

Achieving sustainable low carbon travel

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Introduction



Fig 1. Courtesy of Peterborough City Council,2018.

We are facing challenging times. By 2022, the UK must reduce its greenhouse gas emissions by 34% from 1990 levels and many experts believe the planet we live on is under threat, with carbon emissions being one of the biggest factors, (Peters et al, 2013; Hu et al, 2015, 2016).

Transport has a vital role to play in meeting these challenges and the Sustainable Travel Plan offers an opportunity to make a real contribution not only in decarbonising transport, but also in achieving local targets for health, congestion, air quality, education, housing, economic development and social inclusion. Today, the price of petrol is constantly rising. It is becoming more and more expensive and this has caught our attention. Then there are things like the cost of heating a home and the cost of electricity for the home, everything is becoming more expensive. (Abrahamse and Steg, 2011) So maybe we need to think more about the amount of energy we consume in all aspects of our lives. Therefore I want to focus on trying to encourage people to travel in a low carbon way. Low carbon travel is both energy efficient and environmentally friendly, and helps to slow down global warming and environmental degradation. This is an urgent issue. It is every citizen's responsibility to reduce carbon emissions and to choose low carbon travel. High carbon travel is a problem, so we are trying to encourage people to use more environmentally friendly modes of transport. So I have focused my research on the theme of low carbon travel.

Part One –Low carbon travel delivery



Fig 2. Courtesy of Peterborough City Council,2018.

Low carbon means that energy use should be minimised in everyday life to reduce carbon emissions, especially carbon dioxide, thereby reducing air pollution and slowing down ecological degradation. Reducing oxidation carbon emissions is to live with low energy consumption, low consumption and low expenditure. ‘ Energy saving to reduce carbon emissions is not only a buzzword in today's society. It is also a strategic choice that concerns the future of mankind. It is important to raise awareness of energy saving and carbon emission reduction’ (Jabareen, 2016) , improve one's lifestyle or consumption habits, and make simple and easy changes to collectively reduce global greenhouse gas emissions (mainly carbon dioxide).

‘ Cars are the fastest growing source of greenhouse gas emissions and their transport energy consumption is growing at the highest rate of any sector in the world. Cars also

cause noise pollution that damages human health and the ecological environment ' (Banister , 2008) .The rapid increase in the number of cars is clogging up roads, leading to inefficiencies and preventing the speed, comfort and efficiency that cars are supposed to bring. How can we enjoy more of the benefits and avoid the drawbacks of the car? You and I need to "go green"! A bus takes up about three cars' worth of road space and has dozens of times the capacity of a car at peak times. It reduces per capita emissions and improves urban efficiency. On the other hand, a metro carries 7-10 times more passengers than a bus, and uses less energy and pollutes less.

Based on the analysis of the above data, it can be concluded that the vast majority of people use the car, a relatively high-carbon mode of transport route. On the one hand, people find this mode of travel more convenient and on the other hand they save time waiting for public transport.

Low carbon travel is what allows you to move from A to B in a way that doesn't use fossil fuels. ' Not only can active travel improve your health and wellbeing, but it can also help to reduce your carbon footprint and save you money (Ajzen, 1991) '.

The Sustainable Travel Hierarchy is a useful tool to help you consider improving the impact of your travel. The higher the level, the more sustainable and environmentally friendly the travel options. The most sustainable option is walking, with the only resource required being you, followed by cycling, which requires some equipment. Together with wheeled travel (a term used for wheelchair users) these methods are categorised as active travel.

Save money - cars can be expensive; not just to buy or lease. On average, vehicle tax, maintenance and insurance alone costs £969 per year - get yourself some trainers or a bike to save money!

Improve your health and happiness - regular walking can reduce the risk of cardiovascular disease by 35%, while active travel can help control stress and weight.

Help the planet and your community - switching from fossil fuel vehicles to active travel will reduce congestion, carbon dioxide (CO₂) emissions and other air pollutants that harm public health and ecosystems.

