,035,072 | £2,802,479 | £3,952,136 | £5,247,663 | £7,121,441 |
| Profit/Loss | £198,895 | £371,645 | £616,533 | £931,687 | £1,400,782 | £2,039,612 | £2,858,185 |
| Net cash flow | -£80,013 | £291,632 | £908,166 | £1,839,853 | £3,240,634 | £5,280,246 | £8,138,431 |

**Scenario 5: Fee per hour**

- Fee to encourage turnover of vehicles and more representative of recouping equipment costs.
- 3-22kW chargers: £1.50 / hr
- 43-50kW chargers: £4.50 / hr
- Break-even: 2018

Table 20 - Applying Scenario 5

| Variable | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Electricity consumption from 3-22kW units (kWh) | 54,466.65 | 78,883.22 | 112,220.19 | 157,745.21 | 219,914.26 | 303,593.16 | 417,383.47 |
| Electricity fee for 3-22kW units £/kWh | 20,646.12 | 29,901.46 | 42,538.17 | 59,794.88 | 83,360.66 | 115,079.97 | 158,213.31 |
| Revenue from 3-22kW units | 14,674.55 | 21,252.92 | 30,234.66 | 42,500.13 | 59,249.87 | 81,794.86 | 112,452.55 |
| Electricity consumption from 43-50kW units (kWh) | £112,669 | £163,177 | £232,138 | £326,310 | £454,912 | £628,010 | £863,395 |
| Revenue (index linked) from 43-50kW | £66,035 | £95,638 | £136,056 | £191,251 | £266,624 | £368,077 | £506,036 |
| Total revenue | £178,705 | £258,815 | £368,193 | £517,561 | £721,537 | £996,087 | £1,369,432 |
| Profit/Loss | -£21,428 | £18,379 | £81,973 | £169,039 | £285,535 | £477,668 | £710,308 |
| Net cash flow | -£21,428 | £18,379 | £100,351 | £269,390 | £554,926 | £1,032,594 | £1,742,902 |
| **Variable** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Electricity consumption from 3-22kW units (kWh) | 572,124.43 | 782,556.11 | 1,068,722.97 | 1,457,882.12 | 1,985,462.60 | 2,699,612.23 | 3,664,511.65 |
| Electricity fee for 3-22kW units £/kWh | 216,869.39 | 296,635.59 | 405,109.95 | 552,624.55 | 752,609.13 | 1,023,314.57 | 1,389,069.18 |
| Revenue from 3-22kW units | 154,143.26 | 210,838.31 | 287,938.13 | 392,786.41 | 534,928.52 | 727,336.58 | 987,302.30 |
| Electricity consumption from 43-50kW units (kWh) | £1,183,491 | £1,618,788 | £2,210,749 | £3,015,760 | £4,107,108 | £5,584,390 | £7,580,371 |
| Revenue (index linked) from 43-50kW | £693,645 | £948,772 | £1,295,722 | £1,767,539 | £2,407,178 | £3,273,015 | £4,442,860 |
| Total revenue | £1,877,135 | £2,567,560 | £3,506,471 | £4,783,299 | £6,514,286 | £8,857,405 | £12,023,232 |
| Profit/Loss | £1,032,322 | £1,445,129 | £2,087,933 | £2,912,507 | £3,962,931 | £5,649,353 | £7,759,976 |
| Net cash flow | £2,775,224 | £4,220,353 | £6,308,285 | £9,220,792 | £13,183,724 | £18,833,077 | £26,593,053 |

**Scenario 6: Fixed cost connection and applied fee per kWh consumed**

- Charge Your Car £1 connection tariff currently applied across multiple regions in England, and UK-rate per kWh.
- Additional 30p/kWh to recoup costs
- £1 connection fee + 30p/kWh
- Break-even: 2020

