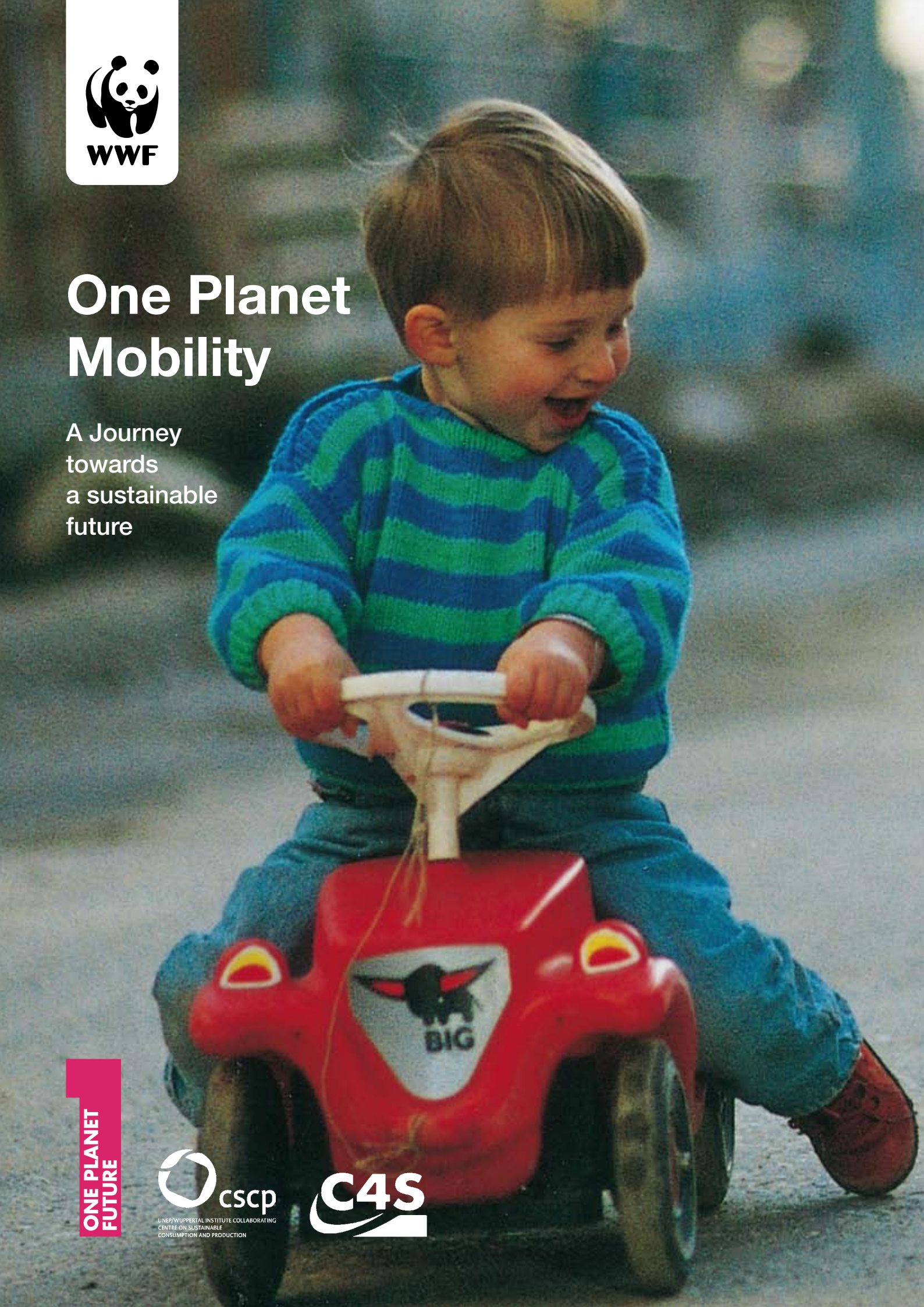


WWF

One Planet Mobility

A Journey towards a sustainable future

ONE PLANET FUTURE

cscp
UNEP/WUPPERTAL INSTITUTE COLLABORATING CENTRE ON SUSTAINABLE CONSUMPTION AND PRODUCTION

C4S

ONE PLANET FUTURE

If everyone in the world consumed natural resources and generated carbon dioxide at the rate we do in the UK, we would need three planets to support us. The impacts – which include climate change, deforestation and biodiversity loss – will affect us all and have potentially devastating consequences on both humans and the natural world. We have been born into a decisive period in human history. The choices we make today will make a world of difference to the people and species that will share this planet's resources tomorrow.

WWF has a vision for a One Planet Future – a world in which people and nature thrive within their fair share of the Earth's natural resources. Our One Planet Future campaign supports individuals and businesses in reducing their footprint, while pressing governments and industry to make the changes needed for us all to lead a one planet lifestyle.

Contents

Executive summary		05
Introduction		08
Chapter 1	The challenges of sustainable mobility	11
Section 1.1	The footprint of mobility	11
Section 1.2	Key drivers of mobility demand	19
Section 1.3	Major barriers to sustainable mobility	24
Section 1.4	The need for systemic change	30
Chapter 2	The One Planet Mobility approach: partnerships for change	33
Section 2.1	The One Planet Mobility philosophy	33
Section 2.2	Participants of One Planet Mobility	34
Section 2.3	A framework for change	34
Chapter 3	Leveraging sustainable mobility	37
Section 3.1	Key leverage points for sustainable mobility	37
Section 3.2	A step approach for change	38
	Action area 1 – Agreeing the evidence base	41
	Action area 2 – Tapping the efficiency potential of products	42
	Action area 3 – Internalising environmental and social costs	44
	Action area 4 – Adapting disruptive technologies	47
	Action area 5 – Enabling the use of low-carbon transport modes	49
	Action area 6 – Thinking about mobility as a means, not an end	51
	Action area 7 – A new mobility paradigm	54
Chapter 4	Multi-stakeholder innovation	57
4.1	Development of prototypes	57
	Prototype 1: GHG emissions comparison	58
	Prototype 2: Fleet renewal	59
	Prototype 3: Electric cars	61
	Prototype 4: Motorway-based coach system	62
	Prototype 5: Work-related travel	63
	Prototype 6: One Planet Mobility shopping	64
	Prototype 7: One Planet City Mobility	67
	Prototype 8: Slow holidays	69
4.2	Towards a One Planet Mobility Alliance	70
Conclusion		73
References		75

