Low Emission Strategy - Background Document Summary Cheshire West and Chester Council

October 2017

Cheshire West and Chester

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1. Introduction

Amec Foster Wheeler Environment and Infrastructure UK Limited (Amec Foster Wheeler) and Cenex were commissioned by Cheshire West and Chester Council (CWAC) to prepare a Low Emission Strategy (LES) for the borough. This document presents a summary of the background information collated by Amec Foster Wheeler and Cenex which informs the recommendations for a LES.

Cheshire West and Chester contains the key city of Chester and towns of Ellesmere Port, Neston, Frodsham, Northwich and Winsford. Large parts of the south and centre of the Borough are rural in nature. The population is around 329,000 of which around 26% is the rural population. There are currently four Air Quality Management Areas (AQMAs) in the Borough, three of which have been declared as a result of exceedances of the annual mean nitrogen dioxide (NO_2) Air Quality Objective (AQO) of 40µgm^{-3} arising from traffic emissions. These AQMAs are in Ellesmere Port, Boughton, Chester and Fluin Lane, Frodsham, with a Chester city centre AQMA, declared in 2017. An AQMA has also been declared in Thornton le Moors as a result of exceedance of the sulphur dioxide (SO_2) 15-minute mean AQO arising from industrial emissions. A further AQMA is likely to be declared on the A41 at Christleton as a result of traffic causing an exceedance of the NO2 annual mean. The AQOs are therefore exceeded at several locations in the Borough, so an overarching strategy for reducing emissions would help in efforts towards achieving compliance and improving the health and wellbeing of residents.

In addition to these AQMAs, there is now irrefutable evidence confirming the detrimental effect on health from particulate matter. Particulate pollution has been linked to approximately 25,000 deaths a year in England alone. Whilst there is no exceedance within the borough of the AQOs for particulate matter, a general reduction would be beneficial for the health of residents as it is a non-threshold substance. It is estimated that a one microgram reduction of particulate matter and nitrogen dioxide levels could result in a 10% reduction of related premature deaths.

In addition to the current situation, the population of the Borough is forecast to increase over the coming years. The Council's Local Plan details plans to deliver in the region of 22,000 new homes and to support an additional 14,000 people in employment. These proposed residential and employment sites are focused on the city of Chester and towns of Ellesmere Port, Northwich and Winsford. Given the current poor air quality in discrete locations in the Borough, it is crucial that development is managed to ensure that existing issues are not exacerbated and air quality is improved as new developments are constructed. Therefore, integration of a LES into the development planning process is likely to be an effective mechanism to achieve results.

CWAC aim to develop a LES with a broad consensus amongst stakeholders to ensure their support and help deliver a strategy that is workable. The LES will be based upon three key principles for the reduction of emissions of key pollutants:

- Shift: change mode from cars to public transport, cycling and walking
- Avoid: reduce vehicle kilometres driven, or emissions from stationary vehicles

- Improve: improve the vehicle technology to reduce emissions

Section 2 below provides an overview of relevant policy and legislation and specifically the air quality management areas (AQMAs). Section 3 provides overview of the baseline health in the CWAC area in the context of air quality. This includes the quantification of the health benefits of improved air quality and the associated economic benefits of improved public health. Section 4 assesses current and future market technology to 2025 and Section 5 makes recommendations for inclusion in the Low Emission Strategy. Appendix A provides vehicle baseline emissions.

2. Air quality legal and policy framework

EU Directive

The legislative framework for air quality consists of legally binding and enforceable EU Limit Values (LVs) that are transposed into UK legislation via the Air Quality Standards Regulations 2010[1], which came into force in the UK on 11 June 2010, replacing the Air Quality Standards Regulations 2007[2]. Air Quality Standards (AQS) must be at least as challenging as the EU Limit Values. Action in the UK is then driven by the UK's Air Quality Strategy[3].

Air quality strategy

The Air Quality Strategy sets the Air Quality Objectives (AQOs), which give target dates and some interim target dates to help the UK move towards achievement of the EU Limit Values. The AQOs are a statement of policy intentions or policy targets and as such, there is no legal requirement to meet these objectives except in as far as they mirror any equivalent legally binding Limit Values in EU legislation. The most recent UK Air Quality Strategy for England, Scotland, Wales and Northern Ireland was published in July 2007.

NO_2, PM_{10} (Particulate Matter with an equivalent aerodynamic diameter of ten micrometres (10 µm) or less) and $PM_{2.5}$ (Particulate Matter with an equivalent aerodynamic diameter of two and a half micrometres (2.5 µm) or less) are the pollutants of greatest health concern associated with road traffic, the main source of pollution in the area. The Department for Environment Food and Rural Affairs (Defra) have shown that policy measures already in place ensure that concentrations of other pollutants comply with the relevant objectives even at busy roadside locations.

NO_2 is emitted from vehicle exhausts as too are oxides of nitrogen (NOx) which undergo photochemical oxidation in the atmosphere, with NO_2 being formed by oxidation of NO to NO_2. Table 2.1 sets out the AQOs that are relevant to this assessment, and the dates by which they are to be achieved. For NO_2, it is the annual mean objective that is the more stringent AQO; it is generally considered that the 1-hour mean NO_2 AQO will not be exceeded if the annual mean objective is not exceeded. For PM_{10}, the 24-hour mean objective is more stringent than the annual mean.

Table 2.1: Summary of relevant air quality standards and objectives

Pollutant	Objective (UK)	Averaging period	Date to be achieved by and maintained thereafter (UK)
Nitrogen dioxide - NO_2	200 μgm^{-3} not to be	1-hour mean	31 Dec 2005

[1] The Stationery Office Limited (2010) Statutory Instrument 2010 No. 1001 Environmental Protection – The Air Quality Standards Regulation 2010.
[2] The Stationery Office Limited (2007) Statutory Instrument 2010 No. 64 Environmental Protection – The Air Quality Standards Regulation 2007.
[3] Defra in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

Pollutant	Objective (UK)	Averaging period	Date to be achieved by and maintained thereafter (UK)
	exceeded more than 18 times a year		
	40 μgm^{-3}	Annual mean	31 Dec 2005
Particles - PM_{10}	50 μgm^{-3} not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
	40 μgm^{-3}	Annual mean	31 Dec 2004
Particles - $PM_{2.5}$	25 μgm^{-3}	Annual mean	2020
	Target of 15% reduction in concentration at urban background locations	3 year mean	Between 2010 and 2020

Local air quality management

Since Part IV of the Environment Act 1995[4] came into force, local authorities have been required periodically to review concentrations of the UK Air Quality Strategy pollutants within their areas and to identify areas where the AQOs may not be achieved by their relevant target dates. This process of Local Air Quality Management (LAQM) is an integral part of delivering the Government's AQOs detailed in the Strategy. Local authorities investigate the levels of pollution in their area by a combination of ambient monitoring and dispersion modelling in the Review and Assessment process. However, as monitors cannot give a complete picture of an entire borough, dispersion modelling is often used to predict pollutant concentrations across a wide area, to investigate future scenarios and to estimate the contribution of different sources to the total pollution, known as source apportionment. In this way, air quality models can be used to assess whether or not the national air quality objectives are likely to be breached in their target year.

Under LAQM, where air quality objectives are not (or are unlikely to be) met, air quality management areas must be designated. The extent of the AQMA may be limited to the area of exceedance or encompass a larger area such as an entire town centre. Following the declaration of an AQMA, the local authority must undertake an assessment of air quality in the AQMA within 12 months and develop and implement an Air Quality Action Plan (AQAP) to improve air quality in that area. AQMAs are what drive various legal provisions in relation to air quality, specifically within the planning system. The local authority may update the action plan from time to time.

While councils have a statutory duty to carry LAQM, it is important to note that councils are not obliged to achieve the AQOs as they do not have sufficient control over all of the sources that could potentially give rise to the breach. Large industrial sources are regulated by the Environment Agency (EA); major roads are controlled

[4] HMSO (1995) Environment Act 1995.

by the Highways Agency and, in London, by Transport for London. Much of the pollution is regional in nature, arising from other areas in the UK or even outside the UK. When the review and assessment was devised, it was thought that national and European measures would achieve compliance with the EU LVs across the UK, with the exception of limited number of hot spots which local authorities would identify and address. However, this is not what has happened and councils are now faced with widespread exceedances.