Table 21 - Applying Scenario 6

| Variable | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Revenue (30p/kWh; £1 connection) | £121,272 | £192,029 | £280,957 | £408,592 | £592,473 | £802,141 | £1,131,705 |
| Profit/Loss | -£78,861 | -£48,407 | -£5,264 | £60,071 | £156,471 | £283,722 | £472,581 |
| Net cash flow | -£78,861 | -£48,407 | -£53,671 | £6,399 | £162,871 | £446,593 | £919,174 |
| **Variable** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Revenue (30p/kWh; £1 connection) | £1,580,997 | £2,230,258 | £3,027,316 | £4,180,161 | £5,830,415 | £7,777,017 | £10,611,900 |
| Profit/Loss | £736,183 | £1,107,827 | £1,608,778 | £2,309,369 | £3,279,060 | £4,568,966 | £6,348,645 |
| Net cash flow | £1,655,358 | £2,763,184 | £4,371,962 | £6,681,331 | £9,960,392 | £14,529,357 | £20,878,002 |

**Scenario 7: Minimum Fee and applied fee per kWh consumed**

- Fee planned by Highland Council
- £1.50 minimum fee + 15p/kWh
- Break-even: 2032+

Table 22 - Applying Scenario 7

| Variable | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Revenue | £50,329 | £72,891 | £103,696 | £145,762 | £203,209 | £280,531 | £385,678 |
| Profit/Loss | -£149,804 | -£167,545 | -£182,525 | -£202,759 | -£232,793 | -£237,887 | -£273,446 |
| Net cash flow | -£149,804 | -£167,545 | -£350,071 | -£552,830 | -£785,623 | -£1,023,510 | -£1,296,955 |
| **Variable** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Revenue | £528,664 | £723,111 | £987,540 | £1,347,137 | £1,834,641 | £2,494,542 | £3,386,145 |
| Profit/Loss | -£316,149 | -£399,320 | -£430,998 | -£523,654 | -£716,713 | -£713,509 | -£877,111 |
| Net cash flow | -£1,613,104 | -£2,012,425 | -£2,443,423 | -£2,967,078 | -£3,683,791 | -£4,397,301 | -£5,274,411 |

**Scenario 8: Fixed fee per session**

- Fee currently applied by Moray Council
- £3.80 per session
- Break-even: 2021

Table 23 - Applying Scenario 8

| Variable | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Revenue | £127,501 | £184,657 | £262,696 | £369,265 | £514,796 | £710,679 | £977,051 |
| Profit/Loss | -£72,632 | -£55,779 | -£23,525 | £20,743 | £78,794 | £192,261 | £317,927 |
| Net cash flow | -£72,632 | -£55,779 | -£79,304 | -£58,561 | £20,233 | £212,494 | £530,421 |
| **Variable** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Revenue | £1,339,283 | £1,831,881 | £2,501,767 | £3,412,748 | £4,647,758 | £6,319,507 | £8,578,234 |
| Profit/Loss | £494,469 | £709,450 | £1,083,229 | £1,541,956 | £2,096,403 | £3,111,455 | £4,314,978 |
| Net cash flow | £1,024,891 | £1,734,340 | £2,817,570 | £4,359,526 | £6,455,929 | £9,567,384 | £13,882,362 |

### iv. Considering an appropriate tariff

In addition to determining the financial benefits of a tariff, each local authority may have varying individual priorities. Table 24Table 15 presents an overview of some of the likely questions local authorities will need to consider when deciding on a suitable payment mechanism.

Table 24 – Local authority considerations for selecting charging tariffs

| Consideration | Questions |
|---|---|
| Local Authority EV policy | • What are the local authority's ambitions for EVs?<br>• How far away are these numbers from 2032 targets?<br>• How rapidly does the local authority want to increase EV usage?<br>• What other incentives does the Local Authority provide to EV owners?<br>• What are neighbouring local authority ambitions? |
| Local Authority EV usage | • What capacity are the current chargers operating at?<br>• What are the plans for future EV charging infrastructure?<br>• What is hourly cost of ICE parking around the charging location?<br>• How long do you want users at chargers?<br>• What is balance between on-street vs off-street charger location?<br>• How might this tariff affect the impact on the wider region?<br>• Are there charger locations that are underperforming? |
| Local Authority financial implications | • How quickly will the local authority need to recoup costs?<br>• What is the future EV infrastructure budget?<br>• What is the future operation model (e.g. public or privately operated)?<br>• Will the Local Authority be using the network for their own fleet vehicles?<br>• Overall Transport budget considerations<br>• What are the implications on existing or future energy network? |

**v. Overstay Penalties**

Charge point availability has been highlighted by stakeholders within the region as key to generating confidence in EV use, particularly for longer distance movements within the region.

