

# Low carbon travel

## Reducing the climate change impact of road transport INFORMATION SHEET FF44

### Foreword

In 1994 the Royal Commission on Environmental Pollution published a report on Transport and the Environment. Sir John Houghton, my predecessor at the time, launched the report saying “ways must be found to make the longer-term development of transport environmentally sustainable.”

13 years on and transport in the UK is becoming less sustainable by the day. Of course there is no silver bullet when it comes to achieving sustainability or tackling climate change, but we simply cannot afford to duck the issue any longer. In this information sheet Sustrans is making recommendations that, if implemented, could deliver real and immediate progress towards sustainable, low carbon transport.

The evidence is now stronger than ever that technological improvements alone will not be enough to deliver the scale of emissions reductions we need to see from the transport sector. Achieving behaviour change is vital – and that means all of us travelling less far, in more energy efficient ways, and at slower speeds. Transport and planning must be better integrated so that people can travel shorter distances to work, shops and schools, and resources should be switched from road building to creating the conditions that will encourage people to walk, cycle and use public transport much more.

There is undoubtedly a growing awareness and sense of urgency amongst many politicians that we have to make real progress. I hope that they will read this information sheet as the important contribution to achieving sustainable and low carbon travel that it is, and work to implement what it suggests.

Doing nothing is no longer an option. We do have the opportunity to bring about sustainable transport, but we need to start now. If one of my successors is writing something similar in 13 years time it will be too late.

Professor Sir John Lawton, CBE FRS

Chairman of the Royal Commission on Environmental Pollution

### Introduction

There is now overwhelmingly strong evidence that it will no longer be possible to mitigate the worst effects of human induced climate change unless we can contain the average surface Earth temperature to within 2° celsius of pre-industrial levels. Sustrans believes that the last chances to do that are now upon us and further that, as part of the

response urgently needed, it is imperative that developed countries lead the way in changing to low carbon travel. This document presents our overview of policies and action needed to significantly reduce the UK's carbon dioxide (CO<sub>2</sub>) emissions from road transport.

Sustrans is the UK's leading sustainable transport charity and works on practical projects to encourage people to walk, cycle and use public transport to benefit health and the environment.

National Cycle Network Centre, 2 Cathedral Square, College Green, Bristol, BS1 5DD



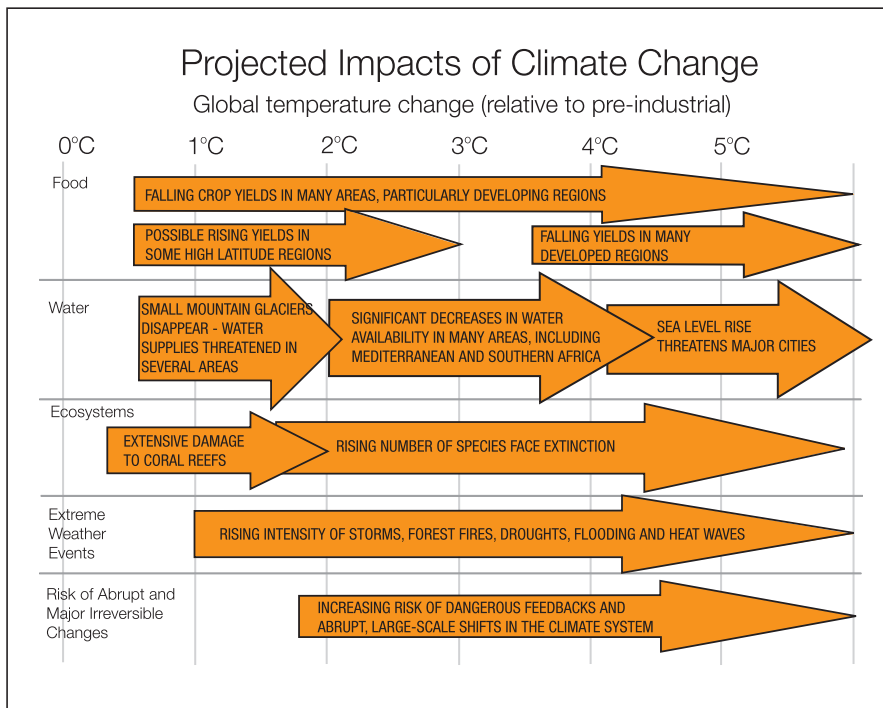
Private motor travel is the dominant source of CO<sub>2</sub> from transport



Oil is a finite resource and we are either at or very close to the peak of production of conventional oil



90% of people favour measures to improve conditions for walking, cycling and public transport



This graphic from the 2006 Stern Review illustrates many, though not all, of the hazards we now face from global climate change (source: Projected Impacts of Climate Change taken from The Stern Review Launch presentation October 2006. Crown Copyright 2006.)