Social - Walking is a great alternative to group travel, you can talk as you go, and cyclists can find a great sense of community. The Urban Transport Group has also found that crime rates have dropped in areas where active travel is popular.

It's quicker than you think - on average, you can walk a mile in 15-20 minutes or cycle in 5 minutes. It can take longer to find your car keys.

Using the plan for low carbon travel as an entry point, I would like to advocate low carbon travel for everyone.

Part Two – Low Carbon Travel Initiative Menu

Walking or wheeling are great travel options and are also the most accessible – walking costs nothing while wheeling provides more opportunity to access the benefits of active travel.

Small steps make a difference – choosing to walk or wheel just one mile to the shop and back once a week rather than drive will see fuel savings of £11 and 29kg in CO₂ annually. Carrying shopping bags home also helps build strength, keeping muscles, bones and joints strong. You won't need to go to the gym for that workout! Walking is the best exercise in the world, defined by Health International as "the best exercise in the world". Studies have shown that the human body is best suited to walking in terms of anatomy, physiology, cardiorespiratory formation and the position of the body's bones and muscles. 'Adults who walk regularly for more than 12 weeks will achieve a more resilient body, a slimmer waistline, a stronger body and less fatigue. In addition, it can treat headaches, back and shoulder pain and promote sleep. Experts recommend daily walking exercise for healthy adults and as a regular, lifelong form of exercise' (Klöckner, 2013.).

When you are outdoors and walking regularly in nature, the fresh air and the beauty of the surroundings can make people feel very happy, and even have a certain effect on the treatment of depression. Walking is also a natural sedative, often walking exercise, can improve the excitability of the nervous system, inhibit depression, so that people after walking in a good state of mind, relaxed body, full of energy.

Jogging is considered the best way to exercise your whole body, but it is no longer the best way. After taking into account safety and time saving factors, we have found that

a safer, easier, more effective and more beneficial form of exercise is walking. Walking is more effective and safer than jogging, especially for women who rarely exercise and for those over 30 years of age. 'Choosing to run for exercise without thinking leads to an increased probability of injury to knees, tendons and other parts of the body; when people with difficulties with organs such as the heart, kidneys, liver or metabolic system can suffer from a severe lack of blood oxygen supply' (Nunally, 1978.). When we are walking, the impact on the soles of a person's feet is about 1 to 2 times their body weight, and in the case of comparison with the jogging method, jogging alone accounts for about 1/3 of the impact on the body when walking improves immunity and slows down ageing. Walking is the most relevant and good way of life, the most economical exercise, and it has incredible results. When we walk regularly for exercise, we can reduce the probability of heart disease by 30%, diabetes by 50%, and also combat mental depression and neurosis. Walking at the right intensity and for the right length of time, and with consistency, promotes the function of the immune system and delays the ageing of the immune organs.

Rather than walking, you may prefer to cycle longer distances. 'There are no limits to how far your bike can take you, apart from the many dedicated cycle paths in towns and cities across the UK. Cycling builds muscle and has been linked to improved cardio. In towns and cities, cycling can save time as you filter traffic and avoid queues (Marsden,, 2014.) '. The UK government has allocated £2 billion for walking and cycling infrastructure, which means that cycle routes and accessibility are expected to improve. If you need some help when cycling, why not go for an electric bike? Electric bikes and electric cargo bikes have an electric motor and battery that can help you complete longer journeys more easily than a traditional bike. In recent years, electric bikes and

easy-access bikes have become increasingly popular and you are likely to see them locally but not notice the difference. Electric bikes and easy bikes. Ideal for anyone who may find cycling physically challenging. 'Provides 25-100 miles of riding capacity on a single charge. Gives you an extra boost for those long journeys or hills. Emits 742 times less CO₂ per mile than a regular petrol or diesel car. Supporting long-term travel , In some cases, active travel may not be an appropriate option, for example, you may have to travel a long distance or have a large burden' (Lo, 2016.).