To encourage increased turnover of charging units a number of network operators within the UK have introduced penalty fees that apply when a vehicle has been plugged into the charge point for a suitably long duration. These fees have typically been applied to higher powered charging units (43kWh / 50kWh rapid charger units) where most vehicles can complete an 80% charge in 20-30 minutes or 100% in around 35-45 minutes.

The following summarises the penalty fees applied by a number of different UK operators:

- Charge Your Car – £5 after the 1st hour for some rapid charge units;
- Source West – £5 after the 1st hour for rapid charger units;
- ChargerNet – £12 after the 1st hour for rapid charger units;
- Tesla Superchargers – Once fully charged, £0.30 / minute; and
- GeniePoint: £10 overstay charge after 1st hour for rapid charger units, £10 overstay charge after 4 hours for fast charger units

Table 25 and Table 26 present the current proportion of sessions across the HITRANS region, which have outstayed the typical duration required to charge a 30kWh vehicle from empty to full for the respective power outlet type.

It is assumed that a 22kW charger will take 1hr 20 – 1hr 40 minutes to charge, whilst 43-50kW chargers will take around 35-45 minutes.

Table 25 – Current percentage of dwell times at fast charging infrastructure above 1.75 hours

| Output Type | No. of Sessions over 1.75 hours | No. of Sessions over 2 hours | No. of Sessions over 2.5 hours | No. of Sessions over 3 hours | No. of Sessions over 3.5 hours | No. of Sessions over 4 hours |
|---|---|---|---|---|---|---|
| 22kW | 2,507 | 2,286 | 1,853 | 1,499 | 1,276 | 1,047 |
| % of total sessions | 52% | 48% | 39% | 32% | 27% | 22% |

Table 26 – Current percentage of dwell times at rapid charging infrastructure above 0.75 hours

| Output Type | No. of Sessions over 0.75 hours | No. of Sessions over 1 hour | No. of Sessions over 1.5 hours | No of Sessions over 2 hours | No. of sessions over 2.5 hours | No. of sessions over 3 hours |
|---|---|---|---|---|---|---|
| 43 & 50kW | 4,348 | 2,695 | 1,068 | 587 | 395 | 313 |
| % of total sessions | 31% | 19% | 7% | 4% | 3% | 2% |

Based on the information above, there is clearly a large percentage of vehicles overstaying the typical time to charge a vehicle within the HITRANS region.

At present it is understood that, due to limitations in charging infrastructure technology and back office systems, the point at which a vehicle's battery capacity is full is not obtainable. However, systems monitor the time the vehicle is connected to and disconnected from the charging unit.

As a result, it is suggested that a payment of £5 after the 1st hour for rapid charging units and £5 after the first 4 hours for 7-22kW charging points may be suitable. This aligns with other operators in the UK.

**vi. Recommendation**

Based upon published operational and maintenance data a payment mechanism of at least a £1 connection fee and £0.48p / kWh would cover the cost of charging in the HITRANS region at present. This figure could be reduced further if the number of units within their warranty period are known, or if a greater understanding of typical local maintenance costs can be obtained.

The £1 connection fee and £0.48p / kWh figure is in excess of what most other operators in the UK are charging and is likely to be unpalatable to users. It is suggested that a fee level of £1 connection fee and a £0.30p / kWh would be an appropriate maximum. This would bring payment in the HITRANS region into alignment with other operators within the UK. This figure would also put energy prices only a few pence above typical UK home energy tariffs, ensuring that those without off road parking are not significantly disadvantaged.

To improve turnover at charging points it is also recommended that an overstay charge is introduced. It is suggested that a payment of £5 after the 1st hour for rapid charging units and £5 after the first 4 hours for 7-22kW charging points is appropriate.

# APPENDIX E: DEVELOPMENT PLANNING

**i. Existing EV Development Guidelines**

Table 27 provides a summary of development guidelines for EV charging infrastructure that are applied by different local and regional authorities across the UK. The guidelines have been split by development type.

