



School of the Built and
Natural Environment



Richard Kotter

Electric Cars & Charging Points

e-mobility NSR



Green Tourism:

*Bringing the Energy, Environmental and Tourism
Sectors Together, 27th October, Gateshead*

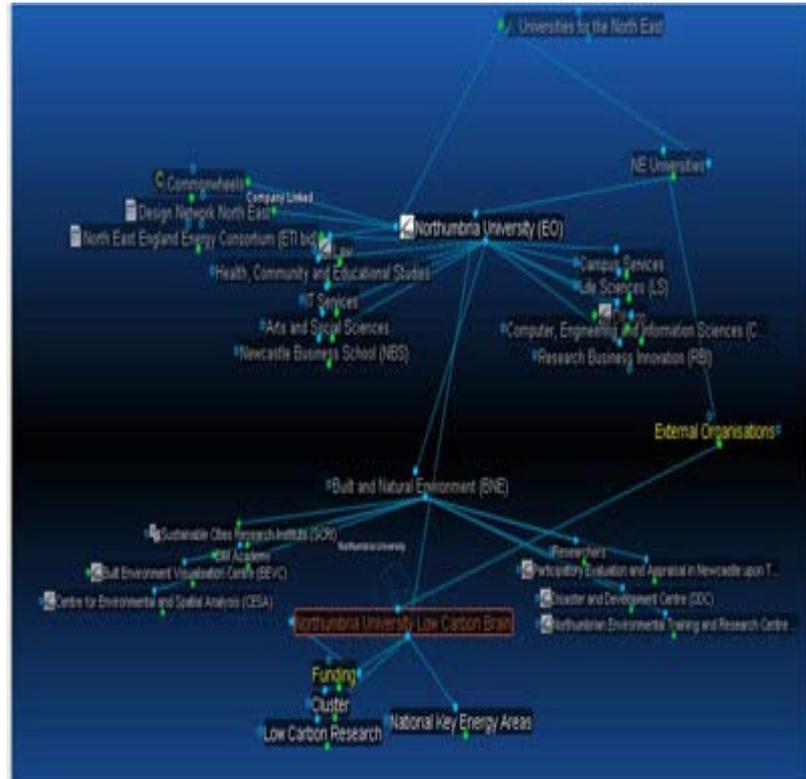
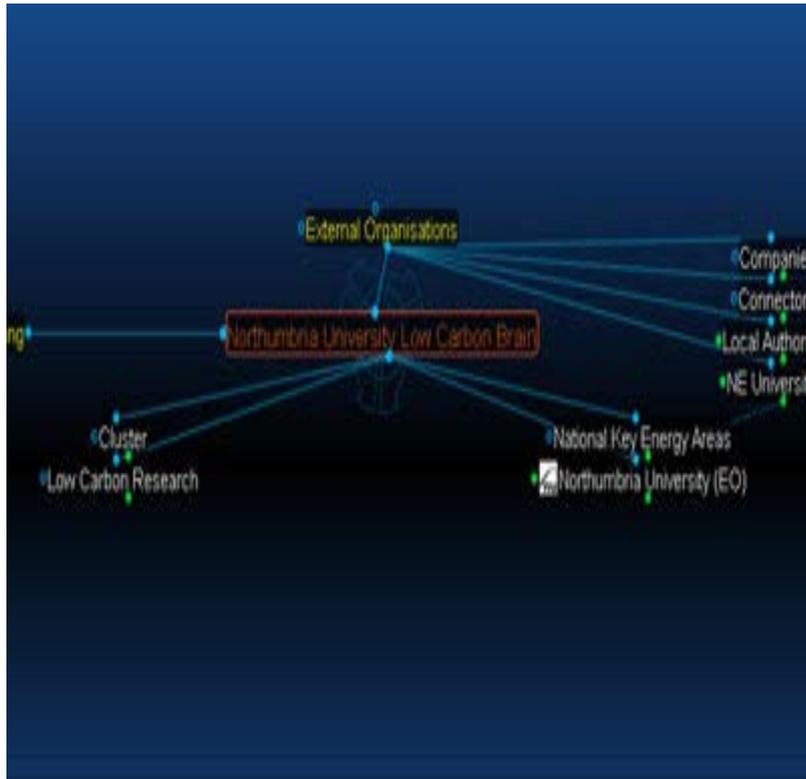