Front cover image kindly provided by Sigrid Gombert from the "Sustainable Urban District Freiburg-Vauban" project. In Vauban, children have reclaimed the streets. This is possible because around 40% of households have no car, and all other vehicles are parked in a communal car park at the edge of the district. For more information, visit www.carstensperling.de/english.html

Authors: Burcu Tunçer – CSCP and Michael Narberhaus – WWF

Contributors: Charlotte Brannigan – C4S, Holger Dalkmann – C4S and Tomoo Machiba – CSCP

Designed by: Coast Creative

Acknowledgements: The authors would particularly like to thank the following people: All the One Planet Mobility participants who brought the project to life; Charlotte Millar for her invaluable support and editorial skills throughout the creation of the report; Patrick Schröder for his flexible round-the-clock research support; Gary Kendall for his thorough review and advice; and Oliver Greenfield for providing the space for One Planet Mobility. Many thanks also to WWF colleagues and many others who have contributed their comments and input or helped to edit and design this report.

Executive Summary

Travel has become an indispensable aspect of our lives. Our level of personal mobility was unheard of just 50 years ago, and it has shaped the way in which we build our communities, where and how we work, and how we spend our leisure time. In Europe, people today travel more often and over longer distances than in the past – whether commuting between home to work or school, to shop or for holidays.

But the freedom of personal mobility has brought it onto a collision course with the finite limits of our planet. On a global scale, personal mobility is now responsible for 26% of carbon dioxide (CO_2) emissions. In Europe, mobility has the fastest growing energy demands of all sectors and is the only sector with consistently increasing emissions in most countries.

Alongside the environmental impacts, some of the benefits borne out of the mobility revolution have not always brought higher levels of wellbeing. The average commuter in the UK, for example, now spends 29 working days each year travelling to work, equating to more than five years over a working life. Local air pollution and increasing noise levels impact poorly on physical and mental health and the costs of maintaining one's mobility, from the price of filling up with petrol to the high infrastructure costs – all have a significant economic impact.

Set against the growing consensus that most European countries will have to reduce their carbon emissions by 80% and possibly more by 2050, it is clear that the challenge faced by the mobility sector is enormous and will require radically different solutions to "business as usual".

So far, these solutions have focused on incremental steps, such as efficiency improvements to vehicles. While this has been successful in relative terms, overall these efficiency gains have been outstripped by the growth in demand for mobility. Fully embracing the challenge, however, presents us with a unique opportunity to realise a new system of mobility in the 21st century – from achieving low carbon travel to improving human wellbeing within the context of a one planet future.

Transformational change is needed, but we need to overcome the barriers to such change. To help overcome these barriers, WWF created One Planet Mobility – a multi-stakeholder forum of key decision-makers and change agents from the personal mobility sector. Its task was to catalyse and inspire change within planetary limits.

During 2007 and early 2008, more than 30 European organisations from business, government and civil society came together in the first phase of One Planet Mobility. This was a unique process aimed at developing a deeper understanding of the barriers and leverage points for sustainable personal mobility. Most important, it set the framework for creating collaborative solutions across different stakeholders to work towards systemic change.

Over a series of six meetings, the following outcomes emerged.

1. **Identification of the barriers to systemic change.**

A common understanding of the current barriers to systemic change was established in the early stages of the work. Some key barriers identified in the project were:

- mobility prices should reflect their true cost, so that ecological and social costs are fully internalised;
- we need to invest in the development of long-term solutions and find ways to bypass our current political fixation on short-term outcomes;
- consumers need the right price incentives and market options to enable them to choose low-carbon options – on everything from how they travel to working closer to home.

2. **Development of a series of pilot and research projects**

Participants in One Planet Mobility collaborated in order to innovate sustainable solutions to overcome some of the barriers to change. For instance, a small coalition of partners are exploring collaboration on accelerating vehicle efficiency and the market breakthrough of disruptive technologies such as electric cars.

Other stakeholders are engaged in projects that are developing new business models intended to reduce the need to travel. This includes videoconferencing and setting up shopping facilities closer to people's homes.

3. Development of an alliance to address structural changes and market frameworks.

To facilitate this sustainable innovation, the creation of an alliance has been identified as a means for further collaboration outside the confines of what can be achieved within a market context. The proposed alliance has the potential to use the collective influence of stakeholder organisations to advocate changes to market frameworks – changes that are necessary to overcome the barriers to sustainable mobility, such as specific policies or price incentives.

Mobility, systems change and the One Planet Future

The work undertaken by One Planet Mobility is the first step in a longer journey aimed at intervening in a system to ultimately deliver transformational change. Through the One Planet Mobility process, participants have gained new insights into how systems change can occur and they will be building on this process within the mobility sector. The projects and alliances that emerged can be seen across three levels that range from short to long-term outcomes.

- **Ready to go:** These are actions that stakeholders agree can be realised in the short term. For our Mobility work, this includes developing an agreed framework to compare emissions from different modes of transport.
- **Experimenting with alternatives:** Stakeholders only roughly agree on the changes required. Experimentation and pilot projects are needed to test new ideas which could disrupt the system in the medium term. Examples have included a pilot project on the electrification of cars in a city context, and creating exclusive lanes for coaches on motorways.
- **Questioning paradigms:** Long-term systems change requires that we question mainstream beliefs and paradigms through informed deliberation. This could include thinking about the possibility of creating societal change, and business models that enhance quality of life while involving less and possibly slower travel.

One Planet Mobility clearly demonstrated that meaningful dialogues are critical to overcoming the differences in our assumptions and beliefs about the world's most pressing sustainability problems and to create meaningful actions to address them.

We have started a journey to systemic change.
We invite other leading organisations to join us.