Air quality across Cheshire West and Chester is generally good, but there are several locations where the AQOs are exceeded. The annual mean NO_2 AQO was only exceeded at 24 of the 60 diffusion tube locations in 2015 when considering relevant exposure. However, the LAQM review and assessment process has identified locations where the AQO is not currently achieved. The following AQMAs have been declared:

- Whitby Road / Station Road, Ellesmere Port. AQMA declared in 2005 by Ellesmere Port and Neston Borough Council due to exceedances of the annual mean NO_2 AQO attributed to pollutant emissions from road traffic, linked to local areas of congestion
- Chester City Centre AQMA declared in 2017 and incorporating former Boughton AQMA, due to exceedances of the annual mean NO_2 AQO attributed to pollutant emissions from road traffic, linked to local areas of congestion
- Fluin Lane / A56 junction in Frodsham. AQMA declared in 2015 by CWAC, due to exceedances of the annual mean NO_2 AQO attributed to pollutant emissions from road traffic
- Thornton-le-Moors. AQMA declared in 2016 by CWAC due to exceedances of the SO_2 15-minute mean AQO

A further AQMA is likely to be declared on the A41 at Christleton due to an exceedance of the NO_2 AQO across a very small area. The sections below summarise the assessments carried out leading to the designation of the AQMAs.

National Planning Policy Framework and National Planning Practice Guidance

The National Planning Policy Framework (NPPF)[5] sets out government's planning policies for England and how these are expected to be applied. With regards to air quality, the NPPF states:

> Planning policies should sustain compliance with and contribute towards EU limits values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.

[5] Department for Communities and Local Government (2012) National Planning Policy Framework

In Paragraph 35, it also encourages the use of sustainable transport modes for travelling and delivery.

> "35. Plans should protect and exploit opportunities for the use of sustainable transport modes for the movement of goods or people. Therefore, developments should be located and designed where practical to:
>
> - give priority to pedestrian and cycle movements, and have access to high quality public transport facilities
> - create safe and secure layouts which minimise conflicts between traffic and cyclists or pedestrians, avoiding street clutter and where appropriate establishing home zones
> - incorporate facilities for charging plug-in and other ultra-low emission vehicles
> - consider the needs of people with disabilities by all modes of transport."

The government has also produced Planning Practice Guidance (PPG)[6] which provides guiding principles on how planning can take account of the impact of new development on air quality. With regards to the development of Local Plans, it is stated that:

> "It is important to take into account air quality management areas and other areas where there could be specific requirements or limitations on new development because of air quality." and
>
> "the Local Plan may need to consider:
>
> - the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments
> - the impact of point sources of air pollution (pollution that originates from one place)
> - ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution."

It is stated that air quality is relevant to planning applications when the development would:

> - "Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large heavy goods vehicle flows over a period of a year or more.

[6] Department for Communities and Local Government (2014) National Planning Practice Guidance – Air Quality.

- Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant;
- Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.
- Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations."

Cheshire West and Chester Local Plan

The Cheshire West and Chester Local Plan Strategic Policies document[7] provides the overall vision, strategic objectives, spatial strategy and strategic planning policies for the borough to 2030. Table 2.2 shows the number of new dwellings listed in the Local Plan Strategic Policies document.

Table 2.2: Local Plan new dwellings proposed

Area	Dwelling completions by 2030
Chester	5,200
Ellesmere Port	4,800
Northwich	4,300
Winsford	3,500
Other rural areas	4,200
Total	22,000

The Strategic Policies document lays out a range of policies related to air quality within the Borough, in particular:

STRAT 1 Sustainable Development states that proposals should:

- Provide for mixed-use developments which seek to provide access to homes, employment, retail, leisure and other facilities, whilst reducing the need to travel;
- Locate housing, with good accessibility to existing or proposed local shops, community facilities and primary schools and with good connections to public transport; and
- Support regeneration in the most deprived areas of the borough and ensure those reliant on non-car modes of transport can access jobs and services.

[7] Cheshire West and Chester Council (2015) Local Plan (Part One) Strategic Policies

STRAT 10 Transport and Accessibility states that:

- In order to minimise the need for travel, new development should be located so as to be accessible to local services and facilities by a range of transport modes;
- New development will be required to demonstrate that appropriate provision is made for access to public transport and other alternative means of transport to the car;
- Proposals should seek to maximise use of sustainable (low carbon) modes of transport, by incorporating high quality facilities for pedestrians, cyclists and public transport and where appropriate charging points for electric vehicles; and
- Proposals for new industrial and warehousing development should maximise opportunities to transport products by non-road modes of transport. Existing or potential freight movement opportunities will be safeguarded from development which could preclude continued or future freight use.

SOC 5 Health and Well-Being states that proposals will be supported that:

- promote safe and accessible environments and developments with good access by walking, cycling and public transport; and
- Development that gives rise to significant adverse impacts on health and quality of life (e.g. soil, noise, water, air etc) including residential amenity will not be allowed.

The Local Plan (Part Two) will set out the non-strategic allocations and detailed policies, following on from the strategic framework set out in the Local Plan (Part One). When adopted both documents will constitute the statutory development plan for Cheshire West and Chester and will replace all former Local Plans. It is proposed that Local Plan (Part Two) is submitted to Secretary of State for examination in 2017[8]. Local Plan (Part Two) offers an opportunity to include policies specifically related to air quality in planning considerations.

Cheshire West and Chester Local Transport Plan (2011-2026)

CWAC's Local Transport Plan[9] sets plans and priorities for transport from 2011 to 2026 to deliver and manage a well maintained, integrated and sustainable transport network with the following themes:

- reducing carbon emissions – travel plans aim to reduce single occupancy car use and promote multi occupancy travel
- a world class place to live and invest – a less congested network improves settlement attractiveness and business journey reliability, supporting economic investment

[8] CWAC (2016) Local Plan Part Two: Land Allocations and Detailed Policies
[9] Cheshire West and Chester Council (2011) Local Transport Plan Integrated Transport Strategy 2011-2026

- supporting regeneration – travel plans ensure that new developments have adequate facilities to support sustainable journeys and aim to minimise traffic impact
- cycling and walking – the promotion of the benefits of walking and cycling and associated measures are achieved through travel plans

Cheshire West and Chester Council – Travel Planning Guidance Supplementary Planning Document

The Travel Planning Guidance Supplementary Planning Document (SPD)[10] was adopted on 16 March 2016 and provides guidance on how CWAC will assess and deal with planning applications where a travel plan is required. It is stated that the overriding aim of travel plans should be to reduce the proportion of single occupancy car trips to and from the site.

On a case by case basis and dependant on the scale of development the requirement for a travel plan will be reviewed for:

- any development near an Air Quality Management Area (AQMA)
- any development within an area identified in the Local Transport Plan (LTP) targeted for traffic reduction, the promotion of public transport, walking or cycling
- any area that the cumulative impact of development is a cause for concern
- areas where the road capacity is already under stress or may come under stress as a result of the planned development
- an extension to an existing development that causes the travel impact of the site to exceed the threshold for a transport assessment

Car Parking Standards

CWAC adopted the Parking Standards SPD[11] in 2017. It states that it is expected that electric vehicle (EV) charging infrastructure will be provided where any new parking provision (including garages and driveways) forms part of proposals and for other development where 10 or more new car parking spaces are to be provided. Specifically:

- all new houses and flats should be provided with sufficient infrastructure to facilitate and encourage electric vehicle use. A separate dedicated circuit protected by a residual current circuit breaker (RCBO) should be provided from the main distribution board to a suitably enclosed and accessible external/garage termination point for future connection to a charge point. Cable and circuitry ratings should be of adequate size to ensure a minimum continuous current demand for the vehicle of 16A and a maximum demand of 32A

[10] Cheshire West and Chester Council (2016) Draft Travel Planning Guidance SPD
[11] Cheshire West and Chester Council (2016) Draft Parking Standards SPD

- in other cases, where ten or more new car parking spaces are proposed, one in every ten spaces should be provided with a charging point

Taxi / private hire vehicle licensing

The CWAC Statement of licensing policy for Hackney carriages, private hire vehicles, drivers, and private hire vehicle operators[12] details the vehicle requirements, the age policy. Under the mandatory age limits, Hackney carriages must be under five years old, or new at first registration in the Chester zone. No Hackney Carriages older than 15 years are permitted. Private Hire Vehicles must be under five years old and will not be permitted when they are over 10 years old. Hackney carriage, private hire vehicle licences will usually be granted for 12 months. This means that newly licensed vehicles will be Euro 5 emission standard (made after September 2009), and Euro 6 standard in the Chester zone (made after September 2014). These policies provide control over the emission standards of these vehicles operating in the borough.