The Interreg IVB North Sea Region Programme



*Investing in the future by working together
for a sustainable and competitive region*

Northumbria University Low Carbon Webbrain



- <http://webbrain.com/brainpage/brain/EB0699A3-F06D-5A3B-2ED8-466FE1AEBFDD/>
- <http://www.northumbria.ac.uk/business/innovation/info4business/lowcarbonmapping/?view=Standard>
- <http://www.northumbria.ac.uk/business/innovation/info4business/lowcarbonmapping/contact/?view=Standard>

A “Snapshot” on Electric Cars and Charging Points

variety of renewable energy technologies & resource efficiency measures:

The shift from traditional fuel vehicles to low carbon vehicles currently involves **three types of low carbon vehicle technology**:

- Hybrid Vehicle
- **Electric Vehicle**
- Hydrogen and Fuels Cells.

Why electric vehicles?

- UK govt backed plan to develop the region into a so-called "low-carbon economic area for ultra low-carbon vehicles"
- North East Plugged in Places valued at £7.9M up to 2013
- UK Technology Strategy Board investment to trial new electric vehicle technologies valued at £10.7M up to 2013
- Nissan, Sunderland – battery plant and production of the Leaf 2012/13
- <http://www.futuretransportsystems.co.uk/projects/electric-car-pilot-project.aspx>

CHARGE 
YOUR CAR
PARK + PLUG + RECHARGE



Electric Vehicles and Technology

- **Electric Vehicles may be the future, alongside hybrid and hydrogen / fuel cell ones**, of the automotive industry and manufacturers are investing hundreds of millions of pounds to bring EVs to market - though full commercialisation and in volume may still take some time as price of (esp. batteries) are still high
 - **Small and medium cars** from major car companies are expected in the next few years (e.g. Mitsubishi iMiEV, Renault, Ford, Citroen, Nissan, Peugeot, MWB, and Tesla etc)
 - **Fleet and pool cars, and leased cars** is a growth market for EVs <http://quickchargepoints.com/news.html>
 - **Commercial vehicles** (Smith Electric Vehicles) and **specialist ones** (Avid) and leisure and agricultural (e.g. GEM or Alke or SEEVs)
- **Smart grid and vehicle-to-grid technology** needs further research and development
<http://www.raeng.org.uk/news/releases/shownews.htm?NewsID=566> and **Energy storage in electric batteries and Solar Roads** are scenarios being investigated

BERR (Oct 2008): Investigation into the Scope for the Transport Sector to Switch to Electric Vehicles and Plug-in Hybrid Vehicles

focused primarily **on cars and light goods vehicles** as most suitable for the application of EV and PHEV technologies and make up the greatest proportion of UK registered vehicles.

The uptake of EVs in the medium term will be centred on urban environments and will start with city markets and van fleets. PHEVs with their increased flexibility will have greater penetration of the market in the medium term.

- A number of volume manufacturers have recently announced intentions to develop **EVs and PHEVs**. These **will initially be introduced in to the UK market as demonstrators or in very low volumes**. Therefore up to 2014 the **market will be supply constrained and uptake will be with early adopters**.

continued

- **The wide spread roll-out and uptake of EVs and PHEVs after 2014 would require increased consumer confidence and education; improvements in battery performance and cost; charging infrastructure which keeps pace with demand; and stimulation of the market through appropriate incentives which encourage the uptake of low carbon vehicles. Without these a 'Business as Usual' scenario would prevail.**
- **Largely due to the high cost of batteries, the consensus is that EVs and PHEVs will cost more to produce than comparable existing vehicles for the foreseeable future. Over the medium term the whole-life running costs of EVs and PHEVs are expected to be lower than conventionally-fuelled alternatives, primarily due to differences in fuel prices.**
- **Currently private consumers buy on capital cost rather than running costs and so education (including piloting and testing) will be required to raise awareness of this benefit.**

<http://www.bis.gov.uk/files/file48653.pdf>

Scenarios and predictions from Arup and Cenex (2008), Investigation into the Scope for the Transport Sector to Switch to Electric Vehicles and Plug-in Hybrid Vehicles, BERR and DfT

Estimates on the uptake of electric vehicles can vary widely. On behalf of the Department of Business Enterprise Regulation and Reform and Department for Transport, Arup and Cenex have developed **four scenarios for the introduction of passenger electric cars into UK:**