Introduction

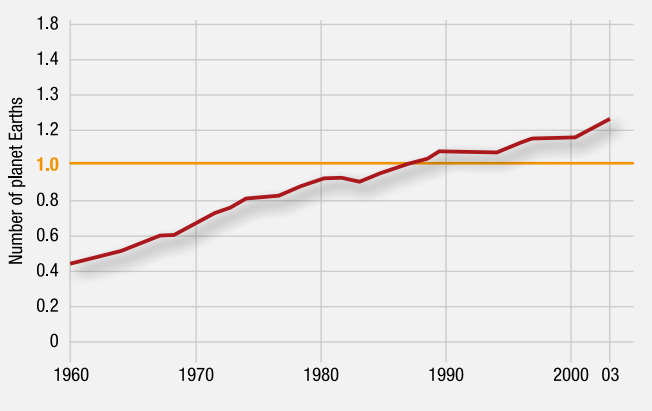
Since the beginning of the Industrial Revolution humanity has created an unprecedented amount of prosperity and material wealth. However, the generation of this wealth has been accompanied by unsustainable levels of resource depletion and environmental degradation.

Trends over past decades have dramatically accelerated resource use and greenhouse gas (GHG) emissions on a global scale. These trends include the globalisation of economy and trade, urbanisation, population growth and new technology. The most imminent threat we face as a result of these trends is climate change and its associated impacts – sea level rise, extreme weather events, permafrost melting, species extinction and increased flooding and droughts[1]. As a consequence, the overall trend of increasing unsustainable consumption is becoming a key challenge for the 21st century[2]. In order to ensure a sustainable future and secure livelihoods for coming generations, radical changes of today's consumption patterns are required[3].

Ecological overshoot

According to ecological footprint analysis (a tool that measures natural resource consumption and environmental impacts) we are already using 25% more of the Earth's resources than it can renewably generate[5] (see Figure 1). If everyone on Earth lived like the average person in western Europe, three planets would be needed to support the global population[6]. Therefore, the biggest changes in working towards sustainable consumption need to be led by industrialised countries. To avoid the most damaging impacts of climate change and to leave ecological space for developing countries, industrialised countries would need to reduce their CO_2 emissions by 80% by 2050[7]. Timing is also a critical factor. A delay of 20 years would require rates of emission reduction three to seven times greater to meet the same temperature target[8].

Figure 1: World Ecological Footprint



Source: WWF Living Planet Report 2006[4]

The consequences for society and businesses are severe: they cannot function and will collapse if ecosystem services* are out of balance or severely degraded. Increasing resource scarcity puts tremendous pressure on supply chains. It is crucial that industries and businesses do not ignore the imperatives of our resource and carbon-constrained planet, not only because our world is precious but also simply for business reasons: if they do not change, they will be forced out of the market[9].

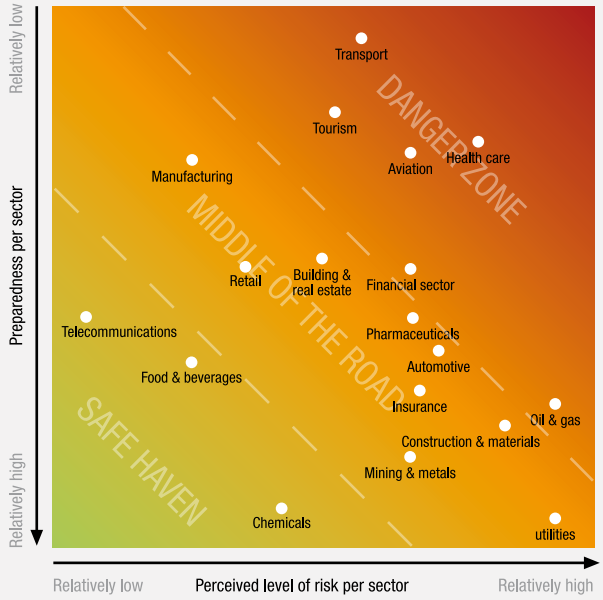
*Ecosystem services are the fundamental ecological services required to fulfil the basic needs of humanity (Millennium Ecosystem Assessment, 2005).[10]

The scale of the challenge for business

Transport businesses from the automotive, aviation and tourism sectors are considered to be exposed to a high level of risk from environmental threats such as climate change. According to KPMG's recent publication Climate Changes Your Business (2008)[12], the transport sector risks one of the highest financial burdens from governments' likely policy interventions on climate change. Extreme weather events due to a changing climate are another risk factor to be taken into account by transport businesses. These risks tend to be generally underestimated and most companies are not well prepared (see Figure 2).

In order to reduce these risks, businesses, governments and society need to look at the big picture and recognise the deficiencies of the current system[13]. This may result in questioning the current economic and political rules of the game, such as the omission of environmental and social externalities in prices and the devaluation of the wellbeing of future generations. The new resource and emissions-constrained world will bring disruptive change and immense innovation opportunities for business.

Figure 2: Perceived climate change risks versus preparedness



Source: KPMG 2008[11]

One Planet Mobility (OPM)

WWF's One Planet Mobility programme was formed to allow business, government and civil society to look at this big picture and take a systemic approach towards sustainable personal mobility. It recognises that transformational change of the current market into one that rewards sustainability cannot be achieved by a single actor alone. To overcome the inertia of the system and technological and institutional lock-in, collaboration is required between a wide range of stakeholders.

The aim of the OPM programme is to facilitate exactly this kind of multi-stakeholder forum and to identify the most effective leverage points* for transformational change.

The scope of One Planet Mobility

As pointed out in WWF's One Planet Business report, three demand areas stand out as having a major impact on the environment and climate change. These are mobility, food and housing, which together globally account for 70-80% of life cycle impacts and cause 70% of climate change[14].

The transport sector risks one of the highest financial burdens from governments' likely policy interventions on climate change.

The first focus area for WWF is personal mobility. This covers all passenger transport (by car, train, bus, plane, bicycle and on foot) and excludes freight transport. This is principally because freight transport is driven by a set of different underlying issues and would require the involvement of a whole range of additional and different actors to create solutions.

