

Demonstration Project Case Study

Project title Introducing electric vehicles and charging infrastructure into NRW

Description

Our aim was to demonstrate how integrating ultra-low emission vehicles (ULEV) and charging infrastructure into our fleet can reduce carbon emissions, whilst still meeting our operational needs, and to support our visitors to travel to our sites sustainably.

Three electric cars (Nissan Leaf Acenta 30kWh) were introduced to NRW's pool fleet in May 2017, based at three offices: Bangor, Buckley, and Llandarcy. The introduction will help reduce NRW's carbon emissions, reduce harmful air pollutants and demonstrate the potential for wider introductions of electric vehicles in the future.

Six electric vehicle charging points were installed: four at NRW offices in Bangor, Buckley, Llandarcy and Haverfordwest (to facilitate fast charging for our electric fleet vehicles), and two at our key Visitor Centres: Coed y Brenin and Bwlch Nant yr Arian (to encourage our visitors to make sustainable transport choices).



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Method

The purchase of our electric vehicles and installation of charging points were developed together to ensure we had the right vehicles and charging infrastructure, in the right places to make our demonstration project a success. A summary of project delivery is set out below in three parts: Electric vehicles; Charging points – purchase; and Charging points – installation.

Electric vehicles

An initial assessment was carried out to identify three offices suitable for the introduction of an electric vehicle. We considered:

- Which offices had the frequency of pool-fleet car use that could achieve high utilisation (over 75%) of an electric pool-fleet car
- Which offices showed common journeys within a conservative range of 75 miles return, which could be undertaken on a single full charge of an electric vehicle
- What common inter office journeys are carried out beyond a 75-mile return journey range, which could identify further charging infrastructure locations to support full utilisation of an electric vehicle.

Through this assessment, we identified three offices for the introduction of electric vehicles: Maes y Ffynnon (Bangor) Buckley, and Maes Newydd (Llandarcy). A further office was identified as a key location for a charging point to support inter-office journeys to Llys Afon (Haverfordwest).

We then considered the most suitable vehicle model for NRW. For this demonstration project, it was decided that a car would be the most suitable vehicle to trial, i.e. rather than an electric van, due to the inter-office nature of suitable journey types. We considered how the range, size and price of different electric car models would fit with our operational needs.

The Nissan Leaf Acenta 30 kWh model was chosen, which compared well to a medium sized fleet vehicle it was expected to replace, provided a suitable range for the journeys required, met safety standards and the purchase price was competitive. We also opted for the 6.6kW on-board charger, which would facilitate charging at 32 amps and reduce charging times to 4-6 hours¹. For this pilot, we chose to purchase the vehicle (including the battery).

Three electric cars & six electric vehicle charging points

Established carbon saving technology

Emissions avoided: 3 tonnes CO₂e saved per annum (approximate total from 3 vehicles)*

Purchase of three electric vehicles: £50,046(net) (£16,682 per vehicle, after OLEV grant is applied)

Purchase of six charging points: £5,938

Installation of charging points: £14,790 (including groundworks)

Total project cost: £70,774

Collaboration with others

NRW staff supporting introduction including: Fleet, Technical Facilities and local Facilities leads. Learning from experience of the National Trust

Delivery date: May 2017

*compared to an equivalent diesel NRW fleet vehicle

**predicted; in comparison to Ford Fiesta; including installation of charging unit

¹ When charged at 32 amps.

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The vehicles were purchased through a Crown Commercial Services (CCS) framework, which is used for the purchase of NRW fleet vehicles. Each vehicle included a £4,500 grant from the UK Office for Low Emission Vehicles (OLEV)², taken off the price of the vehicle by the dealership at the point of purchase. The total cost of vehicles presented in this case study are presented after the OLEV grant has been applied.

Our electric vehicles are part of the organisation's fleet and are available to staff to book through our central pool fleet car booking system (Cyfarch). As part of the strategy for integrating the vehicles into day-to-day use, launch events were held at the three NRW offices to introduce staff to the electric cars and charging procedures. User guides and FAQ documents were also produced bilingually and made available in each car and on our intranet. In addition, key rings were made and attached to the vehicle keys as a quick guide with reminders of the range, that the car is automatic and electric, and with the assistance number for the fleet.