Fig 3: Courtesy of Peterborough City Council,2018. [Internet]

Choosing to walk or cycle once a week for your commute could save around 29kg of CO₂ per year - enough to fill 10 balloons for every mile you walk without a petrol or diesel car. Cutting your car use by a quarter could save £202 in fuel costs and 510kg of CO₂ per year. At least 150 minutes of moderate intensity exercise per week can help reduce your risk of developing a number of mental and physical health conditions:

depression by 30%, cardiovascular disease by 35% and type II diabetes by 40% (source: Chief Medical Officer's Guide to Physical Activity 2019, UK).

If charged at home, a 100 miles ride on an Electric Bike Fees just 55p for electricity. By walking, cycling or wheeling, you are reducing congestion and pollution and making local spaces more enjoyable, quieter and healthier.

An e-bike is a bicycle with an electric motor and a rechargeable battery that helps make riding easier. Using an e-bike is very similar to using a standard bicycle. The same rules of the road apply, but in the UK the legal age limit for using an e-bike is 14 years. 'The motor of an electric bike kicks in during pedal movement up to the legal limit of 15.5 miles per hour - although you can ride faster without motor support.

You can also set the bike to tell it how much support you want it to give you. The lower mode is good for riding on flat roads, while the higher mode uses more electrical assistance and therefore requires less effort, making it ideal for use on hills and steeper climbs. The battery on an e-bike usually takes about 4-5 hours to charge and a single charge should give you 25-100 miles of pedalling power, although this depends on the model you have and how you use it. If an e-bike's battery runs out, it can still be pedalled just like a standard bike' (Hafner, 2017.). A limited number of routes on the National Cycle Network have public e-bike charging stations to help you recharge. The location of the battery and motor can vary - for example, some batteries are integrated into the frame of the bike, while some models can use two batteries for increased range.

Electric bikes are cheap to run, and if you charge them at home, a 10 mile ride on an electric bike will only cost you 3p for electricity. If you drive this distance in a petrol or diesel car, it will cost you up to £1.50 depending on your vehicle. From lower fuel,

repair and maintenance costs, to the benefits of zero tax and free parking, it makes economic sense to trade in your car for an electric bike.

‘The UK Government is supporting the roll-out of electric vehicles. This roll-out includes charging infrastructure, a zero-emissions vehicle supply chain network and alternative sustainable transport methods to ensure that transport greenhouse gas (GHG) emissions are reduced in line with the provisions of the Net Zero Strategy. From 2030, no new conventional petrol or diesel vehicles will be sold in the UK and from 2035 all new vehicles will be zero emission and will support the UK's Net Zero Strategy. in 2020, UK transport will account for 24% of net GHG emissions, the majority of which will come from road transport. Electric vehicle sales in the UK have increased since 2020. UK government figures for 2021 show that there are approximately 1.8 million electric vehicles (EVs) on the road. The data also shows an increase in EV registrations between 2020 and 2021 compared to new diesel and petrol vehicles, and an increase in EV ownership year on year. This has led to a growing desire to switch to electric vehicles and an increase in demand for EVs’ (Hu, 2016.).

‘Consumers are typically more interested in two main types of electric vehicles: standard battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). As we approach 2030, the pressure to move to EVs is taking many businesses by surprise ’ (Chen,2014) .Did you know that 13.9% of new cars sold in the UK so far in 2022 (July 2022) are fully battery electric vehicles (BEV), and another 6.3% plug-in hybrid electric vehicles (PHEV)? So already more than 1 in 5 cars sold are electrified! Dealerships and garages that service and repair vehicles need

to start taking steps now to make sure they survive the move to EVs and have success in the market.

Although the upfront cost of an electric vehicle is often higher, EVs can be cheaper to run, due to the lower cost of electricity compared to petrol or diesel. Recharging at home (overnight) will normally result in the greatest cost savings.

Chargepoints can be installed in homes with a garage or driveway, at workplaces, on residential streets, in town centres, public car parks and at destinations, such as shopping centres or motorway service stations.