OPM has an initial focus on Europe. The European Union has a pressing responsibility to face the challenge of reducing its carbon emissions by around 80% by 2050[15]. Moreover, having taken the leadership in climate change mitigation, Europe now has the highest potential for transformational change.

This was articulated by the Chancellor of Germany, Angela Merkel, who told the UN General Assembly, "We have a clear guiding principle: the principle of common but differentiated responsibility. Industrialised countries must embrace ambitious absolute reduction targets... all industrialised countries will have to drastically reduce their per-capita emissions"[16].

* Leverage point: "small shift in one thing can produce big changes in everything" (Donella Meadows, 1999: "Twelve leverage points to intervene in a system")[17]

Aim of this report

This report takes a systemic approach to understanding the impacts, trends and drivers of personal mobility. Drawing on this understanding, it presents an innovative step-by-step framework for system-wide change towards sustainable personal mobility. It concludes by describing the alternative practical project ideas that resulted from One Planet Mobility on tackling unsustainable mobility patterns.

The report is intended for a wide range of decision-makers from business, government and civil society who work with transport-related issues.

Chapter 1: The challenges of sustainable mobility: outlines the global and European trends of passenger transport and the key underlying drivers of these trends.

Chapter 2: OPM approach: partnerships for change: explains the process of engagement of stakeholders from the transport sector and key decision-makers.

Chapter 3: The step approach for change: describes a series of key leverage points identified in the OPM project and sets out an innovative framework for action.

Chapter 4: Multi-stakeholder innovation: explains the collaborative solutions (prototypes) that stakeholders have developed throughout the OPM process. It also sets out the potential for an alliance of stakeholder organisations to develop into a system change network.

Chapter 1 The challenges of sustainable mobility

The transport sector is making significant contributions to economies and societies throughout the world. Transport is necessary to access services, go to work and enjoy a lifestyle that was unimaginable a century ago.

The flipside of this lifestyle is the enormous ecological burden it has caused.

This chapter examines the causes of increasing environmental impact from mobility and the reasons why the demand for transport is greater than all the positive effects of solutions that have been attempted to tackle the problem so far. Figure 3 outlines the systemic approach used in this report.

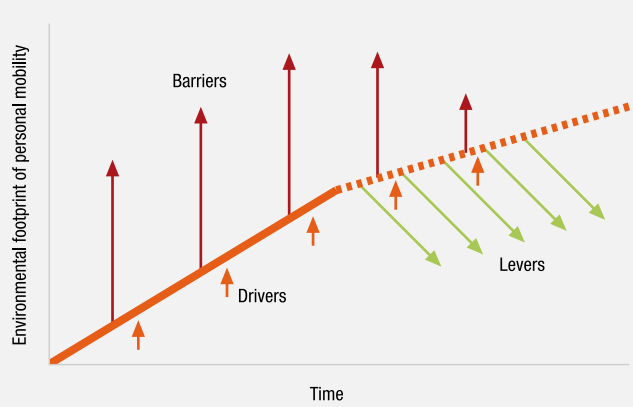
Section 1.1 The footprint of mobility

Global impact of mobility

One Planet Business figures show that personal mobility is responsible for 26% of the total global CO_2 emissions caused by human activity (see Figure 4), the second highest of all areas of consumption.

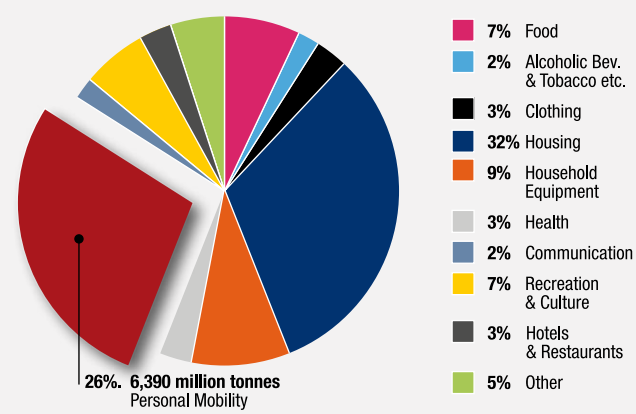
It is clear from this data that the personal mobility sector must radically reduce its own impact in order to meet global targets on GHG emissions reductions[19].

Figure 3: Dynamics behind the increasing environmental footprint of personal mobility



A series of driving forces are responsible for the upward trend of the mobility footprint. Attempts to stop this trend have been unsuccessful so far because they have hit against strong barriers for change. To reverse these trends, it is necessary first to understand the system at a deep level and from there to identify the key leverage points for long-lasting, systemic change.

Figure 4: Global CO_2 emissions of personal mobility

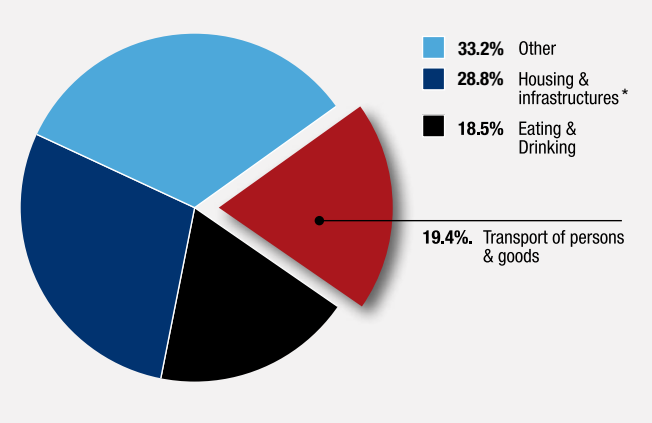


Source: One Planet Business Global Evidence Base, 2006[18]

Footprint of mobility in Europe

In Europe, the picture is similar to the global trend. Transport is the EU's sector with the largest demand for energy, using 31% of total final energy consumption[21]. It is also the sector with the fastest growing demand for energy, which has increased by 29% between 1990 and 2004[22].