- **Business as Usual:** current incentives are left in place and no additional action is taken to encourage the introduction of electric cars.
- **Mid-Range:** environmental incentives continue to grow at their current rate.
- **High-Range:** significant intervention to encourage electric car sales. Charging infrastructure is widely available in urban, suburban and in some rural areas.
- **Extreme Range:** there is a very high demand for electric cars, with sales only restricted in the short term by availability of vehicles. In the longer term, almost all new vehicle sales are EVs or PHEVs.
- **The key projection is that in the medium term (up to 2020) if current initiatives are left in place and no additional action to incentivise consumers takes place there will be 70,000 electric cars and 200,000 PHEV on British roads.**



Market outlook to 2022 for battery electric vehicles and plug-in hybrid electric vehicles (June 2009)

Scenarios for uptake of EVs and PHEVs

The scenarios for uptake of EVs and PHEVs with the key themes were as follows:

- Uptake of EVs and PHEVs will be very limited without upfront price support
- Uptake of PHEVs will occur faster than EVs due to their greater fuel flexibility and lower cost.
- Even under the more optimistic scenarios EVs and PHEVs are unlikely to reach mass production (defined at 100,000 units sold) until the early 2020's.
- Achieving high levels of EV and PHEV uptake will require a high degree of cooperation between local and national Government. Softer, local measures such as access to bus lanes, free parking and the provision of a widespread charging infrastructure will be need alongside central Government initiatives such as upfront price support.
- The launch of advanced diesels will affect the uptake of EVs and PHEVs in the short to medium term.
- However, advanced diesels will only be able to reduce GHG emissions so far. The deepest cut in transport GHG emissions can only be achieved by EVs.

AEA (June 2009): Benefits and barriers

- From a climate change perspective, the key advantage of EVs and plug-in hybrid electric vehicles (PHEVs) is that they provide the opportunity to decarbonise the road transport sector to very significant extent. Of course this is dependent on grid electricity being decarbonised but policy frameworks are already in place in the UK to increase renewable generation capacity, replace nuclear capacity and trial carbon capture and storage technology.
- A significant uptake of electric vehicles leads to several other very significant benefits. For example, it presents the opportunity to significantly reduce the usage of fossil fuels for meeting vehicle motive power requirements. This can have benefits for energy security (by diversifying the energy sources used in the transport sector), and reducing tailpipe emissions of air quality pollutants.
- However, there is also a range of barriers to uptake of EVs and to a lesser extent PHEVs. Lithium-ion (li-ion) batteries are the technology of choice to store the electrical energy on board the vehicle.
- Unfortunately, they are very expensive. A sizeable reduction in range (to typically 60 to 100 miles) and a lack of charging infrastructure are also key barriers.
- That said, arguably the greatest barrier is public perception. Consumers need to be convinced that electric vehicles are a robust technology and that they can fulfil their requirements, particularly in light of the lack of infrastructure and the need to plug-in the vehicle.
- <http://www.aeat.co.uk/cms/a-market-outlook-to-2022-for-battery-electric-and-plug-in-hybrid-electric-vehicles/>

AEA (June 2009): four main new business models to encourage significant uptake of EVs and PHEVs

- **Battery leasing.** By retaining liability for the battery the manufacturer is committed to replacing it if its performance is sub-optimal:
 - removes a significant element of the financial risk for consumers; solves the problem of how to value the residual life of the battery at resale given that most battery technologies' performance deteriorates with use;
 - monthly fee for leasing the batteries could simply switch from the original owner to the new owner
 - further benefit to the consumer is that it allows the manufacturer to take advantage of any improvements in battery technology when the batteries are eventually replaced.
- **Mobile phone-style transportation contracts.**
 - To cater for different customer segments, Better Place offers a range of EV models via a series of subscription pricing packages that will provide access to the network of charging points and battery swap stations. The company owns the charging points and battery swap stations as well as the car batteries, which will be considered part of the Better Place Network.
- **Vehicle leasing.** The natural extension to battery leasing is to use a vehicle leasing business model to further reduce risk and minimise upfront costs. Vehicle leasing is currently being pursued by Mitsubishi as the initial business model for the i-MiEV electric small car
- **Car-clubs.** In the short term the 'car club' business model could be a viable means of introducing the public to electric vehicle technology. In addition, it could provide added value in terms of promoting EVs and PHEVs

“rebirth of the electric vehicle, a species previously thought to have been nigh-extinct since batteries lost out to gasoline in the early years of the last century.”