## Climate change is challenging us

There is no longer any serious scientific doubt as to the existence or the severity of human induced global climate change. Both the Intergovernmental Panel on Climate Change (IPCC) and the 2006 Stern Review have stressed the overwhelming body of evidence that the Earth's climate is being rapidly changed by increases in greenhouse gases caused by human activities, and in particular by CO<sub>2</sub>.

As Stern set out, most climate models indicate that greenhouse gases at twice pre-industrial concentrations (a level which probably will be reached between 2030 and 2060) would lead to a rise of between 2° and 5°C in global mean temperatures. Global warming of 5°C would be far outside the experience of human civilisation and comparable to the difference between temperatures during the last ice age and today. Several new studies suggest up to a 20% chance that warming could even be greater than 5°C.<sup>(1)</sup>

The current scientific consensus is that to avoid the worst impacts of climate change, the mean global surface temperature

should not rise by more than 2°C above pre-industrial levels. The likely impacts of a rise of between 2° and 3°C include:

- two billion people affected by water scarcity
- agricultural losses, extending to the world's largest exporters of food
- the loss of the world's most bio-diverse ecosystems including most of the coral reefs, and irreversible damage to the Amazon rainforest.<sup>(2)</sup>

A variety of positive feedbacks could amplify the effects of CO<sub>2</sub> emissions, such as the transformation of the planet's soils and forests into net sources of carbon, potentially causing an additional 2° to 3°C rise in temperature. Other worrying impacts include an increase in the likelihood of other abrupt changes in climate such as the slowing-down of the Gulf Stream and the loss of the Greenland and West Antarctic ice sheets, raising sea levels by 12 metres.<sup>(2)</sup>

## The time for action is now

The IPCC has suggested that a limit close to 450 parts per million (ppm) CO<sub>2</sub> – or even lower – might be necessary to avoid

## Health impacts

Aside from the widely recognised threat to life from sea level rise and extreme weather events, there is a more truly global public health risk, which is to some extent already being felt. The change in climate is causing diseases to migrate to new areas as infectious agents and disease vectors move their range. Water shortages, sanitation problems, agricultural systems breakdown and famine are impacts of climate change. One of the most significant may well be increased conflict, as whole populations are driven to migrate in search of food and water.

The World Health Organisation estimates that as many as 150,000 deaths per annum may already be attributable to climate change, and points out that the 2003 European heatwave alone caused 44,000 deaths.<sup>(3)</sup>

## Insurers warn 'adapt or bust'

Even without dramatic events such as the disintegration of major ice sheets, the insurance industry has been warning for some time now of the vast potential costs of climate change induced weather variation. Lloyds, for example, is very frank:

"The issue of climate change will be vital to the future of the insurance industry. So far the industry has coped with the huge costs of weather-related catastrophes. But it is by no means certain that we will continue to do so and there is no doubt that we are not taking the issue of catastrophe trends seriously enough. We need to take action now ... It's a case of adapt or bust."<sup>(4)</sup>

more than a 2°C temperature rise.<sup>(5)</sup> The current level is 383ppm CO<sub>2</sub>, and it is rising at more than 2ppm each year.

Sustrans' position is that the UK contribution to this target should be for our emissions to peak as soon as possible, and then to decline by at least 3% year on year, leading to reductions of 10% or more by 2010 and 60% or more by 2050. The longer the downturn is delayed, the steeper the necessary emissions reduction path becomes, which in turn will increasingly limit our future options for action if, as seems likely, the prognosis continues to worsen. In other words, these are the minimum reductions necessary, and assume ongoing cumulative emissions reductions.<sup>(6)</sup> They may be superseded by evidence of sharply accelerated growth in global CO<sub>2</sub> emissions over the past five years, now being finalised by the Global Carbon Project; emissions which were rising by less than 1% annually up to 2000 now appear to be increasing by 2.5% per year.<sup>(7)</sup>