Figure 5: Impact of the transport sector compared to other sectors in the EU (in CO_2 equivalent)



Source: EEA 2008d[20]

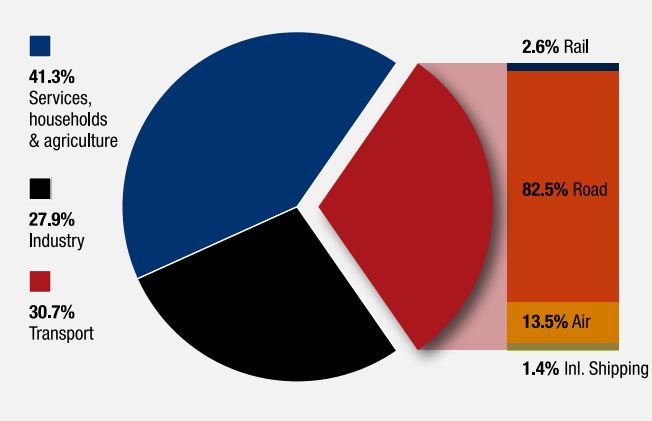
* Including - electrical energy, gas, steam and hot water

As shown in Figure 5, transport has a global warming potential (measured in carbon dioxide equivalents) of about 20% among all other sectors[23], making it the second biggest emitter of GHG emissions after housing and construction.

Footprint of transport modes

A closer look at the different transport modes and their individual share of GHG emissions shows that the car has the biggest impact. All studies consistently indicate that the car is the main contributor to environmental damage caused by personal mobility (see Figure 6). Road transport accounts for about four fifths of the transport-related GHG emissions. This is despite major improvements in recent years in its environmental performance, particularly in reducing its air emissions[24].

Figure 6: Impact share of transport modes in final energy consumption, EU-25* (% million tonnes of oil equivalent – mio toe)



Source: Eurostat, 2007a[26]

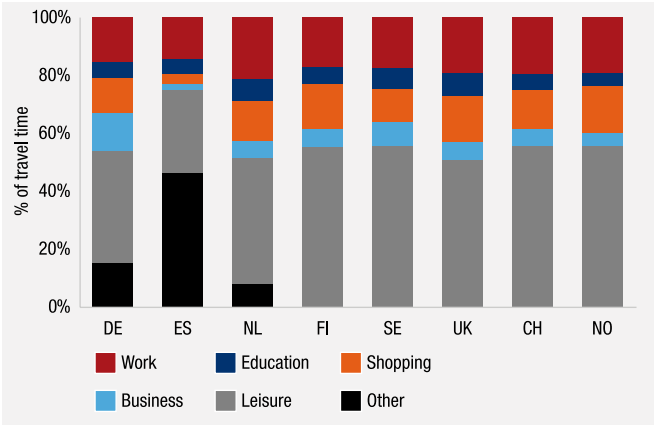
Air travel has the second largest transport impact in Europe. It accounts for 13.5 % of the total energy use of transport in the EU-15** excluding international air travel (Figure 6)[25]. Compared with road transport, aviation's energy use is still relatively small. The relevance of air travel as a focus area for sustainable mobility is largely related to its current growth rates, as discussed below.

* EU-25 refers to the 25 countries in the European Union after the expansion on 1 May 2004
** EU-15 refers to the 15 countries in the European Union before the expansion on 1 May 2004

Travel purposes

Understanding the reasons why people travel and how this relates to the growing impact of mobility is key in identifying and prioritising solution areas. European data shows that most demand for mobility stems from three reasons for travel: leisure, work and shopping. Figure 7 shows that the main reason for travel in most countries is leisure. Work-related travel (for countries with data) is the second most important reason for mobility, followed by shopping which makes up about 20% of the travel time[27].

Figure 7: Reasons for travel in percentage of travel time for selected European countries



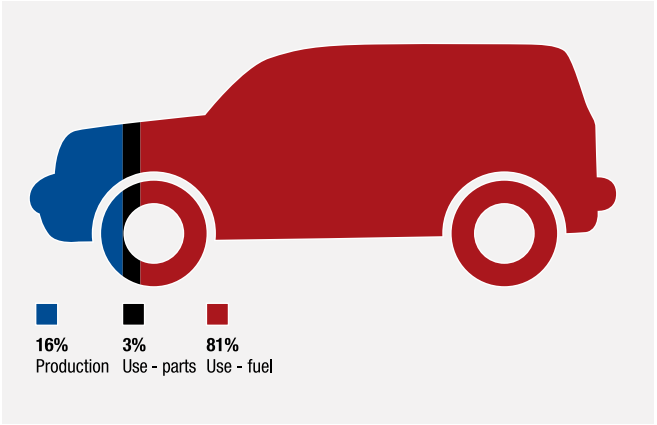
Source: Eurostat, 2007b[28]

Impact throughout the 'life cycle'

Another important perspective of the mobility footprint is revealed by the "life cycle assessment"*.

While discussion in the transport industry has often focused on improving the environmental performance of manufacturing processes, the life cycle assessment of a car suggests that reducing the impact caused by the use of cars is a much more important task. As shown in Figure 8, more than 80% of the car's total life cycle impact is generated while it is being used and driven, rather than during its production.

Figure 8: CO_2 emissions over the life cycle of an average vehicle



Source: One Planet Business Global Evidence Base, 2006[29]

Indirect environmental impacts from personal mobility

While the life cycle assessment is one of the most sophisticated tools used to gauge the impact from transport, it may not tell the whole truth about the impact caused by mobility. The life cycle perspective includes impacts stemming from vehicle production, the use and production of fuel and generally also from the disposal of the vehicle. What is often not being assessed here is the indirect environmental impact related to the use of infrastructure (also referred to as systemic effects)[30] (See Figure 9).

For example, transport infrastructure has to be built and maintained, and once the demand for transport reaches levels that exceed the capacity of the infrastructure (e.g. leading to congestion), it is usually expanded. Asphalt and concrete roads, rail track and new airports are energy and CO_2 intensive constructions.

While calculations of the impact from infrastructure are complex and data often not available, some of the few existing studies show astonishing results. In a study on rail and air travel using Japanese data, the indirect systemic effects from infrastructure emissions were between 100% (rail) and 300% (air travel) higher per passenger kilometre (pkm) than the direct emissions from fuel/electricity use[31]. A separate study[32] showed that infrastructure needed for the transport system can generate 90% of its total natural resource use.