Local initiatives

iTravelSmart

iTravelSmart is a £4.6 million programme which aims to target workplaces in the Chester and Ellesmere Port areas, also reaching to Deeside, Merseyside and Wrexham. It will help to attract new job opportunities and make journeys to existing workplaces easier to access, through:

- promoting car sharing to connect people making the same journeys each day
- getting more people cycling, walking and using bus and rail
- encouraging job opportunities and transport to existing jobs

Clean bus technology fund

CWAC has been awarded £128,000 under the Clean Bus Technology Fund, which will help to retrofit older buses in the local fleet with Selective Catalytic Reduction (SCR). This exhaust gas treatment delivers in excess of 80% reduction of NO_2. The funding will help clean up emissions from older buses in some of our most polluted urban areas, with all the health benefits that brings.

[12] CWAC (2016) Statement of licensing policy For Hackney carriages, private hire vehicles, drivers, and private hire vehicle operators – 17 August 2016 (Version 8)

3. Overview of baseline health in Cheshire West and Chester

Introduction

Air pollution is strongly associated with adverse effects on cardiovascular and respiratory health, with the most important impact being premature mortality as a result of long term exposure to fine particulate matter. In addition, on "high" pollution days, people are more likely to develop respiratory problems and experience adverse cardiovascular events than on other days and rates of hospital admission and mortality arising from acute respiratory and cardiovascular illness are raised. Susceptibility to the adverse effects of air pollution is increased in people with pre-existing illness and disease (e.g. asthma, angina), older people and very young children.

Life expectancy

The Local Plan[7] states that the population is 329,000. The proportion of young people under 20 is slightly less than the English average, at 22.3%, while the proportion of people ages over 60 was higher than the English average, at 26.2%. The greatest proportion of people in the Borough are aged between 40 and 59. The population is also aging. The number of people 65 years old and older has increased from 15% in 1991 to 21% in 2015 and is expected to increase to 28% in 2032[13].

The life expectancy at birth in Cheshire West and Chester is 79.5 years for men, and 83.3 years for women[13]. This compares with the English average of 79.3 years for men and 83.0 years for women. There is however a significant amount of variability in life expectancy across the Council area, with the life expectancy for men being 9.7 years lower, and life expectancy for women being 13.0 years lower, in the most deprived areas of Cheshire West and Chester than in the least deprived areas. The life expectancy in the rural areas of the Council is higher than the national average, at 81.3 years for men and 84.8 years for women.

People in Cheshire West and Chester can expect to spend a higher proportion of their lives in good health than the England average and fewer years spent in poor health. The West Cheshire Clinical Commissioning Group (CCG) states that both men and women in west Cheshire can expect to spend over 80% of their lives in good health.

Premature mortality

Rates of premature mortality (death occurring before age 75) are lower than the national average but on comparison with local authority areas of similar socio-economic status such as Shropshire and Staffordshire, however, Cheshire West and Chester ranked 13th out of 15 local authorities[14]. Over 60% of premature deaths in Cheshire West and Chester are due to two causes: cancer (44%), and circulatory diseases (21%)[13]. It is estimated that over 75% of premature deaths are preventable.

[13] Cheshire West and Chester (2016). Compendium of Health and Wellbeing Statistics.
[14] Public Health England (2015). *Longer Lives: See how your local authority compares.*

Cardiovascular illness

Cheshire West and Chester has significantly lower death rates from cardiovascular diseases than the England average and is amongst the best 25% of Local Authorities in the country[15]. However of the approximate 225 people under the age of 75 who died each year during 2009 – 2011 in the Council, over half died from coronary heart disease. It is additionally estimated that much larger numbers of people are living with undiagnosed conditions that are likely to predispose them to serious cardiovascular events (and increase their susceptibility to air pollution), including an estimated 20,100 people with undiagnosed hypertension[16].

Respiratory illness

During 2009-11 in Cheshire West and Chester, 314 people aged under 75 died from respiratory diseases, an average of 105 each year. Almost half of these (48%) were caused by chronic obstructive pulmonary disease (COPD)[17]. COPD is the name for a collection of lung diseases including chronic bronchitis, emphysema and chronic obstructive airways disease. COPD is one of the most common respiratory diseases in the UK. Other deaths include influenza and pneumonia.

Nationally, asthma is the most common long-term respiratory condition in childhood. Locally, there were 102 emergency admissions of children because of asthma in 2011/12[18]. The two main pollutants that affect asthma sufferers are particulates and ozone[19].

3.1 Existing mortality burden attributable to air pollution

$PM_{2.5}$ is the traffic derived pollutant with strongest documented links to human health impacts[20]. The impact of $PM_{2.5}$ on mortality is a function of $PM_{2.5}$ concentration, population age structure and underlying age-specific mortality rates. As reported in the Public Health England document 'Estimating Local Mortality Burdens Associated with Particulate Air Pollution'[21], the mean concentration of anthropogenic $PM_{2.5}$ in Cheshire West and Chester is reported as 8.2 μgm^{-3} versus the English average of 9.9 μgm^{-3}, and the proportion of mortality attributable to $PM_{2.5}$ is estimated to be 4.7% compared with a national average of 5.6%. This corresponds to 146 attributable deaths per year and an average loss of life expectancy of about 10 years per death in the borough.

The impact of pollution on health has been recalculated using more recent background pollutant concentrations provided by Defra. The attributable fraction (AF), the proportion of local deaths attributable to long-term exposure to anthropogenic particulate air pollution[21], is calculated using Relative Risk (RR), the change in mortality risk for 10 μgm^{-3} concentration, usually represented as a ratio.

[15] Cheshire West and Chester: Strategic Intelligence Team (2013) Integrated Strategic Needs Assessment for Cheshire West and Chester.
[16] Cheshire West and Chester. Integrated Strategic Needs Assessment: Hypertension: Main Report.
[17] Cheshire West and Chester (2013) Under 75 mortality rate from respiratory disease. Available at: (http://www.cheshirewestandchester.gov.uk/your_council/key_statistics_and_data/idoc.ashx?docid=24a2c855-64e4-4ff9-bcbe-b87b46339eb4&version=-1
[18] Child and Maternal Health Observatory (2013). Child Health Profile: Cheshire West and Chester.
[19] Asthma UK (2015). Pollution. Available at: http://www.asthma.org.uk/knowledge-bank-pollution
[20] WHO (2013) Review of Evidence on Health Aspects of Air Pollution – REVIHAAP Project
[21] Public Health England (2014) Estimating Local Mortality Burdens associated with particulate Air Pollution

The $PM_{2.5}$ (RR) is 1.06 (10 μgm^{-3} $PM_{2.5}$ leads to a 6% change in risk). A RR factor for NO_2 has recently been produced[22] which takes into account the recommended World Health Organization (WHO) number and the potential overlap with effects of $PM_{2.5}$ of up to around 30%. The RR for NO2 is 1.039. Calculations of the AF are shown in Table 3.1.

Table 3.1: Calculation of change in attributable fraction of local deaths as a result of predicted changes in $PM_{2.5}$ and NO_2 concentration

	$PM_{2.5}$	NO_2
Background concentration ($\mu g\ m^{-3}$)	9.1	11.1
RR ratio	1.0544	1.0433
AF (%)	5.2	4.1

The number of deaths of people aged over 25 per year has been calculated using the number of deaths in the borough (3,119[21]). These calculations indicate that the total number of deaths per year attributable to particulate pollution would be 161 and the total attributable to NO_2 pollution would be 129. This gives a total of 290 deaths per year attributable to air pollution. This equates to 9.3% of deaths of people over 25 years of age.

These figures suggest that if the LES and other policies (at international, national and local level) could reduce background $PM_{2.5}$ and NO_2 concentrations by one microgram per cubic metre, the number of deaths per year attributable to air pollution could be reduced by 10% (29). Other benefits of reduced background $PM_{2.5}$ and NO_2 concentrations could include a reduction in hospital admissions, allergy and asthma attacks, low birth weight and indicators of both respiratory and heart disease.