Last year saw a large drop in the UK's transport emissions, as people were asked to stay at home during national lockdowns. According to government figures, emissions from transport fell by almost 20% in 2020. As we come out of lockdown, 'electric vehicles' will have an important part to play in reducing emissions from transport and helping the UK reach its net zero targets. Battery electric vehicles are 100% electric vehicles that don't produce any tailpipe emissions' (Nordlund,2003) .

Choosing an electric car can help you save money and reduce your carbon footprint. Electric vehicles are an increasingly attractive option because of their lower running costs, the increasing number of models available and the growing concerns about air quality and climate change. **Battery-electric vehicle (BEV)** A vehicle powered only by electricity, also known as a 'pure' or 100% electric car. The vehicle is charged by an external power source, ie at a chargepoint. These vehicles do not produce any tailpipe emissions. Most battery-electric cars have a real-world range of 100-300 miles on a

single charge. Examples include the Nissan Leaf, Vauxhall Corsa-e, Renault Zoe and Tesla Model 3.

Plug-in hybrid electric vehicle (PHEV), This is a vehicle that has a battery, electric drive motor and an internal combustion engine (ICE). It can be driven using the ICE, the electric drive motor, or both, and can be recharged from an external power source. Typical PHEVs will have a pure-electric range of up to 50 miles. Once the electric battery is depleted, journeys can continue in hybrid mode, meaning that there is no range limitation. PHEVs are only efficient if they are charged regularly, otherwise they can be more expensive to run than a conventional petrol or diesel vehicle. The Mitsubishi Outlander PHEV, BMW 330e and VW Golf GTE are all examples of PHEVs.

Extended range electric vehicle (E-REV), These are a version of plug-in hybrids. An E-REV combines a battery, an electric drive motor and a small petrol or diesel generator. The electric motor always drives the wheels, with the ICE acting as a generator when the battery is depleted. The range of these vehicles can be between 150-300 miles. An example of an E-REV was the BMW i3 range-extender (no longer available).

While the initial upfront purchase price of an electric or plug-in hybrid vehicle can be higher, this is usually offset by lower running costs. 'Electric vehicles offer savings including: A full charge in a pure electric vehicle will give a typical range of over 200 miles and will cost approximately £8-12 if charging at home. Driving 200 miles in a petrol or diesel car will cost around £26-32 in fuel, which can be three or four times more than the cost of charging the electric car. The cost savings will be most significant when owners charge at home and have access to an off-peak overnight electricity tariff. There are fewer mechanical components in an electric vehicle compared with

conventional vehicles, which often results in lower servicing and maintenance costs. Pure EVs have a zero rate of vehicle excise duty. From 25 October 2021, only zero emission vehicles – those emitting 0g/km CO₂ – qualify for the cleaner vehicle discount. All other vehicles, regardless of their emissions status will be required to pay the Congestion Charge. The lower or zero emissions of plug-in vehicles mean that they will attract lower charges from clean air zones being implemented around the UK and London's ultra low emission zone (ULEZ). Free parking for electric vehicles is available in some towns and cities' (Ozaki,2011) .



Fig 4: Electric Vehicles - Courtesy of Nottingham City Council , 2020 (Internet)

Efficient driving is a driving style that reduces fuel bills, cuts carbon emissions and lowers accident rates. 'It is about becoming a better driver, rather than sacrificing the performance or enjoyment of driving. For electric vehicles (EVs), efficient driving also brings greater vehicle range. Save on fuel, reduce carbon emissions and improve air

quality by following our driving tips and thinking about your vehicle choice. Driving efficiently also has safety benefits due to its strong focus on better anticipation' (De Groot,2010) .