Table 27 – Public authority development guidelines for EV charging infrastructure

| Broad Development Type | Greater London Authority | Lancaster City Council | Durham County Council | Dudley Metropolitan Borough Council | Leeds City Council | Surrey County Council | Milton Keynes Council |
|---|---|---|---|---|---|---|---|
| Residential (Allocated parking) | 20% of parking spaces with active provision (with charging unit)<br><br>20% of parking spaces with passive provision (with ability to install charging unit in future)<br><br>3kW charging | 1 charge point per dwelling (3.7kW or higher) | No requirement | 1 external electric charging point per dwelling (32 amp, 3 pin) | 1 charge point per unit (32amp, 3 pin) | 1 charge point per unit (power not specified) | 1-20 parking spaces, no requirement<br><br>21-50 parking spaces, 1 electric charging point<br><br>51-100 parking spaces, 2 electric charging points<br><br>1 charging point per 100 parking spaces thereafter<br><br>No charging power specified |

| Broad Development Type | Greater London Authority | Lancaster City Council | Durham County Council | Dudley Metropolitan Borough Council | Leeds City Council | Surrey County Council | Milton Keynes Council |
|---|---|---|---|---|---|---|---|
| Residential (Non-allocated parking) | 20% of parking spaces with active provision (with charging unit)<br><br>20% of parking spaces with passive provision (with ability to install charging unit in future)<br><br>3kW charging | 10% of all bays provided with dedicated charging points. All other spaces to be provided with passive wiring to allow future connection (3.7kW or higher) | No requirement | Financial contribution to council | 1 charge point per 10 spaces | 20% of all available parking spaces to have electric charging points (power not specified) | 1-20 parking spaces, no requirement<br><br>21-50 parking spaces, 1 electric charging point<br><br>51-100 parking spaces, 2 electric charging points<br><br>1 charging point per 100 parking spaces thereafter<br><br>22kW charger |
| Hotel | 10% of parking spaces with active provision (with charging unit)<br><br>10% of parking spaces with passive provision (with ability to install charging unit in future)<br><br>3kW charging | < 50 bays – At least two electric charging bays and infrastructure<br><br>>50 bays - A total of 4% of the total provision of parking are electric bays with charging infrastructure<br><br>At least 7.4kW charging units | Minimum of 1 charging space per 30-100 parking spaces<br><br>Or 2 charging spaces for over 100 parking spaces | 5 % of all parking spaces (7kW) | 10-20 parking spaces – 1 x 7.4kW charger + 1 x 43kW charger<br><br>21-60 parking spaces – 2 x 7.4kW charger + 1 x 43kW charger<br><br>61 – 120 parking spaces – 4 x 7.4kW charger + 1 x 43kW charger<br><br>>120 spaces – 1:30 spaces to be 7.4kW charger + 1:120 spaces to be 43kW charger | 5% of available spaces to be fitted with a slow charger (power not specified) | |

| Broad Development Type | Greater London Authority | Lancaster City Council | Durham County Council | Dudley Metropolitan Borough Council | Leeds City Council | Surrey County Council | Milton Keynes Council |
|---|---|---|---|---|---|---|---|
| Shopping Centres / Retail | 10% of parking spaces with active provision (with charging unit)<br><br>10% of parking spaces with passive provision (with ability to install charging unit in future)<br><br>7kW charging | < 50 bays – At least two electric charging bays and infrastructure<br><br>>50 bays - A total of 4% of the total provision of parking are electric bays with charging infrastructure<br><br>At least 43kW charging unit | | | | | |
| Offices | 20% of parking spaces with active provision (with charging unit)<br><br>10% of parking spaces with passive provision (with ability to install charging unit in future)<br><br>3kW charging | < 50 bays – At least two electric charging bays and infrastructure<br><br>>50 bays - A total of 4% of the total provision of parking are electric bays with charging infrastructure<br><br>At least 7.4kW charging units | | | | | |