3.2 Economic impacts

The economic impact of emissions can be calculated using the Defra Interdepartmental Group on Costs and Benefits (IGCB) damage cost approach[23]. This produces estimates of the costs to society of the likely impacts of changes in emissions. The IGCB Air quality damage cost central estimate for NOx for transport is £25,252 per tonne of emission change, and the central estimate for PM for transport is £58,125 per tonne.

The Defra emissions factor toolkit estimates that 100 cars travelling 20km per day would emit 0.27 tonnes of NOx and 0.03 tonnes of PM_{10} per year. As an example of the impact of policies relating to air quality, if these were electric vehicles with no tailpipe emissions, the damage costs saved would be £6,837 for NOx and £1,503 for PM_{10}, giving a total of £8,339.

[22] King's College London (2015) Understanding the Health Impacts of Air Pollution in London.
[23] Defra (2015) Air quality: economic analysis – September 2015 Update

4. Market and technology issue report

4.1 Low emission vehicle use and sales in CWAC

Nationally, in 2016, ultra-low emission vehicles (ULEVs) accounted for 1.3% of new registrations, an increase of 40% compared to 2015. Approximately 4,790 ULEVs were registered by the end of 2016 in the North West region. Cheshire West and Chester accounts for approximately 342 (7%) of this total. For reference, this compares to a total of 12,430 in the West Midlands, where the Plugged-in Midlands programme has been operational since 2011. However, uptake in Cheshire West and Chester has seen massive growth in recent quarters (187 new registered plug-in cars and vans increase from Q4 2012 to Q4 2015)

4.2 Estimated growth of EVs within CWAC

Estimates of future EV market growth in the UK are promising, but must be considered with a few caveats in mind. Growth is very dependent upon factors including, but not limited to:

- Changes in EV capital cost and hire purchase offers;
- Continued Government financial support via plug-in car or van grants;
- Continued supplementary incentive support (i.e. benefits in kind and road tax exemptions/reductions);
- The speed at which new models are released by manufacturers (previous experience has shown that release dates tend to be pushed back);
- The public perception and user experience of the vehicles (i.e. marketing campaigns and whether the vehicles meet expectations);
- The actual and perceived availability of supporting public charging infrastructure; and
- Changes in charging infrastructure capital cost.

A simple analysis of the growth pattern observed between 2012 and 2017 by Cenex shows the growth of EV and that by 2020 EVs in Cheshire West and Chester may increase to nearly 3000 without intervention, equating to over 3% of the predicted 90,000 estimated EVs on UK roads for 2020 (Figure 4-1).

Figure 4-1: Plug-in-grant vehicle growth estimation in Cheshire West and Chester.

Year	**Number of plug-in cars sold**
2012	42
2013	96
2014	240

2015	653
2016	1195
2017	1614 (projected)
2020	3000

EV use

An ultra-low carbon vehicle demonstrator (ULCVD) study undertaken by Cenex accumulated over 1.5 million miles from over 276,989 journeys. Charging events topped over 51,000 with 319 MWh electricity used, and 30% of the drivers were private lease (70% corporate). The study found that:

- an EV was used an average of 4.4 times per week
- average trip mileage of 5.1 miles with daily mileage at 21.4 miles
- 90% of trips were <13 miles and 90% of daily mileages were less than 47 miles
- maximum trip mileage was 107 miles with the maximum daily mileage at 241 miles

Most of the journeys (around 70%) were carried out during working hours and the private lease category EV users drove more than the corporate users. The pool car category had the least use out of the three categories (private or corporate lease and pool car).

Range issues

ULCVD vehicle users generally did not experience range anxiety due to use of the vehicles at a high traction battery state-of-charge (SOC). Average power usage was 1.5% SOC/mile equating to about 66.7 miles per 100% charge. Drivers tended to be more cautious on longer journeys resulting in lower energy use per mile when compared to short journeys (under 20 miles). Lower ambient temperatures during winter reduced the average EV journey range by about 21% due to heating requirements. Since the study was completed, the range capability of EVs has increased significantly; a number of models have official ranges of 150 to 250 miles.

Charging activity

The ULCVD study showed that EV drivers charged 43% of the time at home, 30% at work, 5% unknown and 22% at other locations which included public charging infrastructure and external meeting locations. Private users saw public charging infrastructure as less important after three months into the trial (viewed as essential from 87% pre-trial to 71% three months in). The opinion of corporate users did not change (92% saw public infrastructure as essential).

Views of charging after three months of using an EV:

- 89% found adapting to charging easy

- 75% preferred charging to going to the petrol station
- 79% thought that trips could be made without public charging infrastructure

Charging events occurred mostly during the week with peaks at 08:00, 14:00 and 21:00. The 21:00 peak was caused by smart meter timed charging of EVs. The average distance travelled between charges was just over 25 miles with charging events 3.5 times per week. Distances travelled between charges continually rose during the study as the drivers got used to the vehicles.

4.3 Low carbon vehicle technology research

Bus technology

Before 2020 it is expected that new technologies, such as stop-start, mild hybrid and flywheel hybrid systems, offering relatively rapid (less than five years) payback will appear in increasing numbers of city buses. Full hybrids may offer lower total cost of ownership (TCO) compared to diesel buses under certain duty cycles by 2020. Deployments of pure EV buses will grow where policy instruments and funding schemes allow. Conductive bus stop charging and plug-in hybrid electric vehicle (PHEV) buses will gradually emerge in user-led demonstration projects. Biofuels will increase in use but are expected to be mainly blended within standard transport fuel within the current EN590 fuel standards. Natural gas buses will increase in numbers with improved engine efficiency (and hence economics) and reduced CO_2 emissions due to an increase in biomethane use.

By 2025 key advances will be made in all types of hybrids with hybridisation being the default technology choice for diesel and gas buses. Advances in battery technology will incrementally improve the range and cost performance of EV buses. Most deployments of EV buses will be subsidised, but non-subsidised breakeven may be reached if battery durability is proven. Conductive bus stop rapid charging deployments are likely to be demonstrated throughout the EU. Gas vehicles, with blended biomethane will increase in numbers with infrastructure provision supported through the Clean Fuels Directive. If proven economic, drop-in fuels could be blended in high volumes with standard diesel. Hydrogen fuel cell buses transition into the user-led demonstration phase where funding allows.

Car technology

Before 2020 hybrid vehicles will dominate alternative fuel vehicle sales, with EVs, PHEV and range extended EVs (REEV) growing in numbers where local incentives encourage activity.

By 2025 unsubsidised operation of EVs and PHEV/REEV is expected. Fuel cell electric vehicle (FCEV) deployments will grow in numbers but issues of purchase cost and green fuel supply costs will limit mass uptake. Gas vehicles, blended with biomethane will offer cost effective lower carbon transport. If proven economic, drop-in fuels may be blended in high volumes with standard diesel.

Energy storage chemistries

Battery technology is of critical importance to the uptake of low carbon vehicles as this technology determines the overall vehicle range. Current state of the art technologies in use are the lithium titanate, lithium nickel cobalt manganese oxide and lithium iron phosphate chemistries. Further development of new materials and battery chemistries will allow for greater range, better performing and longer lasting batteries

Hydrogen fuel cell development

Fuel cells offer an attractive option for low carbon vehicles due to their zero tailpipe emissions, short refuel time and high efficiency. Fuel cell vehicles are currently available and are being demonstrated through various European demonstration projects. However, the main barriers to commercialisation of fuel cell vehicles include the high cost of the system and the lifespan of the system.

Fast electric vehicle charging

Fast EV charging period varies between six hours and one hour (depending on the EV and the charge point) and is usually performed utilising single or three phase AC energy at 16 Amps or 32 Amps depending on the location, purpose and energy supply limitations. Home charging in a garage or on a driveway typically utilises a wall mounted charge point.

Rapid electric vehicle charging

Rapid EV charging typically takes 30 minutes to obtain an 80% charge and one hour for a full 100% charge (for a 24KWh battery electric vehicle).

Fuels

Table A.2 shows an overview of the different alternative fuels and electric vehicle charging technologies available.