When we have a smooth driving situation, anticipate road conditions as far in advance as possible and avoid unnecessary braking and acceleration as this can increase fuel consumption. Keep a large distance from the vehicle in front of you so that you can adjust your speed without necessarily using the brakes. When slowing down, lift off the accelerator as early as possible but stay in gear. It is good driving practice to shift to a higher gear earlier. Driving at high revs increases fuel consumption, so shift earlier when accelerating, usually at around 2000 rpm. At high speeds, we need to avoid excessive speeds so as to reduce the probability of a sharp increase in fuel consumption. In the case of electric vehicles, we need to be even more concerned because the energy consumption of electric vehicles increases even more when driving at high speeds.

'We need to turn the car off when we are not using it and many newer cars automatically turn off when stationary in neutral. If your car does not do this, turn off your engine if you are going to be stationary for more than a minute. This will reduce your car's energy consumption and extend the life of your car' (Donald,2014) .

Tyre pressure is also an issue that needs our attention. Under-inflated car tyres increase your energy consumption and can be dangerous, so check them at least once a month and before long journeys. Car roof racks, boxes and rails, all of which are not car friendly Hanging these on your car increases drag and fuel costs, especially at high speeds, so try to remove them when not in use.

Car roof racks, boxes and rails, all of which are not car friendly Hanging these on your car increases drag and fuel costs, especially at high speeds, so try to remove them when not in use.

Windows and air conditioning in cars are the least of our concerns, although at higher speeds it is more energy efficient to drive with the windows open than to use the air conditioning. However, we understand that opening the windows on very hot days or at higher speeds is not always pleasant, so if you need to use the air conditioning, please try to use it with caution.

Additional technology for electric vehicles, efficient driving electric vehicles (EVs) also need to make full use of regenerative or regenerative braking, which recharges the battery when you slow down or go downhill. To do this, use higher levels of regeneration as soon as you feel comfortable. This, combined with good anticipation of the road ahead, will mean that most of your deceleration is done by regeneration. You should also remember that heating an electric car uses energy and drains the battery, so use the heater wisely. Most electric cars have heated seats and often a heated steering wheel. By using these features, you may find that you can reduce the cabin temperature and thus save energy.



Fig 5: Courtesy of the Greater Nottingham Partnership 2009 (Internet)

We need to plan shared travel options to achieve low carbon travel. Bike share schemes are publicly available bikes that can be hired by the hour or by the day. Schemes are either docked (bikes must be left and collected from specific docking areas) or dockless (bikes can be left and collected from anywhere within a specific radius).

The benefits of bike share schemes are:

- Zero emission journeys.
- Helps you travel actively – improving health, fitness and wellbeing.
- Cheaper than the car – you only pay for the journeys you take.
- Enables you to try out cycling without the commitment of buying a bike.
- Access to a bike without the need for storage.

Shared transport options, such as using public transport, car sharing or bike rental schemes, offer a low-carbon way to travel. The main benefit of shared transport is its

diversity and there is sure to be an option to suit you. Shared transport includes: bike share schemes, public transport, car clubs, lift sharing.

What needs to be explained here is lift sharing, each country in the UK has different Covid-19 lift sharing guidelines. Lift sharing, also known as car sharing, car pooling is when two or more people share regular journeys in one vehicle. Sharing your car journeys with friends, colleagues and neighbours can help you save money and reduce your carbon footprint. Save money on fuel by sharing the cost of your journey between you and your passengers. Reduce congestion and improve local air quality by reducing the number of cars on the road. Reduce carbon emissions by reducing the number of cars on the road. Improve your health by being more social - sitting alone in traffic can increase stress levels; getting people talking or sharing driving can improve your overall health.

Planning your route and using multiple modes to switch to shared transport does not mean giving up your current mode of travel. The flexibility of shared transport options allows you to use a variety of travel modes, including walking, cycling and using a car. Here are some examples of how public transport can be used in combination with other modes of travel .

Shared transport can help you walk more and get more active. If there is no public transport service that can take you to your doorstep, don't panic and use this time to take a few steps and improve your health. If it's a nice day, why not get off a stop or two earlier and make the most of the fresh air. Brisk walking is classed as a moderate intensity activity.

