

Use of Energy carriers: Legislation & Practicality

Approach

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Introduction

This paper discusses the progression amongst local governments to improve on the emissions created by United Kingdom (UK) fleet and transport vehicles, when considering the effects of climate change.

The United Nations have set a limit on warming via climate change to 1.5 degrees above pre-industrial levels, the decline must fall to within 43 percent by 2030 and be net zero by 2050 (United Nations 2023). Swansea council have targets across their sites and fleet vehicles to be net zero by 2030, they also want their residents to be net zero by 2050 (Swansea council 2023). Furthermore, to increase air quality to the surrounding areas and therefore prevent premature deaths, the World health organisation estimates 7 million deaths global for air pollution each year (World Health Organisation 2023). This translates to the UK, with the figures of 28,000 to 36,000 premature deaths each year due to air pollution (Gov.uk 2022). To this extent this report discusses and recommends new ideas to the council which can improve the environment and the air pollution around the city.

Euro 6 and Euro VI:

Euro 6 emission standard was brought into effect during September 2015, the emission limits were both lower for petrol and diesel than Euro 5. The figures here represent diesel limits of emissions; 0.5 g/km Carbon monoxide (CO), 0.08 g/km Nitrogen oxide (NOx), 0.005 g/km Particulate Matter (PM), Hydrocarbons, and oxides 0.17 g/km (International council on clean transportation 2016). For petrol emission limits it to 1 g/km CO, 0.06 g/km NOx, 0.1 g/km hydrocarbons, and 0.005 g/km PM (International council on clean transportation 2016). For Euro 6 petrol vehicles pollute slightly more than diesel vehicles(RAC 2023). To reduce diesel emissions further selective catalyst reduction was brought in, this uses a liquid (AdBlue) which is released into the exhaust, converting the emission of nitrogen oxide into water and nitrogen which is not harmful (RAC 2023).

Furthermore, exhaust gas recirculation was fitted to petrol and diesel vehicles to lower the combustion temperatures and reduce NOx forming at high temperatures in the combustion chamber. The emissions testing procedure was changed to Worldwide harmonised test cycle (WLTC) which included the worldwide harmonised test procedure (WLTP) WLTP includes urban driving, inter-urban and fast motorway driving with a maximum speed at 130 km/h (International council on clean transportation 2016). The WLTP cycle was supplemented with real driving emission (RDE) test procedure which measure emissions on a real road test cycle (RAC 2023).

The life cycle for euro 6 is 5 years and 100,000 km which is the period the emission standards are valid for; this has been changed for Euro 7 to 200,000 km and 12 years. This change has been

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implemented because vehicle in Europe have an average age of 12 years and 160,000 km. This means vehicles made during Euros 4, 5, and 6 are still on the road along with high km, these vehicles are not guaranteed by the emissions standards of the era (International council on clean transportation 2016).

Euro 7 forthcoming:

Euro 7 emissions standards will replace the current Euro 6 emissions standards effective in 2025. The standard will limit NOx emissions to 60 mg/km per vehicle, this is for petrol and diesel vehicles. Heavy duty vehicles it reduces emissions to 350 mg/km cold and 90 mg/km hot. The standard also limits Ammonia for cars and vans, formaldehyde and nitrous oxide for trucks and buses (Diesel net 2022).

The standards also include tougher test procedures, during the real driving emissions test. The changes being during the test, limit on temperature of 45 degrees, highest altitude of 1800 metres and short trips emissions included. Emissions off tyres and brakes (particles) will be included along with longevity assessments to applied on electric car batteries (Griffiths 2022).

Swansea council's climate change and nature strategy:

The strategy is mitigated, adapt, improve nature spaces, and engage into local community to reduce emissions to net zero by 2030 and in the community by 2050. This is under the United Nations aim to keep global warming to 1.5 degrees Celsius. (Local Government Association 2023)

Swansea council plan to implement during the next seven years a policy to have buildings and fleet vehicles net zero, this will happen by 2030. The policy headline is to reduce carbon emissions to greater benefit the public and community who live and work respectively, further with an increase in biodiversity across all areas of the city. The first tag line reduces fossil fuelled projects by 58 percent up to 2037, the understanding here is that building projects and roading projects will still use fossil fuel after 2030. The council plan to add 32 charging bays to 12 council car parks on top of the 40 chargers in 15 car parks brought by 2022. The electric going to the city would be all renewable available by tidal lagoon, further brought by 900 kW of solar attached to all businesses, schools, housing, and places of worship (Swansea council 2022). Council houses to be built in Swansea will be built to a with high insulation, solar panels and storage, air to source heat pumps, EV charging possible of Vehicle to grid (Swansea council 2022).