### Tackling road transport is crucial

The necessity of reducing road traffic CO<sub>2</sub> emissions is not new. In 1994, the Royal Commission on Environmental Pollution warned that:

***"The unrelenting growth of transport has become possibly the greatest environmental threat facing the UK, and one of the greatest obstacles in achieving sustainable development".<sup>(8)</sup>***

### UK transport policy and its climate change contribution

Under a business as usual scenario, UK transport CO<sub>2</sub> emissions are expected to continue rising, by 35% between 1990 and 2030.<sup>(9)</sup> Transforming transport is therefore critical in achieving our emissions reduction targets. The UK aims to move beyond its Kyoto target towards a 20% emissions reduction (on 1990 levels) by 2010, and to put itself on a path to 60% reduction by 2050. Since 1990, the two sectors where emissions have risen are household and transport, by 12% and 9%

respectively.<sup>(10)</sup> In particular, CO<sub>2</sub> emissions from cars make up 13% of the UK total<sup>(11)</sup> by source; it is clear that strong action is needed on road transport.

A Department for Transport study investigating whether a 60% CO<sub>2</sub> reduction in the UK domestic transport sector could be achieved by 2030 has concluded that this is possible, but only with real and early change in travel behaviour.<sup>(9)</sup>

### 'Predict and provide'

A central tenet of transport policy over the last five decades has been to accept the growth in private motor transport as inevitable, and to cater for it. In appointing the new Transport Secretary in 2006, the Prime Minister drew attention to *"thirty five major road schemes completed since 2001"* as one of the Department's key successes in recent years.<sup>(12)</sup> Despite widespread acceptance that this 'predict and provide' approach can never meet predicted motor traffic growth, the current 10-Year Plan proposed an extra 475 to 511 lane-km of additional road space, and the 'Future of Transport' White Paper planned another 4,000 lane-km by 2025.<sup>(13)</sup> The construction of these massive infrastructure programmes is in itself a major CO<sub>2</sub> source, but in addition once built the additional road space will induce extra traffic.<sup>(14)</sup> Forecasts for past schemes have consistently under-estimated the rate of traffic growth and overstated the 'relief' from congestion that they offer to by-passed settlements.<sup>(15)</sup>

There is now, happily, some apparent recognition within Government that building more roads is not environmentally sustainable. As the Secretary of State for Transport Douglas Alexander himself commented in May 2006:

***"Simply building more and more roads is not the answer. We need only to look at other countries which have built more and bigger roads in the past, only to see them fill up again to know that this is not a sustainable approach. And it is unacceptable in environmental terms."<sup>(16)</sup>***



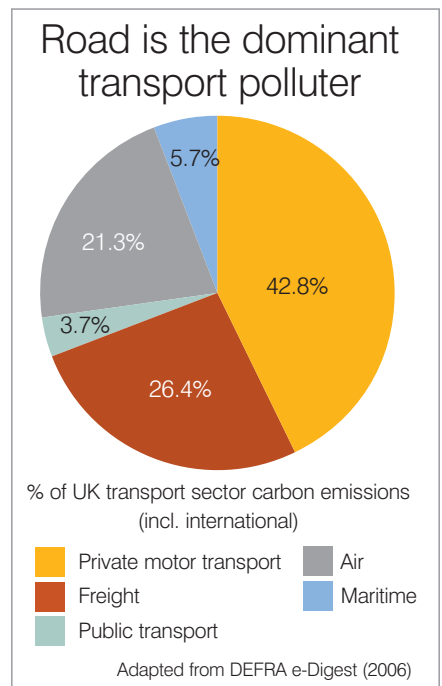
UK transport emissions are expected to rise 35% between 1990 and 2030



CO<sub>2</sub> emissions from cars make up 13% of the UK total



Building more roads is not environmentally sustainable



## Keeping it local

A core concept in the transition to low carbon transport is moving towards local production and consumption of goods, and hence local travel for both freight and people. This can also contribute to the local economy, maintain employment, and enable people to appreciate their local environment; less distance travelled and less motorised travel does not need to mean a lower quality of life.

## Freight

Localism is important because so much trade is so wasteful. For example, the UK exports 1.5 million kilos of potatoes to Germany each year ... and imports the same amount,<sup>(17)</sup> generating unnecessary CO<sub>2</sub>. Freight movement CO<sub>2</sub> emissions can be cut by increasing use of local supplies, including eating locally sourced food in season. Where freight transport is necessary, road trucks produce 123 grams of CO<sub>2</sub> per tonne km, against 23 grams by rail.<sup>(18)</sup> Emission calculations clearly should be central to freight policy.