| Broad Development Type | Greater London Authority | Lancaster City Council | Durham County Council | Dudley Metropolitan Borough Council | Leeds City Council | Surrey County Council | Milton Keynes Council |
|---|---|---|---|---|---|---|---|
| Hospital | 10% of parking spaces with active provision (with charging unit)<br><br>10% of parking spaces with passive provision (with ability to install charging unit in future)<br><br>7kW charging | < 50 bays – At least two electric charging bays and infrastructure<br><br>>50 bays - A total of 4% of the total provision of parking are electric bays with charging infrastructure<br><br>At least 43kW charging unit | | | | | |
| Other Car Parks | 10% of parking spaces with active provision (with charging unit)<br><br>10% of parking spaces with passive provision (with ability to install charging unit in future)<br><br>3/7kW/43kW charging depending on use | < 50 bays – At least two electric charging bays and infrastructure<br><br>>50 bays - A total of 4% of the total provision of parking are electric bays with charging infrastructure<br><br>At least 43kW charging unit | | | | | |

**ii. Recommended guidelines for HITRANS region**

A workshop held on 1st November 2017 with stakeholders from the HITRANS region considered the potential development guidelines outlined in Table 27 and identified a series of guidelines that it was felt were appropriate for adoptions within the HITRANS region. The results of this workshop demonstrated that stakeholders believed the inclusion of EV criteria into development guidelines was appropriate. There was strong alignment on residential requirements, with the group indicating that each property with allocated parking have at least a 32 amp connection provided. For residential development with non-allocated parking there was general support for a high level of active provision with further passive provision to allow charging equipment to be installed in the future. There was less alignment with other development categories with strong desire for high levels of passive provision that allow for tiered provision as levels of EV use grow.

Building upon the feedback a series of recommendations have been made suggesting appropriate guidelines for EV provision as part of new development within the HITRANS region. These are shown in Table 28.

Table 28 – Suggested development guidelines for EV charging infrastructure in the HITRANS region.

| Development Type | Suggested Guideline |
|---|---|
| Residential – Allocated parking | Each residential unit to be wired to provide a 32amp connection adjacent to at least 1 parking space.<br><br>Passive provision (ducting) to all allocated parking spaces. |
| Residential – Non-allocated parking | 20% of all parking spaces to provide a 3kW or higher charging unit.<br><br>Passive provision (ducting) to allow charging equipment to be connected at a further 20% of spaces in the future. |
| Hotel / accommodation | 5% of all parking bays to be equipped with 3kW or higher charging unit.<br><br>Passive provision (ducting) to allow charging equipment to be connected at a further 10% of spaces in the future.<br><br>If accommodation contains restaurant(s) that is/are likely to be well used by non-residents, consider need for 22kW charging unit.<br><br>Reducing levels of provision should be considered where the cost of obtaining a suitable electricity connection is prohibitive. |
| Retail / shopping centres | 5% of all parking bays to be equipped with a 7kW or higher charging unit.<br><br>Passive provision (ducting) to allow charging equipment to be connected at a further 10% of spaces in the future. |
| Office | 10% of all parking bays to be equipped with a 3kW or higher charging unit.<br><br>Passive provision (ducting) to allow charging equipment to be connected at a further 10% of spaces in the future.<br><br>Consider a 22kW charging unit where a high proportion of deliveries/visitors are expected. |

| Development Type | Suggested Guideline |
|---|---|
| Hospitals | 5% of all parking bays to be equipped with a 7kW or higher charging unit.<br><br>Passive provision (ducting) to allow charging equipment to be connected at a further 10% of spaces in the future. |
| Other development types / car parks | 5% of all parking bays to be equipped with charging unit. Power dependent on expected turnover of spaces.<br><br>Passive provision (ducting) to allow charging equipment to be connected at a further 10% of spaces in the future.<br><br>Reducing levels of provision should be considered where the cost of obtaining asuitable electricity connection is prohibitive. |

# APPENDIX F: COMMUNICATION, EDUCATION AND OUTREACH CHANNELS

1. **E-cosse**
An initiative to establish Scotland as an electric vehicle pioneer. The public-private partnership is run by Urban Foresight, with Transport Scotland, and the Energy Saving Trust. The partnership aims to support the Scottish Government's efforts on plug-in vehicles, as well as ensuring an ambitious plan to contribute to Scotland's climate change targets.