From 2015-2020:

- conductive charging will dominate electrical vehicles in the near term with inductive charging in trials and technology demonstrators only. Well to wheel electricity performance is EU average. Varies by country
- natural gas transportation will grow, driven by the Clean Fuels Directive, infrastructure deployment is focused on inner-city and cross European major roads. Fuel availability increases significantly due to implementation of Clean Fuels Directive. The bio-content of natural gas networks will start to increase
- biomethane will be available through both direct use and indirect purchase from the gas grid
- liquefied petroleum gas (LPG) may be suitable for reducing costs from diesel/petrol vehicles where subsidies allow, however will remain niche as no CO_2 benefit is offered

- H_2 will remain expensive and sourced mainly from fossil fuels. If soured from renewables it would offer significant carbon benefit

From 2020 - 2025

- electricity continues to be de-carbonised. Conductive charging is still the dominating technology. For buses, direct use in trolley buses and rapid charging at bus stops is increasing. Well to wheel electricity performance is EU average. Varies by country
- natural gas transport is growing in numbers with de-carbonisation of gas expected to reach an EU average of 20% bio-content, mainly used for inner-city and motorway heavy duty vehicle applications. Fuel availability increases significantly due to implementation of Clean Fuels Directive
- biomethane available through both direct use and indirect purchase from the gas grid
- hydrogen (H_2) filling stations are being populated through major EU transport corridors and EU cities. Key challenge is the low cost supply of green H_2
- with standard road fuel de-carbonising, LPG is likely to be an unpopular choice from motive power
- dimethyl ether (DME) is expected to be available for opportunistic fleets for taxis/buses in urban areas

Vehicles

Table A.1 and Table A.2 show overviews of the different vehicle technologies and alternative fuels available.

For 2015-2020:

- internal combustion engine (ICE) vehicles will continue to be developed with extreme engine downsizing, turbo charging, increasing biofuel compatibility, etc
- availability of pure EVs will increase in passenger car segments but still rely on subsidies for economic operation
- hybrid cars offer environmental and cost benefits in higher mileage urban applications (for car clubs and taxis)
- PHEV/REEV will increase in availability in the period. Subsidies will still be required to ensure economic operation
- FCEVs will become available. Low carbon hydrogen fuel, fuel availability and cost will be a significant barrier to deployment
- hydrogen ICE prototype/early market vehicles may appear, limited by infrastructure availability and fuel cost

- gas vehicles will continue to be mainstream tech around EU. Well to wheel emissions will vary with gas supply route and bio content. Fuel availability increases significantly due to implementation of Clean Fuels Directive

For 2020 – 2025

- ICE vehicles will become lighter and more efficient
- unsubsidised economic operation of pure EVs is likely, especially for higher mileage applications such as taxi applications where zero emission capability is a requirement in EU major cities
- electric hybrids are likely to be the most popular drive train for passenger cars
- PHEV/REEV will increase in availability; subsidies should no longer be required. Likely to be heavily used in taxi applications where zero emission capability is a requirement for EU major cities
- availability of FCEV increasing but limited; high purchase vehicle and fuel costs will prevent mainstream penetration
- H_2 internal combustion engine prototype/early market vehicles may appear, again limited by infrastructure availability and fuel cost
- gas vehicles will continue to be mainstream tech around EU. The average bio-content of natural gas will be gradually increasing. Hybrid gas cars may be developed and available where strong gas car markets exist. Fuel availability increases significantly due to implementation of Clean Fuels Directive

5. Recommendations for low emission strategy

The following policies are recommended for inclusion in the Low Emission Strategy for CWAC. These are divided into four sections: policies which can be applied at the planning stage of new developments; policies for construction and demolition; policies that can be applied across the borough; and policies which will increase the number of LEVs used and therefore reduce transport emissions.

5.1 Planning policies

The NPPF5 states that development plans should protect and exploit opportunities for the use of sustainable transport modes for the movement of goods or people. The Low Emission Strategy for CWAC should build on the NPPF and these policies. It is recommended that measures that can be implemented at the planning stage are included in Part 2 of the Local Plan, or an SPD if necessary to ensure the following benefits:

- to avoid the cumulative impact of small scale insignificant developments that may produce a combined significant impact without mitigation
- so that developers are clear what they are required to provide from the outset
- so that there is no possibility of manipulation of calculations to reduce costs
- so that provision of new infrastructure is guaranteed as part of new developments, which will support the uptake of new technologies in surrounding areas, such as electric vehicle charging points

A blanket application of new standards is included in the West Yorkshire Air Quality and Emissions Technical Planning Guidance[24] and is recommended in the Institute of Air Quality Management's (IAQM) planning guidance[25]. These policies should ensure that the impact of new development is minimised.

Transport

The NPPF[5], CWAC Local Plan[7], Local Transport Plan[9], and Travel Planning Guidance Supplementary Planning Document[10] contain a number of policies that relate to the reduction of the need to travel, the reduction of emissions and the encouragement of walking and cycling. These policies should be supported by the LES. The following policies are therefore proposed to minimise demand for travel by private motor vehicles and encourage transport by ultra-low emission modes, new development proposals should:

- be located so as they are accessible to local services and facilities by a range of transport modes

[24] Air quality and emissions technical planning guidance - part of the West Yorkshire low emissions strategy
[25] EPUK / IAQM Land-Use Planning and Development Control: Planning for Air Quality

- include appropriate provision for access to public transport and other alternative means of transport to the car
- seek to maximise use of sustainable (ultra-low emissions) modes of transport and improve health and wellbeing by incorporating high quality facilities for pedestrians, cyclists and public transport
- seek to reduce reliance on individual-owned cars by supporting the use of car clubs (particularly those using ULEVs)
- include travel plans to promote the benefits of walking and cycling and associated measures, and encourage a reduction in the proportion of single occupancy car trips
- accommodate the efficient delivery of goods and supplies, consider the potential for a freight consolidation centre with Ultra Low Emission last mile deliveries
- give priority to pedestrian and cycle movements, and have access to high quality public transport facilities
- create safe and secure layouts which minimise conflicts between traffic and cyclists or pedestrians, avoiding street clutter and where appropriate establishing home zones
- incorporate facilities for charging plug-in and refuelling other ultra-low emission vehicles
- consider the needs of people with disabilities by all modes of transport

Masterplanning

IAQM/EPUK guidance states that wherever possible, new developments should not create a new street canyon, or a building configuration that inhibits effective pollution dispersion. Developments should therefore, where possible, not create a new street canyon, or a building configuration that inhibits effective pollution dispersion. In particular, bus and taxi facilities should be designed to avoid the build-up of pollution.

New developments should also provide adequate, appropriate, and well located green space and infrastructure to help reduce pollutant concentrations and deliver public spaces that encourage walking and cycling.

Research has shown that the appropriate use of green infrastructure can be used to improve air quality. This should be considered at the masterplanning stage. Use of the species that provide the largest air quality benefits should be prioritised. Where possible, evergreen tree species should be planted for the year-round benefits that they provide and species such as oaks, poplars and willows that produce VOCs should be avoided. Care should be taken to avoid reducing dispersion of pollutants through tree planting. Green walls should be used where possible to reduce pollution, and would be particularly beneficial in the most polluted areas.

Parking

CWAC has adopted a set of parking standards for new development in a new Parking Standards SPD[11]. It is likely these standards shall be carried over into the Local Plan Part 2 and form detailed planning guidance.

In accordance with the recommendations in IAQM/EPUK guidance, CWAC should support the transition to LEVs by enforcing the parking SPD through:

- providing all new houses and flats with sufficient infrastructure to facilitate and encourage electric vehicle use
- a separate dedicated circuit protected by an RCBO (residual current circuit breaker with over current protection) should be provided from the main distribution board to a suitably enclosed and accessible external/garage termination point for future connection to a charge point. Cable and circuitry ratings should be of adequate size to ensure a minimum continuous current demand for the vehicle of 16A and a maximum demand of 32A
- in other cases, where ten or more new car parking spaces are proposed, at least one in every ten spaces should be provided with a charging point. This should focus on destination developments such as hotels, supermarkets and leisure facilities

Provision of rapid charge points per 10 residential dwellings and/or 1000m^2 of commercial floorspace should also be encouraged.

Speed limits

The potential for reducing speed limits in built-up areas from 30mph to 20mph to reduce emissions by reducing acceleration and encouraging smoother driving has been identified and the phased introduction has begun, as outlined in the 20's plenty report[27]. This measure also has numerous other benefits, such as improving safety, reducing noise, sharing road space more equitably between modes, and making streets more pleasant.