Urban areas can benefit from consolidated freight movements, such as in the Bristol city centre consolidation scheme, the first of its kind in the UK. Deliveries are shared between 46 retail outlets, reducing their vehicle movements by 65%, and saving 20,350 vehicle km and 2,470 kg CO<sub>2</sub> (or 0.67 tonnes of carbon) emissions in just over a year.<sup>(19)</sup> Similar schemes are in operation in other European countries.<sup>(20)</sup>

## Aviation

If the Government continues to support current trends, by 2030 the carbon emissions from aviation alone will exceed the nation's total carbon allocation under a 450 ppm regime.<sup>(6)</sup> Despite this, current policy appears to be repeating the old surface transport errors of predict and provide. Sustrans' view is that we will not be able to make adequate emissions reduction without significantly reduced levels of flying.

## Public transport

CO<sub>2</sub> emissions per passenger for train and coach are six to eight times lower than car travel at average occupancy, and public transport could provide a greater share of local and longer distance travel than is currently the case.<sup>(21)</sup>

However, the public consistently perceives alternatives to the car as less competitive than they really are, in terms of convenience, speed and cost.<sup>(22)</sup> For longer distances surface public transport travel will need to become the mode of choice and replace current short-haul air travel.

## Setting a global example

There is an additional urgent aspect to reducing transport sector CO<sub>2</sub> emissions. With an ever-increasing dependence on private motor vehicles, the developed world has set an aspirational, albeit unsustainable, example to developing countries. Moreover, UK investments and aid help fund car-orientated transport infrastructure projects all over the world, further exacerbating CO<sub>2</sub> emissions.

The Kyoto Protocol agrees legally binding emissions cuts for industrialised nations, averaging 5.4%, to be met by 2010. Numerous studies<sup>(23)(24)</sup> show the potential for efficient and sustainable public transport systems. If we expect these to be taken up internationally the UK should lead by example. The conclusion in the IPCC's Third Assessment Report in 2001 was that global emissions should be cut by 60% by 2050, and since that time the picture painted by climate scientists has become gloomier. In developed countries such as the UK, per capita emissions are well above the global average; if there is to be any equity in reductions on a global basis then here in the UK reductions of significantly more than 60% will be needed. Sustrans' position is that the UK should act as an exemplar in reducing our own transport CO<sub>2</sub> emissions, support local and sustainable travel in developing countries, and stop supporting growth in private motor transport.



Freight movements can be cut by increasing use of local supplies



Aviation is on track to exceed our entire carbon allowance



CO<sub>2</sub> emissions per passenger for train and coach are six to eight times lower than car travel at average occupancy

## Energy security and peak oil

Peak oil does not mean that the world is literally running out of oil; simply that oil is a finite resource and that there must come a point at which its production (and therefore its supply) reaches a peak.<sup>(25)</sup> Sustrans' view is that we are either at or very close to the peak of production of conventional oil. As the demand for oil continues to rise and conventional supplies decline, prices will rise steeply enough to upset current economic and social systems. But UK transport policy still seems to be based on the assumption that oil will remain relatively plentiful and cheap.

Cutting energy demand is the logical first action to take in reducing oil dependence or increasing energy security. The UK faces an increasing energy gap between demand and supply of oil. In this context we should look particularly at transport, as energy for transport remains highly dependent upon oil.

## Moving to low carbon travel

### Short term

Personal behaviour change is critical to the reduction of CO<sub>2</sub> emissions,<sup>(9)</sup> not least because it can be implemented more quickly than other interventions. For politicians, among others, travel behaviour change can be a very attractive route to reducing CO<sub>2</sub> emissions because it is relatively quick, uncontroversial and excellent value for money. Also, the benefits of the modal shift from driving to walking and cycling, for example, are spread across several policy sectors and can be marketed positively. They include less congestion, better air quality, fitter and healthier people<sup>(26)</sup> and a reduced burden on the NHS.