In a study on rail and air travel the indirect effects from infrastructure emissions were between 100% (rail) and 300% (air travel) higher per passenger kilometre than the direct emissions from fuel/electricity use.

* Life Cycle Assessment refers to the compilation and evaluation of the inputs, outputs and potential environmental impacts of a product throughout its life, from resource extraction to its disposal.

Box 1: Hyper-mobility comes at a cost

- Public space is taken away by cars and other means of transport. Transport-related infrastructure such as roads, car parks, even metro and train stations, consume a lot of space that could be used for playgrounds, parks or recreation areas.

- Community relationships can get poorer because of car usage and little space for walking along the street. While car mobility enables people to maintain social networks not confined by spatial restraints, a consequence for local neighbourhoods can be that they become anonymous and lack trust. This can lead to public spaces being perceived as unsafe and even hostile, which impedes civic life.

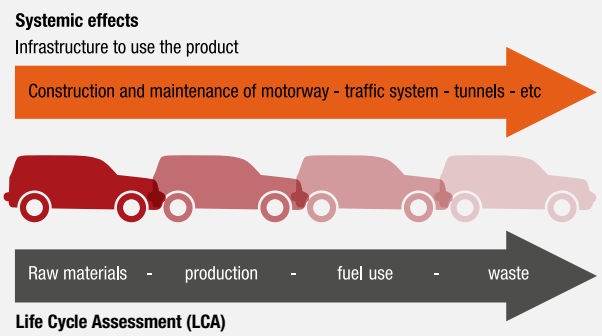
- The danger of traffic poses problems for outdoor play for children, who may not be allowed to go out of the house independently. Being increasingly confined to indoors and depending on adults for mobility, more and more children are becoming overweight at an early age.

Source: Adams, 2005[35]

A clear understanding of the systemic impacts of mobility can improve decision-making for sustainable mobility. Especially in emerging countries, where demand is growing fast and decisions about new roads are taken every day, this can be vital.

Another area of systemic effects of personal mobility is the environmental impact stemming from the construction and operation of hotels, which are used when mobility patterns require overnight stays in the travel destination. While this is an area that traditionally hasn't been included in calculations on the impact of mobility, assessing this impact would help draw a more truthful picture of the impact of mobility and to understand which steps have to be taken to achieve sustainable mobility.

Figure 9: Life Cycle Assessment does often not include systemic effects



Social impacts from personal mobility

The individual desire for more mobility seems insatiable. If people were asked if they wanted to have the mobility lifestyle of Microsoft magnate Bill Gates – private jet included – most people would answer "yes"[33].

These high levels of mobility do not only have severe ecological consequences, but also cause negative social impacts. There is a level of hyper-mobility[34] at which the positive individual aspects are outstripped by the negative sides of it, suffered by the society as a whole (see Hyper-mobility comes at a cost Box 1 opposite).

A mobility-intensive life comes at a cost to society, one of the most obvious being the increasing amount of time wasted in traffic jams or at airports. Other costs include social and geographical dislocation due to the loss of a feeling of community and the sense that you live in a particular place. This leads to community disintegration and less time to spend with family and friends. Local air pollution, increasing noise levels and negative aesthetics of transport infrastructure such as roads also impact poorly on physical and mental health.

The social costs of ever-increasing mobility are outweighing the benefits. The most mobile nations are not necessarily those with the highest levels of wellbeing. Despite increasing GDP and geographical mobility, the "Happiness Index" for industrialised countries does not rise accordingly (see Box 2).

Box 2: More travel, but not more quality of life

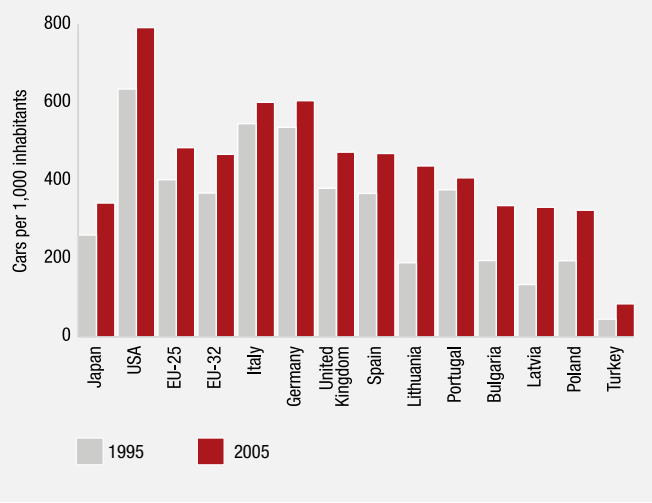
In western Europe investment in inland infrastructure continues to increase – recently by as much as 20% between 2000 and 2004, particularly in Ireland, Sweden and Spain[36]. However, quality of life in European countries has remained more or less constant since the 1960s – while carbon footprints have risen by as much as 75%[37].

The trend is growth

As a consequence of the growth in demand, GHG emissions in the European passenger transport sector continue to increase steadily.

The total number of cars per capita in Europe increased substantially and more rapidly than economic activity in recent years. Private car ownership has increased steadily with rising incomes and growth in GDP, while average occupancy rates of cars have been declining. In the EU-10* countries, car ownership doubled between 1990 and 2003[38]. The largest growth was observed in the new EU member states and Turkey – with Lithuania topping the growth charts, up from 198 cars per 1,000 inhabitants in 1995 to 428 in 2005[39] (see Figure 10). As a consequence, transport GHG emissions have risen steeply in many countries.

Figure 10: Car ownership is increasing in Europe



Source: EEA, 2008a[40]

Air passenger travel is growing at an even faster pace. Travel distances and frequency are rapidly increasing both for business and leisure. The total growth rate in the EU between 1995 and 2004 was 49% (EU 25)[41] while a further growth rate of 20% is expected until 2010[42]. Due to the exclusion of emissions from international air travel in the Kyoto Protocol, aviation is often dismissed as an insignificant contributor to climate impacts. However, recent estimates show that due to the rate of growth in flights, absolute emissions from aviation are growing faster than from other transport modes: 96% between 1990 and 2005[43]. This is despite the fact that as a result of engine and airframe improvements, relative fuel efficiency per seat in today's new aircraft has considerably improved over the last decades[44].