Charging points - purchase

Through the assessment of offices suitable for an electric vehicle, four NRW offices were identified as sites to install electric vehicle charging infrastructure (charging points): Buckley, Bangor, Llandarcy and Haverfordwest. This encompassed the locations chosen for the introduction of the three electric vehicles (Buckley, Bangor, Llandarcy) and an additional office to facilitate inter-officer travel (Haverfordwest).

The Carbon Positive Project also recognised the opportunity to install charging points at key Visitor Centres to encourage our visitors to make sustainable transport choices. Coed y Brenin and Bwlch Nant yr Arian were chosen for installations as part of the demonstration project due to their size, visitor numbers, electrical capacity at site, and presence of centre staff to support the use of the unit. As an additional benefit, the two Visitor Centre charging points will also expand our ability to support our staff making journeys in the area.

Before procuring charging points, we considered the size (i.e. power) of charging unit we could install. This involved investigating the electrical capacity at the proposed installation site(s) and determining what size (amps) of charging point could be accommodated without the need for a major electrical upgrade. We sought to install the maximum sized charging points possible without requiring an electrical upgrade to the site. At each site, a survey was undertaken by our maintenance contractors to determine the electrical load available (capacity). This identified the ability of



Map showing locations of installed EV charging infrastructure at NRW sites. Map data © 2018 Google.

² part of Department for Transport and Department for Business, Energy and Industrial Strategy

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current electrical systems at sites to accommodate the requirements of an electric vehicle charging point³.

From this assessment, the appropriate charging point size (power) was determined for each of the identified sites: 64-amp capacity at Maes y Ffynnon and 32-amp capacity at the other five sites⁴. All sites identified were single phase. This therefore excluded the option of installing rapid (i.e. 30-minute charge) charging units and limited our options to fast charging (i.e. 4-6 hour charge).

There are a number of different charging point models and suppliers in the market, and to identify the most suitable charging points for NRW's operational needs we considered a number of factors:

- Whether a pedestal/unit or wall mounted design be more suitable for the proposed installation site
- Whether the model would be compatible with the charging requirements of our electric vehicles
- Upfront costs and likely ongoing costs, e.g. payment platforms/systems, maintenance
- If the model would be future proof, i.e. whether it could be upgraded to meet future needs
- If the unit could be secured, i.e. to avoid misuse where installed in publicly accessible locations
- Whether the unit could provide a function to monitor use

Following an open competition to procure the charging points, the Rolec 'Autocharge: EV Pedestal'⁵ model was chosen. The model is a pedestal/unit design, meets our charging requirements for vehicles, and can be operated on a 'plug and play' basis with no ongoing cost to the organisation beyond electricity use and operational maintenance⁶. The units can be upgraded in future, should NRW wish to introduce cost recovery for electric vehicle charging points. In addition, the units can be locked to prevent misuse and have meters installed inside the charging units allow monitoring of electricity use.

We chose unit configurations to utilise the maximum electrical capacity at sites and provide the ability to charge a number of vehicles at sites (i.e. a unit with two sockets where possible). This involved installing the following unit configurations: 64amp unit with 2 x 32amp sockets (Maes y Ffynnon), 32-amp unit with 1 x 32amp socket (Buckley, Haverfordwest), 32-amp unit with 2 x 16amp sockets (Llandarcy, Coed y Brenin, Bwlch Nant yr Arian).

Charging points – installation

Installation of charging points was awarded separately to the purchase of the units. We worked collaboratively with local facilities staff to see units installed in between the two closest standard parking bays to the office or Visitor Centre; providing dedicated facilities to park and charge two electric vehicles at most sites, in the most convenient locations, to promote their use. Signage was also installed to mark the bays for electric vehicle charging only and internal communications materials were shared at the office locations to educate staff on the need to keep the parking spaces free.

Due to the locations of our offices and parking spaces, groundworks were required at all sites; which involved up to 60m of groundworks to lay cable between the distribution board and charge point location. To future proof the installations, works included installing a "draw rope" in the ducting to allow easy installation of additional

³ i.e. ensuring there was sufficient electrical load to support a charging point drawing down power to charge an electric vehicle.

⁴ Llandarcy, Buckley, Haverfordwest, Coed y Brenin and Bwlch Nant yr Arian.