Several local authorities around the UK have reduced speed limits on the roads that they control in efforts to improve safety. This policy also has numerous other benefits, such as reducing noise, sharing road space more equitably between modes of transport, and making streets more pleasant. It has been suggested that reducing the speed limit in urban areas from 30 mph to 20 mph can also reduce emissions. The theory relating speed limits to emissions is that removing the acceleration which occurs between 20-30mph by limiting the speed limit to 20 mph and encouraging smoother driving will reduce fuel consumption, and therefore emission and consequently have a positive impact on air quality.

A study undertaken by Imperial College London on behalf of the City of London determined that NOx emissions were lower from diesel vehicles travelling at 20 mph than those travelling at 30mph[26]. NOx emissions from petrol vehicles are actually higher when travelling at 20mph. However, the higher contribution of diesel vehicles

[26] Transport and Environmental Analysis Group, Centre for Transport Studies, Imperial College London (2013) An evaluation of the estimated impacts on vehicle emissions of a 20mph speed restriction in central London

to overall emissions of NOx suggests that speed control measures could significantly reduce overall NOx emissions.

In 2016, CWAC rolled out mandatory 20mph limits for most residential roads throughout the Borough[27]. The cabinet approved the following:

- to approve the implementation of 20 mph limits on residential roads across the Borough where mean speeds on most roads are currently less than 24 mph and around schools where the mean speed is currently less than 30 mph
- to endorse the preparation and development of a report detailing which areas would benefit the most from the revised speed limit how the schemes would be prioritised and a work programme formulated for consultation
- include £200,000 per year for four years within the Council's capital programme to be funded from LTP grant or other available external funding
- to streamline the consultation process and approve appropriate delegated powers and authority to enable the Head of Service (Place Operations) in consultation with the Cabinet Member for Economic Development and Infrastructure, to develop and implement the programme for roll out of 20 mph speed limits in residential areas and around schools

Therefore, in order to reduce emissions from motorised vehicle traffic and encourage walking and cycling by improving safety and making streets more pleasant and liveable, in accordance with CWAC policy[27], all residential roads in new development proposals have a speed limit of 20mph.

Exposure reduction

Developments should not increase the area of exceedance of EU established health-based standards and objectives for NO_2 (AQMAs). Where new developments are introduced into areas where the standards and AQOs are exceeded, developments should be designed to minimise and mitigate against increased exposure to poor air quality.

This can be achieved through internal arrangement and good design to create distance between the source and receptors. As a last resort, and where the requirement for the housing is considered essential the incorporation of a ventilation strategy to ensure that polluted air is not drawn into the development. Air intakes should be located away from sources of air pollution, including on-site combustion, to minimise increased exposure to poor air quality.

[27] 20's Plenty (2016) Cheshire West and Chester Council Approve Borough-wide 20mph. http://www.20splenty.org/cheshire_west_chester_council

Assessment of planning applications

Demolition and Construction

The IAQM guidance on the assessment of dust from demolition and construction sets out the methodology for assessing the air quality impacts of construction and demolition and identifies good practice for mitigating and managing air quality impact.

An assessment of the impact on air quality of the development during the construction phase should be carried out in order to demonstrate that potential impacts have been considered and suitable measures for controlling dust and pollution emissions in line with the guidance have been incorporated into the construction environmental management plan (CEMP).

Operation

Assessment of the air quality impacts of the operational phase is required to demonstrate that the relevant policies have been incorporated into the development design and ensure that appropriate mitigation is included to reduce exposure where necessary.

In accordance with the EPUK/IAQM guidance, an air quality assessment should include the following:

- relevant details of the proposed development
- the policy context for the assessment
- description of the relevant air quality standards and objectives
- the basis for determining significance of effects arising from the impacts (typically using EPUK/IAQM criteria)
- details of the assessment methods. Typically air quality dispersion modelling is carried out to predict the impact of the development and the pollutant concentrations to which introduced receptors would be exposed
- model verification (when modelling of road traffic emissions is undertaken)
- identification of sensitive locations
- description of baseline conditions using existing air quality monitoring and/or modelling data
- assessment of impacts
- cumulative impacts and effects
- mitigation measures, to reduce exposure or the impact of the development, where significant effects are identified
- summary of the assessment results

Damage cost calculations

For developments meeting the EPUK/IAQM assessment criteria detailed above (considered to be 'major schemes' with respect to air quality) where the impacts from the operation phase of a proposed development are predicted to be greater than negligible (as determined in the air quality assessment), CWAC will request funding from developers to support projects to improve air quality and mitigate the impacts. The draft version of Local Plan (Part Two)[8] states that 'development which results in a measurable increase in NO_2 or PM_{10} levels will be expected to offset this increase through mitigation measures. Any such application for development within an AQMA shall be accompanied by an environmental damage cost assessment in accordance with the Council approved methodology.'

It is recommended that the value and scale of mitigation requirements for developments is calculated using the damage costs approach. The damage cost approach provides a transparent, simple method for calculating costs using the Defra damage costs, the cost to society of a change in emissions (from both vehicles and other combustion sources) of different pollutants[28], and calculation of the additional emissions generated by the proposal. This method applied in isolation does risk penalising developments on sites with low existing trip generation, even when they have been well designed, as all emissions will be additional and incur costs. Where development is taking place on such sites, designs that minimise emissions should be encouraged. Therefore, it is recommended that damage cost calculations should only be carried out for sites that are predicted to have an impact on local air quality that is greater than negligible.

5.2 Construction policies

Freight, delivery and servicing

Construction logistics strategies for major developments should be developed in order to reduce the pressure on the road network during the construction phase and minimise construction transport emissions as far as possible. The Manchester Ship Canal, river Weaver navigation and rail network may be particularly suitable for freight use and these opportunities should be integrated into development proposals where feasible.

Control of dust

The IAQM guidance on the assessment of dust from demolition and construction[29] seeks to reduce emissions of dust, PM_{10} from construction and demolition activities. It sets out the methodology for assessing the air quality impacts of construction and demolition and identifies good practice for mitigating and managing air quality impacts that is relevant and achievable, with the over-arching aim of protecting public health and the environment. Developers and contractors should employ the mitigation measures set out in this guidance when drafting their construction plans and measures to minimise air pollution during the demolition and construction process recommended in the guidance should be implemented.

[28] https://www.gov.uk/air-quality-economic-analysis#damage-costs-approach
[29] IAQM (2014) Guidance on the assessment of dust from demolition and construction

Non-road mobile machinery (NRMM)

NRMM used in demolition and construction is a significant source of pollution. Diesel or petrol powered plant items emit higher levels of PM and NOx than electric equivalents. Therefore, wherever possible, renewable, mains or battery powered plant items should be used.

Exhaust emission from NRMM are controlled through the NRMM regulation (Regulation (EU) 2016/1628 of the European Parliament). It is recommended that CWAC consider the adoption of emission standards for NRMM based on these directives. For example, it could be required that NRMM of net power between 37KW and 560KW used on any site meets Stage IIIA of the Directive as a minimum for both NOx and particulates.

5.3 Borough-wide policies

Parking

The CWAC Parking Strategy should be used to support the use of public transport and active travel modes, promote the use of park and ride facilities and to reduce traffic flow into town/city centres, and use signage, marketing and technology to intercept traffic on main radial routes into cities, town and villages to direct them to appropriate parking locations.

The parking regime should also be used to support the transition to EVs. Initially it is envisaged that the majority of private EV owners will mostly charge their vehicles at home and work. Despite this, it is important to make rapid progress with the provision of publicly accessible charging infrastructure over the next few years, for rare instances when daily vehicle mileage exceeds the battery range. Evidence suggest that accessible charging infrastructure helps to alleviate 'range anxiety', which can otherwise limit the utility of EVs. It is therefore recommended that when car parks come up for refurbishment, resurfacing or renewal of ticketing facilities, that CWAC take the opportunity to install EV kit and dedicated bays / dedicated bays without chargers. This is the extension of the EU Directive 2014/94/EU on the deployment of alternative fuels infrastructure.

Buses

While funds were secured under both the clean bus technology fund (CBTF) and the clean vehicle technology fund (CVTF) for retrofitting some local services, funding opportunities will be sought for a continued retrofit programme and to work with operators to support the transition to clean technology.