<http://www.trendtracker.co.uk/store/2010/12/single-user-licence---evs--energy-infrastructure-and--mobility-in-the-real-world?download-electric-vehicle-report>

Automotive research publishers, **Trend Tracker** have published their comprehensive review of the global Electric Vehicle Market in their **2011 Electric Vehicle Report** – published February 2011. The Report is a 3 year study into Electric Vehicle technology, energy demand infrastructure and fiscal challenges that face governments, investors, environmental lobbies and citizens.

The **Electric Vehicle report** entitled: *EVs: Energy, Infrastructure and Mobility in the Real World*, contains:

- Electric vehicle technology
- Electric vehicle battery chemistry
- Overview of recharging issues and developments
- Electric Vehicle market forecasts
- Fiscal and political Electric Vehicle policies
- Business models for Electric Vehicle distribution

Please note: in the fast-moving world of electric vehicles, the companies involved in vehicles and batteries are announcing new initiatives and developments almost every day. Therefore we have dropped the reviews of vehicle and battery manufacturers as originally published.

EV pioneers: some issues (OU Dec 2010)

Charging Infrastructure

- Where will EV drivers be able to plug-in? Charging in public places is clearly more complex than at home, raising different issues. **Drivers need to be able to identify not only where public charging points are but whether they are vacant.** Interconnective technology may enable drivers to check availability via mobile
- **Will free spaces be allocated for EVs in car parks in convenient spaces to meet requirements?**

Business operation suitability

- Which operating situations are served well by EVs? There are operational capability issues associated with vehicle weight and distance driven per day. For battery EVs drivers wish to complete journeys without the need for time-wasting recharging so journeys should not exceed 80 miles/day. EVs appear to be a suitable technology for light vans and cars operating on a regular cycle, with frequent stops, and travelling up to 80 miles/day.
- There is some ignorance about the expense and benefits of EVs. **Business users need reliable information on:**
 - EV suitability for operations with reference to vehicle payload, range reliability, distance per charge and recharge timing. It was thought that there could be a strong case for investment in EVs for business operations that EVs serve well, such as regular cycles, with frequent stops, and travelling up to 80 miles/day in light vans and cars.
 - **The costs, location and availability of charging points. This includes clarity on issues associated with private/public charging, fast/slow charging, peak/off peak charging, parking, charge point locations and vacancies. Interconnective technology may support this requirement.**
 - Driving, maintaining and leasing EV's

http://design.open.ac.uk/documents/ReportU_STIROpenEVPioneersWorkshop.pdf

Technology Strategy Board (2011): Initial Findings from the Ultra Low Carbon Vehicle Demonstration Programme (first 3 months)

Looked at both personal drivers (PD) and fleet drivers (FD):

- More straightforward in than thought – Evs not more difficult to use (95 %)
- No significantly changed journey length or daily mileage
- Users are pleased by EV performance, when compared to conventional vehicles
- Drop in range anxiety after using, but still 92 – 120 mile range expected / needed to be covered
- Understanding of vehicle capabilities, driving techniques and journey planning (changing for many attitude to battery charging level)

Who are the early adopters of electric vehicles?

The approach of an sustainable travel officer / transport planner

- With emerging technologies, it is **important to identify 'early adopters' who through their purchasing preferences and behaviour are quick to adopt a new product. High tech products, such as electric vehicles, are often bough first by innovators and early adopters, with mass market consumers following once a product is established and perceived as less risky.**
- **The Travel Smarter style data analysis tool was used to determine the socio-economic features of early adopters.** Identifying the characteristics of these groups will enable a better understanding of what motivates potential early adopters and more effective communication of electric vehicle benefits.
- Utilising the Smarter Travelstyle groupings, the following early adopters were identified:
 - **Young Minded: younger, single or co-habiting, students, have a car**
 - **Family Focus: large households, married with children, middle aged, have a car**
 - **Traditional Values: small household, 1 car, married**
 - **Affluent Professionals: car users, employed, high income, married**
- In order to maximise the uptake of electric vehicles amongst the population of Tyne and Wear, it is important to cross analyse these smarter types = groupings with other location specific data which has been derived from the Census and Household Travel Survey focused around key trip characteristics (locations were the proportion of people are driving more than 10km to work). Mapping the information across Tyne and Wear provides an understanding of where future electric vehicles owners are likely to live and where the priority locations are for the roll out of infrastructure to support electric vehicles across Tyne and Wear.