A range of tools to deliver behaviour change is available, focused on improving individual knowledge, perceptions, attitudes, and choice of alternatives to single occupancy car use. These "Smarter Choices" measures include workplace travel plans, car sharing, teleworking, teleconferencing and individualised travel marketing. These could save the

equivalent of up to 2.5 million tonnes of carbon (MtC) per annum in 2015, and a cumulative total of 14.2 MtC by that date.<sup>(27)</sup>

Given that fundamental behavioural changes are required, it is important to understand current attitudes to travel. Travel behaviour research carried out by Sustrans for the DfT in Darlington, Peterborough and Worcester showed that the overwhelming majority of people view past and future motor traffic growth as a negative trend. The surveys also revealed that:

- around 90% favour measures to improve conditions for walking, cycling, and public transport, even where these disadvantage car users
- on average 47% of car trips within each town could be replaced by walking, cycling and/or public transport under existing conditions
- cycling is a viable mode choice for 39% of all trips across the three towns but currently accounts for only 3% of trips.<sup>(28)</sup>

It is important that policy makers take these silent majority views into account.

### Medium term

#### Examples of fiscal policy interventions

Appropriate fiscal measures can be introduced on a relatively short timescale, and increasing taxes is known to be effective in dampening demand. Even more interestingly, EU countries with the lowest fuel taxes burn some 50% more fuel to earn €1 of GDP than countries with the highest fuel taxes.<sup>(29)</sup> Increasing Vehicle Excise Duty on less efficient vehicles is one targeted approach.

#### Speed policy

Given that fuel efficiency decreases markedly with higher speeds, an enforced 60mph speed limit on motorways could save around 1.9 MtC a year.<sup>(30)</sup> Even enforcement of current limits could achieve significant reductions in emissions. In France, in 2004, strict enforcement on main motorways reduced CO<sub>2</sub> emissions by 19% as well as cutting crashes by 30%.<sup>(12)</sup> Alongside blanket

## European Emissions Trading Scheme

The European Emissions Trading Scheme (EU ETS), the largest multi-national greenhouse gas emissions trading scheme in the world, is a key part of EU climate change mitigation policy. Each participating country has a National Allocation Plan specifying caps on greenhouse gas emissions for individual power plants and other large point sources (meaning that it covers direct emissions only, and not those caused by the consumption of goods or services the provision of which involved direct emissions by other organisations). There are strong criticisms of the EU ETS as it is currently set up in that it simply has functioned to reward the biggest polluters - the firms using the most fossil energy which have qualified for free emissions permits.<sup>(31)</sup> At the very least, however, given the significance of transport emissions, we believe that all such emissions should be included in the ETS, not just these from aviation.

## European Climate Change Programme

In 2000 the European Commission launched the European Climate Change Programme (ECCP) to "identify and develop all the necessary elements of an EU strategy to implement the Kyoto Protocol". Although it acknowledges the importance of reducing transport emissions, the ECCP completely fails to take into account the potential of non-motorised travel or of reducing the need to travel. It focuses instead on technological fixes, although its own monitoring programme shows that these are not delivering the emissions reduction required. We are optimistic that the second generation ECCP, due in 2007, will be more wide-ranging and effective.

20mph speed limits in urban areas, which would encourage a further switch to walking and cycling,<sup>(32)</sup> such a step would send a powerful signal to the public of official commitment to the degree of behavioural change we need.

## Longer term

### Vehicle technology and biofuels?

Until now, UK and European climate policy has relied heavily on voluntary agreements and technological solutions. The 2003 Energy White Paper highlighted the technological contribution which low emission vehicles and biofuels might bring.<sup>(33)</sup> However, whilst CO<sub>2</sub> per km from new cars has fallen since 1998, at current rates of progress the UK will not achieve the EU target of 140g/km until around 2022.<sup>(11)</sup> Nearly a century ago, Ford's Model T achieved 25 miles to the gallon. Today many Ford cars and trucks achieve less than this,<sup>(34)</sup> while traffic growth has more than compensated for any efficiency improvements.

It is commonly argued that alternative fuels could bring important savings in CO<sub>2</sub> emissions. There are, however, doubts about the ability of the biofuel industry to pick up the predicted percentages of the fuel market, and increasingly critical analyses of the environmental and social impacts of the industry as it grows.<sup>(35)(36)</sup>

Even if the average emissions profile of the total car fleet were to reduce to 90g/km in 2030, the crucial 60% target reduction is not possible over the timescale envisaged, due mainly to projected increases in car travel.<sup>(9)</sup> CO<sub>2</sub> emission reductions through technology, if they can be achieved, still must play a secondary role to faster-acting reductions in our reliance on private motorised transport, such as reducing the need to travel and switching to emission-free modes.