Outside of London the bus market is deregulated which limits the influence CWAC has on bus technology deployed. To enhance the adoption of lower emission buses CWAC should:

- facilitate the provision of Quality Partnerships. Partnerships between bus operators, suppliers and local government, for the bus sector which progress ideas and actions to common goals, such as improving the environment and reducing costs

- introduce minimum standards for contracted bus services. For example, set environmental standards for buses in service procurement documents

Taxi/private hire vehicle licensing

The vehicle age policy in the CWAC statement of licensing policy for Hackney carriages, private hire vehicles, drivers, and private hire vehicle operators[12] should be enforced so that the emission standards of taxis and private hire vehicles continue to improve. The current Cheshire West and Chester statement of licensing policy for hackney and private hire, vehicles drivers and operators has an entry and exit policy for all licenced vehicles. All vehicles entering the system must be under five years old and will not be licenced after they have reached 10 years old or 15 years old in the case of wheelchair accessible vehicles. This ensures a rolling programme of improved emissions from all licenced vehicles with all taxis licensed since January 2017 meeting Euro IV standard.

In addition, it is recommended that when the policy is updated, it includes reference to idling so that drivers do not stay stationary with their engines running. This message should be reinforced by signage at key locations where exposure to road traffic-related air pollution is high, such as rail stations and the adoption of anti-idling legislation[30].

Consideration should be given to the inclusion in future policy of incentives to operators who wish to operate EVs in their fleet.

Smoke control areas (SCAs)

Resident that live within an SCA and allow smoke to escape from their chimneys could be prosecuted unless they are burning an authorised fuel or using exempt appliances, such as burners or stoves. There are several SCAs within CWAC that have blanket coverage across the local area. These include Ellesmere Port, Helsby and Frodsham. However, others are patchy, such as Winsford, and some areas, such as Chester do not have any SCAs. There is scope to extend the coverage of certain SCAs, which would comply with the new LAQM PG16 guidance on public health and $PM_{2.5}$, which states that once an AQMA has been designated and the district council prepares an Action Plan, relevant powers and mechanisms should include environmental health functions, including those concerning the Clean Air Act (e.g. the ability to declare smoke control areas). It is therefore recommended that the existing SCAs are reviewed and amended where necessary, and that new SCAs are designated, particularly in AQMAs.

Anti-idling legislation

The Road Traffic (Vehicle Emissions) (Fixed Penalty) (England) Regulations 2002 state in Reg 6(3) that:

A local authority (whether or not a designated local authority) may authorise any officer of the authority, or any other person, in any area of that authority:

[30] Vehicle idling is an offence against the Road Traffic (Vehicle Emissions) (Fixed Penalty) (England) Regulations 2002.

(a) in accordance with regulation 12, to stop the commission of stationary idling offences; and

(b) to issue a fixed penalty notice in respect of such an offence committed in its area.

These powers should be used by CWAC to ensure that idling is minimised, particularly in the designated AQMAs.

Awareness raising

The National Institute for Health and Care Excellence (NICE) guidance – Air pollution: outdoor air quality and health[31] recommends raising awareness of local air quality issues with the general public and business. In particular they recommend providing information on the how:

- health is affected by air pollution
- travel choices contribute to pollution and exposure to levels of local pollution
- engine idling affects air quality in the vehicle as well as outside
- exposure can be minimised by altering travel habits or routes

CWAC should consider options for raising awareness of these issues, including, as a minimum, using the LAQM Annual Status Report (ASR) for this purpose.

Business/freight policies

In accordance with CWAC Local Transport Plan[9] policy, proposals for new industrial and warehousing development should maximise opportunities to transport products by non-road modes of transport. Sites alongside the Manchester Ship Canal, river Weaver navigation and rail network may be particularly suitable for freight use and these opportunities should be integrated into development proposals where feasible.

5.4 Increased LEV use

Policies to encourage LEV uptake

Based on the size of Chester city, the population of the region and the requirement that the policies be as low cost as possible whilst having the largest impact, the following policies are recommended for consideration to promote the uptake of low emission vehicles. Recognising the constraints faced by the Council, Table 5.1 has tried to rank the measures based on: long-term overall financial benefit; initial capital cost/loss of revenue; staff time to implement the measure; and political cost of implementation. For reference, the table also gives examples of authorities where the measures have been implemented. All options will have a positive environmental impact.

[31] National Institute for Health and Care Excellence - Air pollution: outdoor air quality and health

Table 5.1: Potential measures to increase LEV uptake

Key					
Positive		Neutral		Difficult/costly	
Potential for long term cost improvements. Relatively easy to implement.	Positive	Similar cost potential. Some implementation overhead.	Neutral	More expensive than status quo. Difficult to implement.	Difficult / Costly

	Political cost/difficulty	Staff time to implement	Upfront cost / loss of revenue	Long-term financial benefit
Electric vehicle charge points as a planning condition (Dudley Council)	Difficult / Costly	Difficult / Costly	Difficult / Costly	Positive
Explore potential for a Clean Air Zone (London)	Difficult / Costly	Difficult / Costly	Difficult / Costly	Positive
Explore potential for a work place parking levy (Nottingham)	Difficult / Costly	Difficult / Costly	Difficult / Costly	Positive
Use long-term total cost of ownership and air quality impact in vehicle procurement	Positive	Neutral	Neutral	Positive
Fleet review (undertaken by organisations such as Cenex, including GPS device, back-end data analysis and final reporting)	Positive	Neutral	Difficult / Costly	Positive
Green scoring in procurement of transport services such as, school taxi contracts (Dundee) – costs dependent on technology bias	Neutral	Neutral	Positive	Neutral
Educational and promotional activities surrounding LEVs	Positive	Neutral	Positive	Neutral
Promote work place charging grants	Positive	Neutral	Positive	Neutral
Free parking for EVs , access to bus lanes, free resident parking permit	Positive	Neutral	Positive	Difficult / Costly
Incorporate EV cars into Enterprise car club – (underway)	Positive	Neutral	Positive	Difficult / Costly
EVs free parking available to Council staff via salary sacrifice scheme (underway)	Positive	Neutral	Positive	Difficult / Costly

	Political cost/difficulty	Staff time to implement	Upfront cost / loss of revenue	Long-term financial benefit
Support residents without off street parking to access charge posts (promote OLEV on-street residential charge point scheme)	Positive	Neutral	Positive	Difficult / Costly
Electric buses (London, Milton Keynes and Nottingham). Costs reduced through funding schemes (when available)	Neutral	Neutral	Difficult / Costly	Neutral
Gas refuse collection vehicles (Sheffield)	Neutral	Neutral	Difficult / Costly	Neutral

Leading by example

CWAC should lead by example and demonstrate that electric vehicles can be operationally and financially sustainable as well as delivering cleaner air and cutting carbon emissions. Actions should include:

- reviewing vehicle operations to identify suitable duty cycles for electrification
- revising procurement to ensure a total cost of ownership approach to vehicle purchasing and a clean vehicle hierarchy; and
- supporting staff to switch to ULEVs by providing work place charging and developing a salary sacrifice scheme for ULEVs

Low emission vehicle infrastructure

Electric vehicle charging infrastructure

It is recommended that the Council undertake a specific study on the charging requirements and locations for the area taking account of the information contained within Appendix A.

Points of interest that have a high demand for transportation

CWAC has a booming tourist industry and as such has several points of interest that will likely result in a high demand for transportation. Key sites include Chester (Roman remains, Museum, Zoo), Cheshire Oaks (shopping, Aquarium), Northwich (Museums, Blakemere village, show ground) and rural attractions such as Delamere forest and Beeston castle. These destinations should be kept in mind when planning electric vehicle infrastructure for the area. See Section 5, recommendations for future infrastructure.

CNG/LNG refuelling infrastructure

The uptake of CNG/LNG is currently very slow. This is due to the high capital cost of the vehicle and the low amount of infrastructure. Therefore it is only recommended to invest in CNG/LNG infrastructure if there is a significant market pull from potential consumers.

Hydrogen refuelling infrastructure

Based on the current level of uptake the introduction of hydrogen refuelling stations it best tackled through either:

- awaiting private investment by fuel/infrastructure providers who are responding to national wide H_2 vehicle growth or government incentives and funding schemes
- through local interest groups and businesses to collaborate in funded research and development programmes to introduce captive fleets trialling H_2 technology

Public procurement

All vehicle procurement should be based on total cost of ownership principles and not lowest purchase price. Departments should be required to prove why an ULEV is not suitable. The default purchase position hierarchy should be electric, plug in hybrid, hybrid, petrol and diesel, and for larger vehicles CNG should also be considered.