Benefits to consumers

- Currently, electric vehicles offer consumers the closest 'near to market' green technology - if the energy going in is sourced from renewable energy
- The technology associated with electric vehicles, particularly the battery technology, has enabled vehicles range to be extended in excess of 100 – 130 kilometres.
- With fuel prices expected to continue to rise in the near future, electric vehicles are becoming more cost effective to operate over their life cycle.

FINANCIAL BENEFITS:

- a host of financial benefits to owning an Electric Vehicle. These will often balance the higher purchase costs for some EVs:
Fuel costs are obviously much less than for conventional vehicles due to the fact that fuel is reliant on electricity which is tax free. Typical fuel costs will be around 1.5 to 2.5p per mile. Free charging points will also be made available in public spaces through the Charge your Car project. All EVs are exempt from vehicle excise duty ('road tax').

<http://www.chargeyourcar.org.uk/allyouneedtoknow.php>

Charging / charging points

- Charging points will be a major part of our transport infrastructure in the future and this is the opportunity to gain funding and support to be at the forefront of a developing technology.
- Arguably, in the coming years, businesses will be expected to provide charging points for employees and visitors.
- Battery swap and home charging may be part of the future mix as well
- **First privately-funded network of electric vehicle charging points heading for Britain** July 21, 2011 <http://www.mas-wm.org/news/first-privately-funded-network-of-electric-vehicle-charging-points-heading-for-britain>
- More than 4000 charging points across 10 UK towns and cities are being planned by **Chargemaster** by 2012, a company specialising in electric vehicle infrastructure.
- The 'Polar' programme will boost infrastructure considerably and builds on the 1000 points already in place through the Government-backed scheme 'Plugged in Places'.
- Users of Polar will pay a monthly subscription of roughly £20 and then 90p to charge their car with up to 100 miles of power.
- Chargemaster believes the Polar network will cost £10m to roll out and funding is coming from internal sources.

Battery Vehicle Society www.BatteryVehicleSociety.org.uk
and **EV Network** www.EV-Network.org.uk (Nov. 2009)

Why install Electric Vehicle Charging Points?

Advantages of Installing EV charging points:

- Installing charging points provides visible evidence that your business is actually supporting green travel
- Facilitating greater use of EVs helps to reduce particulate pollution. EVs are ideal for local commuting to work, for shopping, etc. If your visitors are using an EV instead of a petrol car, this reduces their carbon footprint for each local trip by about 60% when charged with "brown" electricity and by 100% when charged with "green" renewable electricity.
- Installing a charging point at your location effectively allows 4 times the number of people to use EVs as their method of travel to your location
- For example: allowing people to re-charge at work, so that they are not dependent on their vehicle getting them to work **and back again, means they can travel double the distance during their daily commute - potentially, four times the number of employees will be able to commute in EVs - doubling the commute radius quadruples the area of the possible circular commuting catchment-area. The same reasoning applies to increasing accessibility of your business to EV-driving members of the public.**

continued

- **The increased usability of EVs - resulting from installation of charging points at business addresses - is probably more significant than that resulting from other non-domestic charging points (e.g. fast charging stations). However, such facilities will only be used if the user is confident that their vehicle will complete charging successfully (i.e. not trip-out or be disconnected).** It is therefore important to follow the recommended guidelines regarding individual circuit protection, and reservation of EV parking bays.
- **Installations at shopping centres and cinemas allow for around 50% more EV-drivers to visit**
- Again by considering the area of the circular 'catchment area' of a charging point: if an electric car takes 8 hours to fully re-charge, and most people spend about 2 hours shopping or watching a film, then the increase in range (commute radius) is $2/8 = 0.25$. Therefore the potential multiplying factor of people affected, is $1.25 \times 1.25 = 1.56$

Charge Your Car and EV drivers

<http://www.chargeyourcar.org.uk/searchmap.php?ebaddr=NE1>

Charge Your Car: Electric Vehicle Drivers Membership - Subscription rates

Membership is subject to a low cost monthly or annual subscription.