### Can't we just offset it?

While offsetting is often advocated as an approach to tackling climate change, Sustrans is wary of offsetting schemes for a number of reasons:

- they may disguise the urgent need for behaviour change, or provide an excuse for delay

- they have been associated with energy savings schemes which would have been implemented anyway
- it is inequitable to use some of the poorest people in the world to mitigate the impact of the behaviour of the developed world.

Many offsetting schemes have been based around tree-planting, which is at best a short term solution and may have the reverse of the intended effect – if not properly managed forestry can actually be a net source of carbon. There is evidence that high latitude forests probably already have a net warming effect on climate.<sup>(37)</sup>

The UK government is now studying how to quality assure offset schemes, and future regulation should ensure that schemes do not cause net carbon emissions. However, we should not for a moment imagine that offsetting can prevent the worst consequences of climate change. Sustrans considers that such schemes are likely to be most effective only as a way to get individuals and society thinking clearly about the need for behavioural change.

## Sustrans' contribution

Sustrans was originally founded, in 1977, to address the environmental damage done by motorised transport and to promote a shift towards more sustainable and healthy ways of travelling. The name of the charity derives from **Sustainable Transport**.

Sustrans now operates a range of exemplar programmes, demonstrating what might be achieved by a widespread shift to a more sustainable transport system. These include:

- the National Cycle Network – this passes within one mile of half the UK population, and carried 232 million trips in 2005, half by pedestrians. Usage growth on the Network of approximately 15% per annum shows a ready demand to travel on foot and by bike, and over a third of trips made are substituting for car use<sup>(38)</sup>
- TravelSmart or individualised travel marketing - this addresses perceived



Reducing and enforcing speed limits could achieve significant reductions in emissions



There are doubts about the ability of biofuels to replace oil



The National Cycle Network carried 232 million trips in 2005

barriers to walking, cycling and public transport, by providing households detailed information on these alternatives to the car. TravelSmart has demonstrated, in a range of settings, consistent reductions in car traffic of between 10% and 13%, and it is estimated that a national programme targeting all 25 million UK households would save around 0.9MtC per annum<sup>(39)</sup>

- Bike It, a direct intervention within schools, now being rolled out nationwide. A pilot programme with 40, very disparate, schools quadrupled levels of cycling to school in a single year. At the start of the project twenty of the schools had no cyclists at all; one in 12 journeys is now made by bike. A third of the new cyclists were previously driven to school<sup>(40)</sup>
- Active Travel, working with the health sector on policies and programmes – to encourage the active travel modes of walking and cycling
- Liveable Neighbourhoods, re-generating residential zones dominated by the car, using techniques proven in central and northern Europe, to permit more local access and non-motorised travel.

## Conclusions and recommendations

Substantial emissions reductions are required – within the next decade – or it will probably be too late to limit the damage caused by climate change.

With particular regard to surface transport policy and practice, it is now critical to reverse the upward trend in emissions. Of course, this needs to be done at a global level, but the UK, as a higher than average per capita polluter, must act quickly and decisively.

In addition, there should be recognition of the cross-sectoral shared objectives – any shift from private motor transport to walking, cycling and public transport will also help achieve objectives in areas such as physical activity promotion, obesity, social inclusion and crime reduction, as

well as environmental and sustainability policy.

Measures addressing surface travel should include the following:

- **land use planning policy** and practice to be focussed on ensuring local access to a full range of services without the need for car use
- **adoption of a steadily reducing carbon budget for transport emissions** at national, regional and local levels
- **a nationwide individualised travel marketing programme**
- **widespread road space reallocation** from private motor transport to non-motorised transport and public transport modes allied to a moratorium on any further roadbuilding (or widening) without exceptional justification
- **fiscal measures** designed to make sustainable modes of transport more competitive, such as a programme of incremental increases in fuel taxes, sending a clear message that the long term trend of declining real costs of motoring will be reversed
- **road user charging** designed to reduce our car use rather than to reduce congestion (which may simply displace traffic to other times and routes)
- a comprehensive programme of physical and wider cultural **measures to support walking and cycling.**

Underpinning this necessary transition is the need for strong, clear, cross-government commitment and a multi-sector policy framework. Government should be measuring and publishing its successes in facing up to climate change, and the way those successes contribute also to public health, safer streets and so on. This communication programme would improve understanding of the seriousness of climate change and its implications, and so win widespread public support.