Conversely, travel by bus and rail is increasing at a much slower rate than car and air travel and has even receded in some countries[45].

Past attempts to change

Increasing fuel efficiency of new vehicles

From 1990 to 2005 car ownership has doubled in the EU-10 countries and in the same time period, European emissions from aviation have increased by 96%.

Improving the energy efficiency of vehicles, and reducing the CO_2 emissions tied to the production and distribution of fuel, are the two main strategies used in the past to reduce GHG emissions from road transport[46].

A well-known example of the efforts to improve the fuel efficiency of cars is the voluntary commitment made by the European Automobile Manufacturers Association (ACEA) to reduce the average emissions of new cars to 140g CO_2 per km by 2008-09. At present it seems highly unlikely that industry will meet this target, considering that the reduction achieved was only 1g CO_2 per km: from 161g CO_2 per km in 2006 to 160g CO_2 per km in 2004[47]. As a result, the European Commission is now trying to set binding targets for CO_2 emission limits for new cars.

Manufacturers have a long history of applying technical innovation to improve the energy efficiency of their vehicles. In fact, the average efficiency improvement of new cars would have been much higher had these advances not been outweighed by the steadily increasing power and speed, as well as by the addition of comfort and safety-improving devices[48]. As a consequence, the weight and energy consumption of vehicles has actually increased, rather than decreased (see Box 3).

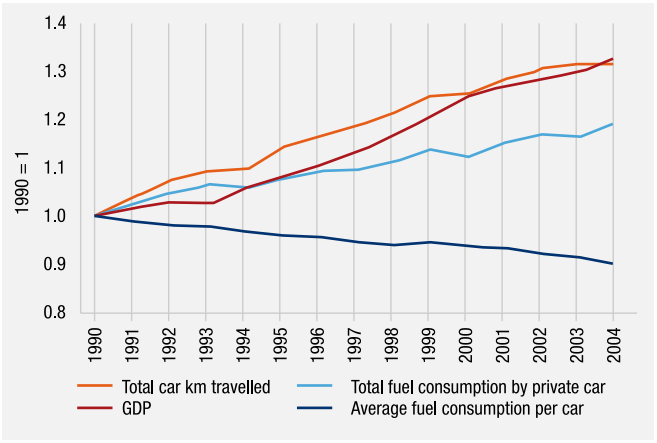
* EU-10 nations are Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

Box 3: Efficiency gains being outweighed by increasing weight of vehicles – the example of Volkswagen Golf

The Volkswagen Golf has been one of the top selling cars in Europe for many years and is a reference point for trends in the market. Since its introduction in 1974 the model has gone through many technological changes that represent general developments of the car industry: fuel consumption was reduced by only 6% from 7 litres/100km in 1974 to 6.6 litres/100km in 2003. This is small due to weight increases from 780kg in 1974 to 1,174 kg in 2003 – an increase of 50% since 1974[49].

Other means to encourage the purchase of new, more fuel-efficient vehicles such as car labelling have so far not induced large-scale changes[50]. Throughout Europe consumers still show a strong preference for larger and less fuel-efficient cars[51]. The GHG emissions reductions achieved by new low-emission cars are being outweighed by the increased distances travelled.

Figure 11: Growth in private car travel versus fuel efficiency (EU-15)



Source: Enerdata, 2006[52]

Demand outpacing efficiency

Evidence shows that the total amount of kilometres travelled by car in Europe has been increasing at a similar rate to GDP growth. Despite improved fuel efficiency, total fuel consumption continues to rise (see Figure 11).

In the past, actions to tackle the environmental footprint from mobility have mainly focused on efficiency improvements and have not tried to tackle the growing demand for mobility. Rather than fundamentally tackling the actual problem, research shows that improving energy efficiency makes travel cheaper and can often increase the absolute demand for mobility. This phenomenon can be described as the rebound effect (see Box 4). This leads to the conclusion that absolute reductions in resource use and waste (including emissions) from transport cannot be achieved by technological efficiency improvements alone.

Box 4: The rebound effect

The rebound effect is defined as loss of potential efficiency gains. The increase in overall consumption, which limits the potential reduction directly and indirectly, can be caused partly by an increase in the use of goods due to their higher efficiency[53]. For example, in the area of transport, the number of vehicle miles travelled will increase by 10-30% as a result of improvement in fuel efficiency. For private transport in Europe the rebound is estimated at 30-50%[54].

Rather than fundamentally tackling the actual problem, research shows that improving energy efficiency makes travel cheaper and can often increase the absolute demand for mobility.

Biofuels – more harm than good?

Biofuels were once touted by political leaders all over Europe as a major solution in tackling the GHG emissions caused by transport (as well as being a potential solution to the security of energy supply). This is illustrated by the European Commission's proposed target for 2020 for 10% of all energy used in transport to come from renewable sources[55]. It is expected that most of this target will come from biofuels. But since the proposal was made, many scientists and development and conservation groups now regard biofuels with scepticism.

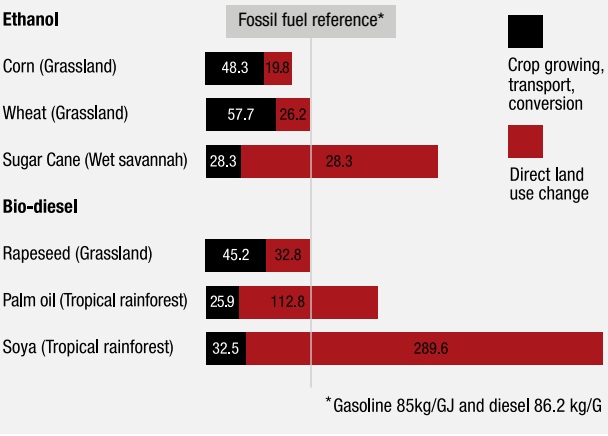
The demand for land and resources to produce biofuels competes with demands to grow food, which can result in rising food prices. The UK government's Chief Scientific Adviser, Professor John Beddington, recently warned, "The rush towards biofuels is threatening world food production and the lives of billions of people". This has already started to happen – witness, for example, the 400% increase in corn prices in Mexico, where the cereal is a staple food for the country's poor.