- In North East England, membership is £10 monthly or £100 for an annual subscription, and members enjoy free parking and free electricity whilst recharging on all CYC bays in the region.
- In other regions, membership is £50 for an annual subscription. This includes free electricity, members will need to pay for parking on-site in some locations

The need for an infrastructure platform

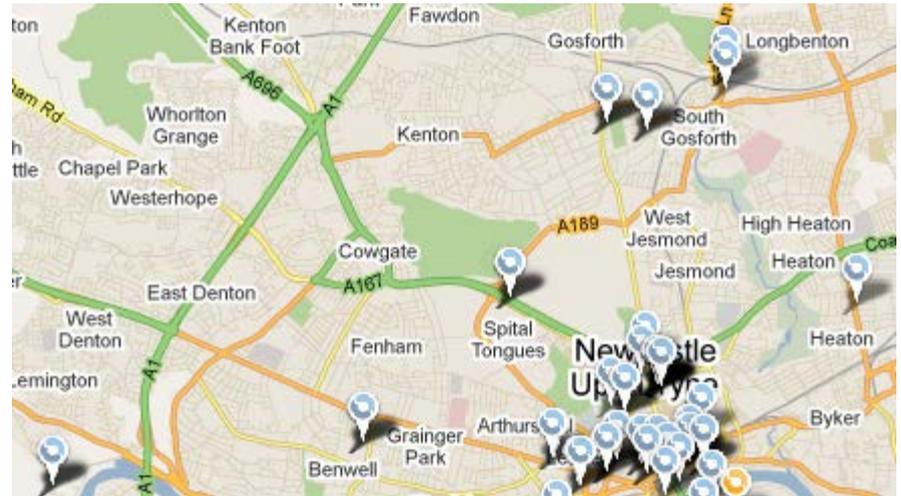
As electric vehicles have a shorter range than conventional vehicles the availability of a comprehensive charging infrastructure is critical in creating a viable environment for operation.

There are **three main types of infrastructure**:

- **Standard (3kw) points** can top up a battery in a couple of hours and charge a battery from flat to full in 6 to 8 hours.
- **Fast (7 – 46kw) points** are able to top up points in 30 minutes, and charge from flat to full in less than 4 hours.
- **Quick (50 – 250kw) chargers** will act as an emergency to be utilised when drivers are near-empty battery. This is due to the high level of infrastructure required for the technology to operate safely, as a result these will be located in strategic off road locations.

Infrastructure Platform in Newcastle

- 47 public charging points on highway
- Additional provision on private land such as Universities
- Mixture of on street and off street locations
- Newcastle City Council will continue working with partners through development to secure additional infrastructure – public and domestic, and has Preferred Supplier Status and is Lead Delivery Partner for “Plugged in Places”



www.chargeyourcar.org.uk

Charging post installation issues and costs

- **Q: How do I install a number of electric car charging posts?**
- **A: If you are planning on anything other than individual domestic use (and even then) it probably makes sense to install a purpose built charging post(s).** If you are a company or organisation e.g. a council, planning to supply a number of charging points then getting a number of **posts installed by one of the main charging post companies makes sense.** These posts will be more robust and will come with a range of 'benefits' e.g. software which can monitor the usage, electronic tags to keep access secure, maintenance contracts etc. <http://www.electriccarsite.co.uk/electric-car-charging-points>
- If you are looking to put a number of posts in, try a few companies, get quotes, negotiate a deal. Some things to consider are **whether your charging posts are for staff or customer (day) use or for commercial fleet (potentially night use) or both and will you want the posts be made available to the wider general public?**
- <http://www.electriccarsite.co.uk/electric-car-faqs>

Funding for installing charging posts

Q: Is there funding available to help install electric car charging posts?

- Currently the main way to get funding towards the installation of electric car charging points is through the Government's ['Plugged in Places'](#) initiative. This is aimed at a much larger scale than the individual charging post however, looking to encourage constortia to install networks of posts over a large geographic area.
- For individual installers or those seeking to put in one or two posts, one option is to try and get involved in a Plugged in Places scheme (if there is one in your area). Your post would then however become part of a much wider scheme and be available to all those who have signed up to the relevant charging network.
- If you just want a charging point for personal or private customer use it is likely that you will have to take on board the cost of installing the post(s) yourselves.
- If you are a public sector organisation or charity, It may be possible to get some industry backing and you can always try speaking to the Energy Savings Trust (EST) to see if they can assist in anyway.
- <http://www.electriccarsite.co.uk/electric-car-faqs>

“Charge Your Car” (Plugged-in-Places, OLEV) Funding Criteria – until March 2013

Funding and Criteria

Through the Plugged in Places programme, match funding is available for the installation of charging points on streets, in car parks and in commercial, retail and leisure facilities.