To further promote the uptake and usage of LEVs, it recommended that an innovation procurement framework is integrated within the existing local authority procurement framework by 2020. For maximum effect, this framework would measure potential vehicles against:

- life cycle sustainability performance
- noise emissions
- vehicle safety
- economics
- supplier sustainability credentials

Appendix A: Vehicle emission baseline assessment

Introduction to low emissions vehicle technologies

A number of technological options are available for the reduction of emissions from road vehicles, within this chapter the baseline position is assessed regarding the progress of these technologies in the CWAC area.

Each low emission vehicle technology provides benefits and limitations, in order to understand these a summary of the key characteristic for the drivetrains and fuels presented in the form of a traffic light analysis for buses and passenger cars is presented in section 5.4 .

These technologies are introduced as follows:

Table A.1 Vehicle technology options

Alternative drivetrains		
Type	Description	Typical vehicle segments (2016)
Pure electric vehicle (EV)	Vehicle powered purely by electricity which is generally stored in a battery	Car, van, HGV to 12t, bus
Hybrid electric vehicle (HEV)	Uses a combination of an ICE and one or more electric motors	Car, van, HGV to 12t, bus
Plug-in hybrid EV (PHEV)	Hybrid vehicle with a relatively large battery able to be charged from an external electricity supply, typically offering a modest electric only range	Car
Range extended EV (REEV)	A pure electric vehicle with the ability to charge the traction battery from an on-board generator, typically powered by petrol or diesel or fuel cell technology	Car
Flywheel hybrid	Uses the rotation of a flywheel to store energy normally lost during braking and deceleration. Energy fed back reduces the fuel required	HGV, bus
Hydraulic hybrid	Uses pressurised fluid to store energy normally lost during braking and deceleration. Energy fed back reduces the fuel required	HGV, bus
Fuel cell EV (FCEV)	Combines H_2 and air to create electricity, used to propel the vehicle	Car, bus
Alternative fuel engines	ICE vehicle modified to run on alternative fuels e.g. biofuels, LPG	All

Table A.2 Alternative fuel options

Alternative fuels and electric vehicle charging technology		
Type	Description	Typical vehicle segments (2016)
High blend biofuels	Blends of fossil and biofuels above those allowed under the current diesel (EN590) and petrol (EN228) European standards	All
Drop-in fuels	Biofuels that can be blended up to 100% with fossil fuels under the current diesel (EN590) and petrol (EN228) standards	All
Pure plant oil (PPO)	100% vegetable oil	Van, HGV, bus
Natural gas	A fossil fuel costing of mainly methane	Van, HGV, bus
Biomethane	A sustainable road transport fuel consisting of mainly methane. Biomethane is chemically similar and interchangeable with natural gas as a fuel	Van, HGV, bus
Liquefied Petrol Gas (LPG)	A fossil fuel costing of mainly propane or butane	Car, van
Hydrogen	Hydrogen can be used to power vehicles, either through direct combustion or conversion to electricity in a fuel cell	Car, van, bus
Conductive charging	Electric vehicle charging where vehicle is plugged into the electricity supply network	Car, van, HGV to 12t, bus
Static inductive charging	Wirelessly charges vehicle whilst stationary. Vehicle does not have to be plugged in	Car, van, HGV to 12t, bus
Dynamic inductive charging	Wirelessly charges vehicle whilst in motion.	Car, van, HGV to 12t, bus

Current electric vehicle charging infrastructure in the borough

There is a limited level of existing public charging infrastructure to support the regions electric cars and vans in Cheshire and Cheshire West. Table A.3 details existing charge points included on Zap Map[32]. The locations primarily consist of service stations, hotels / bed and breakfasts and dealerships. There are currently no charging points in car parks operated by CWAC.

Table A.3: EV charge points in Cheshire West and Chester

	Name	Location	Type
1	Lookers (Renault dealership)	Sealand Road, Chester, CH1 4LQ	Two fast
2	Asda Chester	Greyhound Retail Park, Chester, CH1 4QG	Four fast
3	Holiday Inn Express (Race Course)	New Crane Street, Chester, CH1 2LY	Three rapid
4	The Mill hotel	Milton Street, Chester, Cheshire, CH1 3NF	One fast, one standard
5	Abode hotel Chester	Abode Chester, Grosvenor Road Chester, CH1 2DJ	One fast
6	Marks and Spencer Cheshire Oaks	2 Stanney Woods Avenue, Ellesmere Port, CH65 9LF	Two standard
7	GM Vauxhall (main car park)	North Road, Ellesmere Port, CH65 1AL	Two standard
8	Chester services	M56 Junction 14, Elton, CH2 4QZ	Five rapid
9	Best Western Forest Hills hotel	Overton Hill, Frodsham, WA6 6HH	One fast
10	Holdcroft Nissan Northwich	Chester Way, Northwich, CW9 5NN	Two fast
11	Brownlow Furniture	5 Barrowmore Estate, Chester CH3 7JA	One semi-rapid
12	Garden House Nursery	Chester High Road, Neston CH64 3TH	One fast
13	Barons Quay car park	Barons Quay Road, Northwich, CW9 5LD	Four standard
14	Hooton Station	Hooton Station, Hooton, CH66 7NL	Two fast
15	Sandstone Trail Cottages	Sherrington Lane, Broxton, CH3 9JU	One fast

[32] Source: zap map https://www.zap-map.com/

Existing compressed natural gas (CNG) and liquefied natural gas (LNG) infrastructure in the borough

There is no existing public gas refuelling infrastructure in the Cheshire West and Chester area. Table A.4 details existing infrastructure close to, but outside CWAC[33], which are also illustrated in **Error! Reference source not found.**. The locations consist of private stations or public stations where prior arrangement is required for access.

Table A.4: Regional CNG and LNG refuelling stations outside Cheshire West and Chester

	Name	Location	Type
1	CNG Services Ltd – Crewe (prior arrangement required)	CNG Station, The Sidings, Weston Road, Crewe. CW1 6BW	One CNG filling station with bio-content
2	Chive Fuels – Cheshire (prior arrangement required)	Chive Fuels, Poplar 2000 Ltd, Cliffe Lane, Lymm, Cheshire WA13 0TE	One LNG filling station
3	BOC ltd – Warrington (private station)	The Stobart Group, Stretton Green Distribution Park, Langford Way, Appleton, Warrington WA4 4TQ	One LNG filling station

Existing hydrogen infrastructure

There is currently no hydrogen infrastructure in Cheshire West and Chester on in the surrounding region. Automotive hydrogen expertise exists in the region (Runcorn) with ACAL Energy a fuel cell development company working on automotive power trains and stationary power sources[34]. Currently, the nearest hydrogen refuelling station is in Sheffield/Rotherham M1 J33[35].

[33] Source: Gas Vehicle Hub - http://www.gasvehiclehub.com/

[34] http://www.acalenergy.co.uk/

[35] http://www.netinform.net/H2/H2Stations/H2StationsDetail.aspx?ID=374

Employment sites

The key employment sites include education, health, retail and leisure areas in and around the city and are summarised in Table A.5 along with approximate numbers of employees (where available).

Table A.5: Major employment sites

Location	Number of employees
Chester business park, A483 Wrexham Road	4,500
Airbus, A5104 Chester Road	5,000
Sealand Road industrial and retail parks (off A548 Sealand Road)	1,500 (estimated)
Chester city centre	23,230
Chester central business quarter	3,500 (forthcoming)
Broughton shopping park, A5104 Chester Road	1,400
Deeside industrial estate	9,000
Chester zoo	400
Countess of Chester hospital	4,000
University of Chester, and West Cheshire College	2,000
Chester race course	1,000

Points of interest that have a high demand for transportation

CWAC has a booming tourist industry and as such has several points of interest that will likely result in a high demand for transportation. Key sites include Chester (Roman remains, museum, and zoo), Cheshire Oaks (retail, leisure, aquarium), Northwich (museum, Anderton boat lift) and rural attractions such as Delamere forest, Blakemere craft centre, and Beeston castle. These destinations should be kept in mind when planning electric vehicle infrastructure for the area. See 5.4, recommendations for increased low emissions vehicle use.