Not everyone has a metro or train station on their doorstep. Most city bike share schemes have docking stations near train stations or stations that allow you to cycle there without having to cycle to the train. Also, when you return, there should be a bike waiting at the station for you to get home. Most trains have bike storage areas, allowing you to take your own bike with you or leave it safely at the station.

Avoid driving into the city centre and avoid congestion by making the most of the park and ride options in your area. Park your car in a designated car park and take a bus or train to your city destination. Not only will this save you time, but it may also save you money on congestion charges and city parking fees.

Electric cargo bikes are an effective way to transport goods and make last-mile deliveries. There are many advantages to making the switch, including lower upfront costs, reduced congestion, a happier workforce and cleaner, healthier air.

It is now possible to have almost anything delivered to our doorstep. This growing demand is leading to more delivery vehicles on the roads, increasing traffic congestion and, depending on the type of vehicle, having a negative impact on air quality and noise pollution.

Bicycles, particularly cargo and e-freight bicycles, are an excellent alternative to petrol and diesel transport and are increasingly being used by individuals and commercial organisations. A cargo bike is any bike specifically designed to carry a load, whereas an electric cargo bike is simply a cargo bike with the addition of an electric motor. Most importantly, electric cargo bikes have zero tailpipe emissions. This means that there is no negative impact on air pollution when conventional petrol and diesel vehicles are

replaced by bicycles, cargo and electric cargo bikes. When considering costs, electric cargo bikes also make good economic sense. The upfront costs are much lower compared to cars and vans, and as it is cheaper to buy electricity than petrol and diesel, e-freight bikes are also much cheaper to run. Insurance, maintenance and repair costs are all much cheaper too.

Freight and electric cargo bikes take up less road space than conventional lorries, which eases congestion while improving efficiency. They can take shorter, faster routes by using cycle lanes and bus lanes, wheeling through pedestrian-only zones or moving through stationary traffic. In addition, their small size means that they can park closer to their destination and therefore deliver faster.

Finally, the use of cargo and electric cargo bikes helps to create a healthier, happier workforce. The physical activity of using a bike is good for the rider's health and some companies even report that their electric cargo bike riders take less sick leave than other drivers.

Powered light vehicles (PLVs), or Class L vehicles, are a group of two-, three- and four-wheeled vehicles divided into seven groups based on power output, number of wheels and maximum weight. As a lightweight and low-cost alternative to conventional vehicles, zero-emission buses provide zero-emission transport for personal use, commuting, service use and goods delivery services. Zero Emission Buses offer organisations an innovative and cost-effective way to reduce their carbon footprint.

Zero emission light vehicles (Ze PLVs) can work for us, offering an efficient, clean and practical form of personal and commercial mobility. Their compact size and light weight optimise road space and can be an economical alternative to larger cars or vans. They

can also be an effective alternative where walking, cycling or public transport is not feasible.

The benefits of PLVs are numerous; Electric buses will have zero tailpipe emissions. This means that they will have lower emissions associated with them than fuel-based buses, cars and vans. The extent of the emissions will depend on the efficiency of the motor and the carbon intensity of the grid. they are small and compact, optimising roads and parking spaces when we encounter roads where space is very tight, especially in urban areas. PLVs are light in weight and energy efficient, saving on running costs and electric powertrains. Zero-emission PLVs are a clean form of transport and produce no local emissions. Zero-emission PLVs are very practical and suitable for everyday use. It is a clean and affordable alternative to walking, cycling or public transport, which is not a viable option.

Conclusion

I believe that the Low Carbon Travel Plan has the potential to make a real contribution to this in challenging times. As with any transport intervention, success will require careful analysis of the issues, a robust assessment of options for developing an appropriate package, and a framework for funding, delivery and monitoring.

If properly planned, they can deliver tangible local benefits across a range of local objectives, from reducing congestion to improving health, air quality, education, housing, planning and social inclusion. Active travel, for example, plays an important role in reducing obesity, increasing physical activity and improving quality of life. These initiatives can also be cost effective, cost efficient, low carbon and flexible to implement.

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