The local government association explains different possibilities of switching fleets of vehicles to battery electric (Local Government Association 2023). The impact of changing these vehicles is high

on the budgets attached to the councils, company vehicles are usually lease from supplier firms or specialised through the manufacturers and will have to influence new equipment for future.

The government association suggests a couple of short-term fixes regarding RCVs, the rear electric lifting mechanism and conversion of the vehicle to eco fuels or hydrogen cells, with efficiency on the lifting mechanism and reduction in vehicle emissions respectively (Local Government Association 2023). The collective suggests replacement of diesel cars to BEV, suggesting the current lease with Peugeot vehicles could be adapted to change to BEVs (Local Government Association 2023). If vehicles are provided to individual council workers to be used during home and site visits, electric car chargers are to be installed in the residences of these workers. Neighbourhood community buses and vehicles to also be replaced with electric vehicles. (Glasgow city council 2020)

Vehicles to be upgraded:

Dennis eagle are the primary operator and manufacture to council refuse collector vehicles (RCV), the manufacturer has developed the Dennis Eagle e collect. The version here has been designed to suit typical RCV operation, for example, the collection of up to 20 tonnes of waste on an 8-hour shift. The vehicle is made from 5 lithium-ion batteries which produce 300 kWh of power to drive a 200-kW motor (Dennis Eagle 2023). Battery is positioned into the chassis underneath for weight distributions and centre of gravity, the vehicle aims to last as long as diesel RCVs (Dennis Eagle 2023). As with electric vehicles the charge time is six to seven hours should be enough time to charge overnight on 11 kW found on industrial sites (Dennis Eagle 2023).

Volvo FL Electric, which is the smallest truck in the range is best suited to the council. This vehicle has a battery capacity of 280 – 585 kWh with up to 3 to 6 batteries and a range of 420 km (Volvo Trucks 2023c). The vehicle's charging times differ dependent of the number of batteries the vehicle contains, with the 4-battery version takes 16.8 hours on 22 kW AC and 2.3 hours with 150 kW DC charger, the vehicle has 130 kW of power and 425 Nm of torque (Volvo Trucks 2023c). The operation of this vehicle is suited to suburban to urban deliveries and waste collections.

Gas powered vehicles could fix the issues regarding the distance Battery electric trucks can travel, with a range of 420 km on the FL as the largest range of any truck in Volvo's electrified range. The vehicle operative range is limited to city and suburban environments. If the county of council region is large, then a vehicle that can travel up to 1000 km between fill ups is more suited (Volvo Trucks 2023b). This is where liquid natural gas (LNG) powered trucks could be used, the vehicles would run using modified existing engines, this is available on FM, FH, or FL (Volvo Trucks 2023b). The most powerful version of this vehicle has 368 kW and 2500 Nm of torque (Volvo Trucks 2023a).

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Mercedes Benz e-Actros uses 3-4 batteries, the battery is powered at 112 kWh each (Mercedes-Benz 2023a). The total is 336 to 446 kWh this allows for a distance 330 km to 400 km and has DC fast charging of 1 hour and half (Mercedes-Benz 2023a). This truck is like the Volvo FL as it can be used for urban environment deliveries. This is another electric lorry RCV which could be used instead of the Dennis Eagle (Mercedes-Benz 2023b).

(DAF 2023).

(Scania 2023a) (Scania 2023b) (Scania 2023c)

To reduce fleet emissions the council will replace the current diesel vans with electric. Mercedes Benz offers 3 electric vans in small to big sizes, these are the e-Sprinter, e-Vito, and e-Citan (Mercedes-Benz 2023c).

The e-Sprinter is offered with a 55kWh battery capable of rather short of 85-to-95-mile range and DC rapid charging of 30 minutes (Mercedes-Benz 2023c). This vehicle is not as range capable as the ford e-transit or Peugeot e-boxer, therefore, a choice from competitors could be more suitable.