Standard Charging Points:

The Offer

50% matched funding for each post

50% matched funding for installation

Host owns the asset after successful installation

The host would contribute only £2,500 towards the full cost of each charging post

Criteria

Host to provide free parking space and access

Host to provide free electricity for EV charging for 3 years

Host to maintain equipment for at least 5 years

Quick Charging Points:

The Offer

- 100% Funding of purchase cost of unit.
- 100% Funding of installation to an existing supply
- Host owns asset after successful installation

Criteria

- All hosts must meet certain criteria and be in an ideal location
- Host to provide free parking space and access
- Host to provide free electricity for EV charging for up to 3 years
- Host to purchase and operate a Service Level Agreement for maintenance of charging equipment for at least 5 years

<http://www.leadthecharge.org.uk/all-you-need-to-know/funding>

Hosts of Charging Points and Charge your Car

Hosts of Charging Points:

All 1,300 charging points will be promoted through an online journey planner through the Charge your Car public website. There will also be an opportunity to be involved in publicity for the project as it progresses.

Commercial Benefits:

The environmental benefits of this technology are well reported but there are also commercial opportunities. As a result of intelligent investment in the North East by both the public and private sector over the last ten years, the region has developed a reputation as a hub for green technology. **Being involved in this project will underline your organisation's green credentials and mark you out as being progressive to businesses and prospective employees alike.** Research has been undertaken into the type of consumers who would be likely to purchase an Electric vehicle. **Early adopters are likely to be from the MOSAIC category Symbols of Success, giving hosts access to this particular group of people.**

The Club network:

All **hosts of charging points** will also automatically become part of the North East Club network and **will be kept up to date with news of the Electric vehicle market and the project itself. Each host will also be provided with data and information taken from the chargers.** This will include regular reports on usage patterns as well as information on energy consumption, parking times and visit time statistics.

<http://www.leadthecharge.org.uk/>

UK hotels to house electric car charging stations

Hotels across the UK will be installing electric car charging stations on their premises, with the aim of attracting motorists to use their facilities while cars are charging. Over 10 hotels and resorts have partnered with Tesla, as US electric vehicle producer, to install the stations, which will all be privately owned but available for public use, either free of charge or for a small fee. Tesla aims to create a network across the UK to promote the use of electric cars, and said that the "forward thinking" hotels it has partnered with will benefit from extra business as "motorists recharge while having a meal, using leisure facilities, and or indulging in an overnight stay". Charging batteries would take anything up to three hours.

Including the **Radisson Blue Hotel, Durham**

- <http://www.bighospitality.co.uk/Business/UK-hotels-to-house-electric-car-charging-stations>
- <http://news.infotel.co.uk/does-your-hotel-charge-cars>

Radisson Blu Hotel, Durham DH1 5TL (HPC)

LEAF talk: Kevin Sharpe (19-08-2011, 11:32 AM): “There is 'free' (with lunch) charging at the Tesla Charging Station in the centre of Durham at the Radisson Blu Hotel; <http://www.radissonblu.co.uk/hotel-durham> they are considering adding ZCW Charging Stations to the site”

<http://www.leafstalk.co.uk/archive/index.php/t-3692.html?s=6357f99e12db92f0d6032cfd7bbee1ae>



High Power Chargers (HPC - capable of recharging the 212 mile range Tesla Roadster in around 3 to 4 hours) installed by hotels in conjunction with Tesla Motors and a volunteer effort led by David Peilow.

Success for First Ever Production Electric Vehicle Run from John O'Groats to Lands End

“The hotels all generously offered to host these chargers and contributed to their installation. They make the chargers available to all visiting motorists with compatible electric cars, either offering the electricity free, complimentary with a modest purchase or for a nominal fee.”

<http://zerocarbonworld.org/archived-news/60-success-for-first-ever-production-electric-vehicle-run-from-john-ogroats-to-lands-end>

Resources / contacts

Charge Your Car (Plugged-in-Places)

<http://www.chargeyourcar.org.uk/indexx3.php>

Colin Herron, MD, Charge Your Car

Mobile 07872417046

<http://www.chargeyourcar.org.uk/contactus.php>

E-mobility in the NSR

<http://e-mobility-nsr.eu/>

<http://e-mobility-nsr.eu/events/>

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ENEVATE

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