E-cosse hosts regular forums in a range of Scottish towns and cities on issues pertinent to EVs.

2. **Electric Vehicle Association Scotland (EVAS)**
EVAS aims to represent the interests of EV users, promote EV use and raise issues concerning ownership and use of EVs in Scotland. The association seeks to work with relevant stakeholders including governments (Scottish, UK and European), local authorities, E-cosse, Transport Scotland, as well as manufacturers and equipment suppliers to achieve their aims. In April 2017, EVAS membership reached 507, with membership increasing 45% in 14 months.

EVAS is regularly represented at EV-related events across Scotland, with members speaking at events and their very own members' forum to discuss their daily EV experiences.

3. **Energy Saving Trust (EST)**
The Energy Saving Trust works in Scotland managing the Home Energy Trust, a programme initiated by the Scottish Government. EST has administered the Electric Vehicle Loan in Scotland since August 2015 giving Scottish drivers a loan of up to £50,000 for electric and plug-in hybrid vehicles. EST also administers the Low Carbon Transport Business Loan that provides up to 100,000 in interest-free loans, as well as other EV financial incentives in Scotland, such as Switched On @Work and Switched on Fleets.

EST hosts several events around Scotland every year, as well as webinars on EV topics of broad and current interest.

4. **Orkney Renewable Energy Forum (OREF)**
Formed in 2000, OREF are dedicated to supporting the renewable energy sector and sustainable transport solutions in the Orkney Islands. Individuals and businesses are welcome to attend events, participate in research and provide insight into the strategic position of the group. In 2015, their Electric Vehicle Show hosted a talk from celebrity EV enthusiast Robert Llewellyn, who also took the opportunity to film an episode for his YouTube Channel, "Fully Charged" called "Island of the Future".

The uptake of EVs in the Islands has surpassed the Scottish average, accounting for over 2% of the country's plug-in vehicles. This popularity has been due in part to the island's secure and extensive renewable energy sources and the establishment of a dedicated second-hand EV dealership, Eco-cars. Eco-cars owner Jonathan Porterfield is passionate about EVs and a member of OREF.

In April 2018, OREF launched the Orkney Electric Vehicle Strategy 2018-2023. This aims to guide investment in EVs in Orkney, including the types of chargers and pricing schemes that would best support the island's EV users.

# APPENDIX G: INSTALLING CHARGING INFRASTRUCTURE, QUICK GUIDE

**i. Picking a Charging Power**

The power of the charging unit should depend on its intended use. If the unit is expected to support vehicles stopping for a short period of time – 20 to 30 minutes – to charge their vehicle then a Rapid Charging unit (43kW AC / 50kW DC) is the most appropriate. If the charging unit is expected to be used while people park and undertake an activity then it is likely to be more cost effective to provide a charging unit that matches the expected parking duration. Table 29 provides an approximate guide on how long it takes to charge most current (2017) electric vehicles from 0 – 80%.

Table 29 - Charger power type and approximate charging times

| Charging Unit Power | Typical Charging Duration (0 – 80%) |
|---|---|
| 3kW (standard charger) | 6-10 hours |
| 7kW (fast charger) | 4-6 hours |
| 22kW (semi-rapid charger) | 1-1.5 hours |
| 43kW/50kW (rapid charger) | 20-40 minutes |
| 150kW (expected 2018) | 10-20 minutes |

Early engagement with the Distribution Network Operator is essential. Costs to connect the charging unit to the electricity grid can be significant and obtaining a budget estimate as soon as possible may help to ensure that the works can be delivered within budget. Shown in Figure 8, UK Power Networks have developed a guide outlining approximate electricity connection costs associated with various charger power types.[60]