⁵ Type 2, single phase, Mode 3 charging socket(s) and designed for public facing and commercial environments.

⁶ To be carried out by our own maintenance contractors.

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cabling for further charging units in the future without the need for additional groundworks. Wooden posts were installed in front of the units to protect the unit from damage by vehicles; wooden posts were chosen over a steel alternative as substituting steel products for wood can yield almost 80% reduction in embodied carbon⁷, demonstrating further mitigation measures.

Where cabling was run internally through existing buildings (e.g. drilling through walls), asbestos surveys were conducted. CDM requirements were considered through construction plans, managed by NRW technical facilities staff. Where sites contained ICT infrastructure and an electrical shutdown was required, we collaborated with ICT staff to put in place mitigation of risks to ICT infrastructure. Local facilities staff were integral to overseeing works on site and liaising with staff on the installations.

Outcomes

Overview of the launch:

- Three cars and six charging stations were successfully put into operational use in May 2017.
- Staff response to using the electric fleet vehicles was very positive and in the first four months of use following the launch (May-September 2017), utilisation was up to 75%, with vehicles being used almost four out of five working days in some offices.
- Charging points available for use at visitor sites were operational in time for the summer season and through promoting the units' installation on social media and ZapMap (a free online EV charge point map), utilisation grew quickly.

Benefits to our staff:

- As an environmental organisation, our staff have passion for the environment and to drive sustainability. The electric vehicles gave staff an opportunity to select a more sustainable transport option, where using a vehicle was essential.
- As EVs are automatic, this has increased opportunities for staff who cannot drive manual cars, e.g. for health or license reasons, to use a pool car rather than hiring vehicles (which then has cost saving implications).
- Providing guaranteed, convenient parking spaces for the vehicles when visiting offices (where parking can be challenging), has further incentivised the use of the vehicles.

Benefits to our ambitions to decarbonise:

- Branding the vehicles as '100% electric' and with our '#BeCarbonPositive' hashtag, linked the electric vehicles to our wider programme of decarbonisation under the Carbon Positive Project. This gave a visible presence to the Carbon Positive Project and expanded knowledge and understanding of NRW's work to decarbonise, both internally and externally.
- The success of the pilot has resulted in a further 3 electric vehicles being purchased in 2018, to maximise the availability of the charging infrastructure installed as part of the pilot.

⁷ Hammond, G.; Jones, C. (2011) Inventory of Carbon & Energy (ICE). Version 2.0. Sustainable Energy Research Team. University of Bath: UK. <http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html#.V8gV5E1ARaQ> Accessed 14/08/2018.

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- Fleet and Carbon Positive are now exploring expanding EV charging infrastructure across NRW sites, to facilitate further integration of electric cars and vans into the fleet. Within this, we'll be exploring the utilisation of payment platforms for cost recovery, to facilitate a sustainable system to enable our staff and visitors to utilise installed charging infrastructure. We hope this facility would then encourage our staff and visitors to choose electric vehicles for their journeys.
- A strategic fleet carbon review conducted as part of the Carbon Positive Project for NRW has outlined the potential for 56% of the fleet (not including plant machinery) to be replaced with electric alternatives, which could reduce emissions by 413tCO₂e per year. This will help to steer our ambition to expand electric vehicles in our fleet.

Benefits to budgets:

- Each electric vehicle is predicted to save us £900 per year in total compared to a conventional fleet vehicle. The strategic fleet carbon review (mentioned above) highlighted that replacing 56% of our fleet with electric vehicles could save £136,000 per year in fleet costs⁸.
- Our electric vehicles cost approximately 2 pence per mile, compared to around 7 pence for a comparable diesel fleet vehicle. Considering a typical annual mileage of a fleet vehicle at 10,000 miles per year, this is expected to yield a fuel cost saving of £500 per vehicle per year.
- Alongside fuel savings, there are also benefits from reduced servicing requirements, every 18,000 miles rather than 10,000 miles on a diesel equivalent, which reduces costs to the fleet budget.