The M-B e-Vito is supplied with a 66-kWh battery capable of 217-221 miles, available for DC fast charging at 100 kWh in 40 mins (Mercedes-Benz 2023c). This vehicle is more like for like competitor to the VW ID. Buzz and the ford Transit electric regarding range and charge speeds.

Volkswagen ID. Buzz is a ground up electric van offered with a 77-kWh battery; this vehicle is capable of up 256 miles WLTP with charge time 30 minutes at charging speeds of 170 kW (Volkswagen 2023). The vehicle as with electric vehicles is fast around town, especially away from junctions, roundabouts, and gaps in traffic. Volkswagen has another van called the multivan offered as a plug-in hybrid, this vehicle has small battery of 13 kWh and 30 miles on ran electric only, then a petrol engine drives the vehicle (Volkswagen 2023).

Peugeot e-partner offers a 50-kWh battery with up to 170 miles of range and the ability to charge at 100 kW in 30 minutes DC (Peugeot 2023). This vehicle is small van which allows for easy parking and easy moveability around town.

Peugeot e-Expert comes in two different powertrain options 50-kWh and 75 kWh form with a range up 148 and 211 miles, the vehicle charges using 100 kW DC with the small battery charging in 30 minutes and the big battery charging in 45 minutes (Peugeot 2023).

Peugeot e-boxer is the weakest offering in the range but is the largest van, the vehicle is equipped with a 75-kWh battery capable of 154 miles and charges at 50 kW in an hour (Peugeot 2023). The main problem with this van is that the Ford e-transit beats in the areas on range and charge speeds.

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Ford e-Transit uses 68 kWh with a range of 196 miles, the vehicle is a similar size to the Peugeot e-boxer (Ford 2023a). This vehicle could be a suitable alternative to the Peugeot and VW rivals, it is worth considering Volkswagen do not offer an electric van in this size.

Ford will from next year offer a new smaller transit van this vehicle will be considered as an electric van as well as diesel or hybrid. This van will be the same as the next Volkswagen transporter T7, as an electric van it will be capable of 236 miles of range and 170 kW of charging is offered (Ford 2023b).

Vehicle charging facilities Swansea area:

When the changes are implemented into the vehicle fleets, council offices and sites. The areas will require different types of chargers. These could be 3-and 7-kW slow chargers and 22 to 43 kW AC moderate chargers, with possibility for DC fast chargers of 50 to 100 kW (Zap Map 2023). The chargers based at council offices and sites could be used for the employees and visitors of the council. The car park provided will have to have chargers for each space, the charger here will be of the slow type. If the vehicles used are pool vehicles, maintenance van these vehicles will be hooked up to the moderate to fast chargers. If the vehicles are required to be used again then these vehicles need to be hooked up to the fast DC chargers. Residential visitors' spaces could also have chargers if these people go to the council.

With consideration for the public to charge their vehicles the council offers Clenergy ev chargers, these are the slow destination chargers with type 2 AC sockets (Zap Map 2023). The intended use of these chargers is for people out and about in the city when these people are shopping or eating. The Fast DC CCS and CHAdeMO are commonly in McDonald's, Tesco, BP pulse, and shell recharge these areas are determined by short stays and quick fill ups, hence the high wattage chargers (100, 150) (Zap Map 2023)

Consideration must be given to add further chargers to the car park to allow for an increasing number of electric vehicles being sold to the public. These places could quickly become inadequate for number of electric cars per residents in the city. Considerations to disabled people must be given when size of charger dimensions and positioning at the back of car parks far away from paths and lifts. Further considerations must be given to chargers as these can often be unreliable.

Further changes to council buildings/sites:

Improvements will be required at these council buildings and areas so that the vehicles have enough grid capacity. Upgrading of substations and grid infrastructure will allow for fast chargers to exist, in the variety of 100 to 150 kW. Slow chargers could be attached to solar so that the charging here

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exists for free or lower cost, these chargers could be bi-directional in capacity for vehicle to grid operation, moreover the council building could add battery storage.

If some of the vehicle cannot be converted to electric consideration for storage of fuels or places to go to fuel up vehicles must be provided. Hydrogen fuel or eco fuels must have sites close by, so these vehicles can easily be fuel up, eco fuels could be stored on site safely, but hydrogen fuels must be stored under pressure. Vehicles of these type are likely to be trucks or earth moving machinery, only two passenger cars exist; Hyundai Nexo and Toyota Mirai these are heavily compromised difficult to use and expensive. 12 hydrogen fuelling stations exist and synthetic fuel is not available for fuel station.