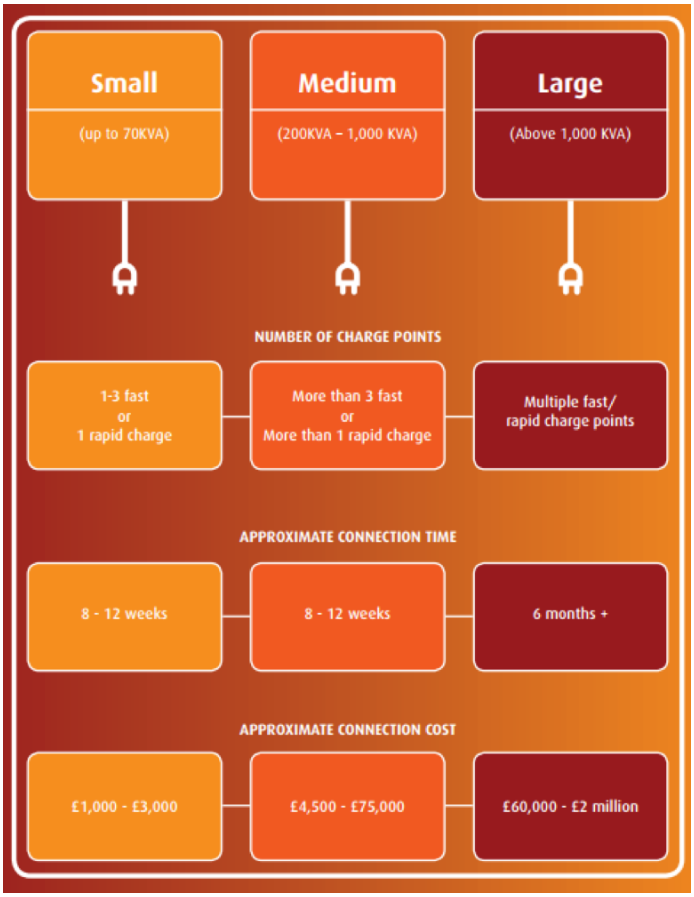



Figure 8 - Indicative costs and time for the power supply to be connected to different types of charging power

60 Getting Electric Vehicles Moving: All you need to know about installing on-street charge points – A guide for local authorities, Flow chart taken from: UK Power Networks, 2017

**ii. Locating the Charging Point**

Most charging units will be connected to the vehicle through a 3m or 5m long cable. With most vehicles having charging connections on the front or front-side of the vehicle, placing the unit so that cables easily reach all vehicles is essential.

For perpendicular parking this is best achieved when the unit is located in front, rather than to the side of the vehicle. For parallel parking this is best achieved where the unit is located on the kerb near to the end/between parking spaces.

Some units will allow multiple vehicles to be connected to a charging unit at once. It will be necessary to consider how cables will be able to be connected to all vehicles at the same time. For perpendicular parking this is likely to be achieved when the unit is located in front of the vehicle but between two parking spaces. For parallel parking this is best achieved where the unit is located on the kerb between parking spaces.

Consideration should also be given to where the cable will run when the vehicle is plugged in. Charging units should be located to ensure that cables do not create a trip hazard or obstruction to footways, or in other locations that pedestrians / cyclists are likely to use.

If a charging unit is installed on a footway, consideration should also be given to maintaining suitable minimum footway widths so that all users of the footway can pass the unit safely.

When located on the side of a road, charging units should be mounted at an appropriate distance from the kerb edge to ensure risk of being hit by passing vehicles is minimised. Consideration should be given to whether it would be beneficial to provide protection from low speed manoeuvring vehicles. This is often achieved through the installation of bollards placed in front of the charging unit.

Ensuring that charging units are located in prominent, highly visible locations is beneficial. In-vehicle navigation systems are provided in almost all electric vehicles to help guide vehicles to the approximate location of the charging units. Being able to see the location of the units from car park entry points or from the road network will help users to find charging points.

**iii. Signing and Line Markings**

Suitable signage and line marking should be provided for each parking bay that is expected to be used by the charging vehicle. They should conform to the Traffic Signs Regulations and General Directions and clearly indicate that the parking space is for the use of charging electric vehicles only. Where appropriate, signage should also indicate the parking regulations that govern the parking space.

It is suggested that for charging units placed in car parks, directional signage is also provided from the nearest road. This will help guide users to reach the charging unit.

**iv. Other Guidance Documents**

The Orkney Renewable Energy Forum have developed an EV Charging Infrastructure Design Guide to assist those planning and delivering charging infrastructure

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