Wider Benefits

- Electric vehicles and charging infrastructure will help NRW and others withstand changes in the supply and price of fossil fuels (contributing to a resilient Wales).
- Alongside emissions savings, electric vehicles also provide reductions in noise pollution and air pollutants (such as nitrogen oxides), supporting improvements to air quality and associated health benefits (a healthier Wales).
- Improving our services to our visitors contributes to Wales' tourism and a prosperous Wales goal.
- Integrating EVs into our fleet reduces the impact of our operations on global climate change and sharing our experience helps to encourage others to take up the technology (contributing to a globally responsible Wales).
- Our implementation of electric vehicles also demonstrates the principles of the Sustainable Management of Natural Resources (SMNR)⁹, of: adaptive management by beginning to shift our fleet to electric, utilising evidence to demonstrate the business case for change, pursuing wider benefits (e.g. infrastructure to support visitors using electric vehicles), ensuring collaboration and engagement through working with staff across the organisation and sharing our experience, and taking long term, preventative action on climate change, which builds our resilience as an organisation (e.g. to future changes in fossil fuel supply and price).

⁸ on a lease basis (rather than purchase)

⁹ <https://naturalresources.wales/media/678317/introducing-smnr-booklet-english.pdf>

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Learning

Electric vehicles

The purchase of electric vehicles was relatively straightforward as this drew upon existing procurement frameworks and staff knowledge. We learnt that when considering or costing electric vehicle purchase it is useful to:

- discuss operational needs with fleet teams
- be clear on the options included on the model being considered
- consider whether additional capital expenditure on vehicle extras (e.g. satellite navigation systems) will add value and be more suitable to operational needs
- check whether the price quoted includes the OLEV grant
- explore and compare lease options, particularly when considering larger scale expansion of electric vehicles in a fleet

Ensuring effective support was in place for the vehicles and charging points was essential to the success of launch. We delivered detailed user guides, frequently asked questions (FAQs) and demonstration sessions for staff supported by our fleet team. Staff feedback was extremely positive on the support in place and this contributed to staff confidence and utilisation rates.

Our car booking system currently makes one all day booking when the electric vehicle is used, to guarantee vehicles are fully recharged before the next use. In future, we will seek to introduce a more sophisticated way to book an electric car for a short period of time, whilst ensuring the system schedules in an appropriate recharge time. Alternatively, we will also consider the operational need for rapid charging units (i.e. that charge a vehicle in around 30 minutes).

We will continue to monitor utilisation of vehicles and seek to promote their use where utilisation is low and expand vehicle numbers where utilisation is high in the future.

Charging points

Charging electric vehicles from a 13-amp supply (i.e. through a standard 3-pin plug) is not a long-term charging solution. Charging vehicles in this way can present a safety risk due to the sustained draw of power for long periods of time (e.g. charging an electric vehicle for 12 hours overnight on a standard 3-pin plug) putting pressure on a buildings' electrics. Dedicated charging infrastructure is a necessary investment to support electric vehicle charging.

Electrical capacity can be a key constraint in installing charging infrastructure. Operational needs should be considered to ascertain the cost benefit of undertaking electrical upgrades to support more powerful charging options.

Choice of charging infrastructure should consider what best meets the needs of the organisation. This could include consideration of: online payment platforms for cost recovery, unit or wall mount design, and the purpose of the unit (e.g. business only use or public/visitor facing).

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Some charging points are designed to be supported by an online payment platform system, which requires an online connection via 3G reception to work. At some more remote NRW sites it has been identified that charge points with payment platforms would not be suitable due to the lack of 3G reception. Future consideration will be made as to how to overcome network issues to further expand our electric vehicle charging infrastructure, where this includes the use of an online payment platform. One solution may be to utilise existing internet connections at nearby buildings and run a network cable to the charging unit.

The purchase of charging units required collaboration between fleet and facilities staff to reach agreement on the most suitable units and location for installation. Installation of units was more challenging, as this required development of knowledge and skills through the development and delivery of the tender and so took longer to deliver than expected. Future installations should factor in time for project planning, to reach consensus on suitable units, location for installation, to confirm any financial support for ongoing costs regarding payment platforms and confirm handover of responsibility of charging units to local facilities teams and maintenance contractors.

Evidence & information

Examples of successful adoption/initiatives:

[Swansea Council](#)

[British Gas' Electric Fleet](#)

[Go Ultra Low Nottingham Council](#)