Public transport and alternatives:

First Cymru (south Wales & west Wales) (First Bus 2023a),

First Cymru (Wales) operate buses across the south Wales and west Wales, the company operate 200 Bus services in this area. The services operate to towns and cities around this region From Haverfordwest, Tenby, Carmarthen, Llanelli, Swansea, Pontardawe, Neath, Port Talbot, Maesteg, Bridgend, Cardiff (First Bus 2023a). Some of the services operated are covering Swansea, other services are offered to further away towns and are integrated into train and ferry services.

University bus services run between the Swansea university campuses and the student living areas and student housing areas; these buses are very frequent in with waiting times of seven minutes (First Bus 2023b). There is a park and ride buses on the behalf of the local authority which runs into town and surrounding areas when the town is busy with a service frequency of 15 minutes in the case of busy times for car parking (First Bus 2023b). Hourly at peak times and half hourly at peak times run an express service between Cardiff, Swansea, and the hospitals (First Bus 2023b).

Transport for Wales operates trains and buses across the whole of Wales, this also includes the south Wales metro (Transport for Wales 2023a). The company plans to improve with new trains, refurb and new stations, ticketing and better commuter and region express services (Transport for Wales 2023a). The impacts here to improve on emissions to stop negative effects of climate change. Local commuter services can also be considered of the longer distance journeys are well. Trains often stop at smaller footfall stations, though often on request by passengers to guard, these stations are often within commuting range of Swansea, these could be used by the staff of council

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(Transport for Wales 2023b). There are also train services to Cardiff, Newport, Bristol which are an hour to two away, there are also services to London, Shrewsbury, and Chester these services are run by TfW and GWR (Transport for Wales 2023b).

Cycle paths and routes exist to remove people from their pollutive and congestive vehicles, these routes can be situated next to roads or away from them. The biggest examples of these are the Swansea bath promenade or path next to the river (Swansea Council 2022a). Other exist next to the main Fabien Road and further along the A483 (Swansea Council 2022a). The cycle hire scheme exists of Santander hire bicycles with 6 location points to and from, these include Swansea university singleton park, Civic centre, national waterfront museum, Fabien way park and ride, Swansea university bay campus and Mumbles promenade (Nextbike 2023).

Footpaths exists next to all roads in Swansea, though there are some that are not direct associated next to roads to make it more pleasant to walk against. In the city areas exist of pedestrianisation which ban vehicles from the area as well (Swansea Council 2022b). The city being relatively compact also experiences countrified experience and public footpaths in these areas (Swansea Council 2022b).

Limitations:

The limitations of the electric vehicles could be range, considerations to how far the vehicle travels and when it charges will have to be made. Considerations must be made if a charger is out of order or there are vehicles already using them, how long the vehicle has to charger for as well. For the RCV and lorry type vehicles, can these vehicle do the quoted range and will there be differences in winter and summer time range of the vehicle. Will the extra cost of these be quoted into the council budgets or will cheaper alternatives have to be order regarding eco fuels, hydrogen powered or gas-powered vehicles.

Conclusion

In conclusion, the progression towards electric, use of public transport and use of walking or cycling could widely benefits users and residence of Swansea city council. The steps taken to remove diesel/petrol vehicles from the fleets will improve the local emissions given lack of fuel combustion vehicles, sees decrease in hydrocarbon gases and increase in air quality. The possibility of reducing running costs on the vehicles as well considering electric powertrains and ability to generate electricity. The provision of electric chargers for workers and public could foresee public shift towards battery electric vehicles.

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Furthermore, promoting the use of public transport allows another version of sustainable transport, reduction in traffic congestion and reducing in greenhouse emissions with benefit overall improvement in air quality. If run properly this can see reductions in fare prices and introduction of subsidies with an increase investing money into more reliable and efficient systems. These uses can be seen in buses, rail, and light rail such as trams.

In addition to the other points, the increase in pavements and cycle routes, which are safe will see an increase in residents wanting to use them. Incentives given by companies and governments will encourage workers to use their bicycles or their feet.

Moreover, considerations to the limits of these vehicles must be made regarding the range, infrastructure, weather, and servicing. The council must consider if these vehicle are suitable for all routes, distances, and environments.

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