Usage of the National Cycle Network has grown by approximately 15% per year



Bike It works directly with schools to enable children to cycle safely to school



The Dings home zone in Bristol, a regenerated residential area where people have reclaimed their street for walking, cycling and playing

## Further information

### Climate Change science

<http://www.ipcc.ch/>

<http://www.metoffice.gov.uk/research/hadleycentre/index.html>

<http://www.realclimate.org/>

### Current statistics

<http://www.defra.gov.uk/environment/statistics/globalatmos/index.htm>

### Emissions reduction frameworks

<http://unfccc.int/2860.php>

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

<http://www.capandshare.org/>

<http://www.thecornerhouse.org.uk/summary.shtml?x=544225>

### Carbon sinks

[http://www.fern.org/campaign\\_area\\_extension.html?clid=6&id=3358](http://www.fern.org/campaign_area_extension.html?clid=6&id=3358)

### Peak Oil

<http://www.peakoil.net/>

[http://www.netl.doe.gov/publications/others/pdf/Oil\\_Peaking\\_NETL.pdf](http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf)

<http://www.energybulletin.net/index.php>

### Sustainable Transport

<http://www.transportenvironment.org/>

### Campaigns

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

<http://www.foe.co.uk/campaigns/climate/>

<http://www.stopclimatechaos.org/>

### Practical community led programmes of action: energy descent planning

<http://www.transitiontowns.org/>

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- 13 **Transport 2000, 2006** Driving up carbon dioxide emissions from road transport
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- 16 **Department for Transport, 2006**  
<http://www.dft.gov.uk/press/speechesstatements/speeches/bettertransport?version=1>
- 17 **New Economics Foundation, 2006** The UK Interdependence Report. How the world sustains the nation's lifestyle and the price it pays
- 18 **European Environment Agency, 2003** TERM 27
- 19 **Bristol City Council, 2005** [http://www.tellus-cities.net/media/en/Goods\\_WS05\\_Freight\\_Consolidation.pdf](http://www.tellus-cities.net/media/en/Goods_WS05_Freight_Consolidation.pdf)
- 20 **START Project** [http://www.start-project.org/consolidation\\_of\\_deliveries.html](http://www.start-project.org/consolidation_of_deliveries.html)
- 21 **David Jamieson, Transport Minister, 2004** Hansard 8th July
- 22 **Sustrans, forthcoming** Travel Behaviour Research Baseline Lancashire 2006
- 23 **Wright and Fulton, 2005** Climate change mitigation and transport in developing nations, Transport Reviews, 25, No. 6
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- 29 **European Federation for Transport and Environment, 2006** Less oil, more welfare

- 30 **Slower Speeds Initiative, 2005** Getting the genie back in the bottle: Limiting speed to reduce carbon emissions and accelerate the shift to low carbon vehicles
- 31 **Feasta, 2007** The Great Emissions Rights Give Away
- 32 **Slower Speeds Initiative, 2006** Road Safety Strategy 2nd Three Year Review. The road safety strategy and climate change
- 33 **Department for Trade and Industry, 2003** Our Energy Future – Creating a Low-Carbon Economy
- 34 **US Department of Energy** [www.fueleconomy.gov](http://www.fueleconomy.gov)
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- 36 **Patzek and Pimentel, 2005** Thermodynamics of Energy Production from Biomass
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## Technical terms

When we use “CO<sub>2</sub>” we refer to atmospheric concentrations of carbon dioxide (currently about 383 parts per million (ppm)), which should not be confused with “CO<sub>2</sub> equivalent”, a shorthand way of describing the full range of greenhouse gases (including CO<sub>2</sub> and currently about 430 ppm).

For targets for emissions reductions, we use MtC (million tonnes of carbon). To translate this measure into carbon dioxide, multiply by 44 and divide by 12.

Figures for the share of emissions due to transport vary depending on whether they are allocated to actual source or the end user; if the latter, then emissions from power stations and refineries are allocated to the user of the electricity or fuel. End user figures tend to be about 10% higher than source figures.

Sustrans is a member of Stop Climate Chaos, a broad coalition of environmental, development, faith-based, women's and other organisations campaigning to stop human-induced climate change.  
**[www.stopclimatechaos.org](http://www.stopclimatechaos.org)**

## Further information

For further information on Sustrans, visit **[www.sustrans.org.uk](http://www.sustrans.org.uk)**