There are two main arguments for this: one is that the demand for land and resources to produce biofuels competes with demands to grow food, which can result in rising food prices. The UK government's Chief Scientific Adviser, Professor John Beddington, recently warned, "The rush towards biofuels is threatening world food production and the lives of billions of people"[56]. This has already started to happen – witness, for example, the 400% increase in corn prices in Mexico, where the cereal is a staple food for the country's poor[57]. Although it is still unclear to what extent current production levels of biofuels are already contributing to the rise of global food prices, examples such as the Mexican "tortilla crisis" suggest a real linkage[58].

The second argument is that the actual GHG emissions savings from biofuels currently used vary hugely and most policies that support or mandate their use do not ensure best performance. As Figure 12 illustrates, many biofuels have worse GHG balances than fossil fuels if associated land use changes are taken into account.

The current debate shows that biofuels can play a role in future sustainable transport solutions, but only if the sustainability of their production is assured – with tough and mandatory standards for GHG balance and wider environmental and social impacts, and only if indirect negative impacts on the environment and poverty are prevented. If biofuels are to play a more significant role in climate change mitigation, technologies need to be developed that allow them to be produced with substantial GHG savings and without drawing excessively on natural resources. The development of second-generation biofuels – for example those from biomass waste products such as crop residues, municipal waste or algae from sewage ponds – may offer some of these technologies.

Figure 12: GHG emissions of selected biofuels for the whole life cycle including direct land use changes, in kg CO_2 equivalent/GJ biofuel



Source: Source: Friedrich-Ebert-Stiftung 2008[59]

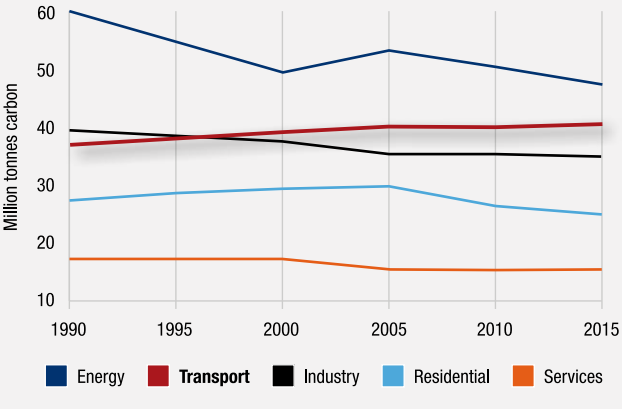
Section 1.2 Key drivers of mobility demand

Focus on absolute reductions

While relative indicators such as fuel consumption per passenger kilometre might be stable or even declining, what really matters is the level of absolute impact, which is still growing. In the context of the growing consensus that most European countries will have to reduce their carbon emissions by around 80% by 2050, this creates an enormous challenge for transport and certainly requires some radically different solution approaches.

Since 1990, all other sectors in Europe (industry, energy, services and households) have to some extent reduced CO_2 emissions. The only sector that in most European countries still makes a consistently growing contribution to climate change is transport (see Figure 13 for the UK). In Europe, transport CO_2 emissions have been rising rapidly in recent years, growing from 21% to 28% of total European CO_2 emissions between 1990 and 2004[61].

Figure 13: In the UK, transport is the only sector of the economy where CO_2 emissions continue to rise



Source: DTI Energy White Paper, 2007[60]

Box 5: Selected drivers of mobility demand

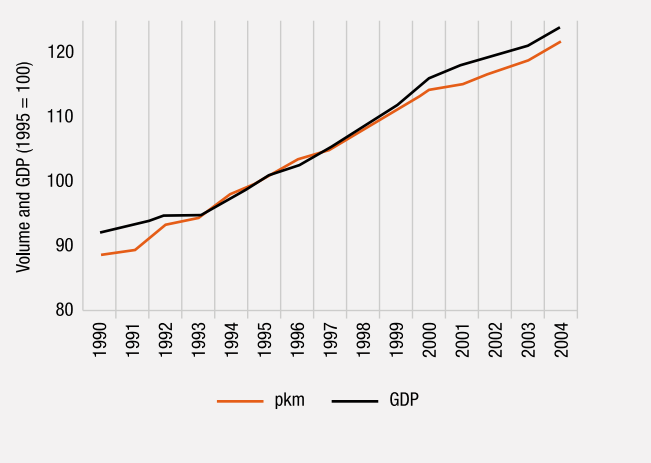
- Increasing level of income
- Increasing speed of travel
- Integrated transport as a stand-alone solution
- Decreasing cost of travel
- Urban sprawl
- Shrinking household size
- Globalisation

Such data adds to the evidence that passenger transport (as well as freight transport) is an area that requires special attention. A much better understanding of the underlying issues driving the demand for mobility is urgently required if a meaningful debate on solutions is to take place. Some of the most significant drivers are summarised in Box 5 and discussed below.

Increasing level of income

The increase in GDP is closely linked to the growing demand for mobility. Rising incomes are a main driver for car ownership. Whereas in western Europe ownership has reached a level of relative saturation, in eastern Europe it is expected to grow as incomes rise, and will lead to further absolute increases of the mobility footprint.

Figure 14: The growth in passenger transport closely follows GDP growth



Source: EEA, 2007[62]

While the growth in passenger transport kilometres since the mid-1990s has been slower than the growth in GDP, an absolute decoupling has not yet been achieved (see Figure 14).

Increasing speed of travel

There is historical global evidence to suggest that on average, people spend more than an hour a day travelling despite widely differing transport infrastructure, geography, culture and per capita income levels[63]. As technology allows us to travel faster, so the distance we travel increases. For our holidays our "travel time budget" allows us to visit remote and exotic places – in many cases several times a year. Hence the volume of international air travel is increasing rapidly. The global tourism industry is expected to see 1.6 billion international tourists by the year 2020, of which many will be travelling by plane[64]. This trend is also played out in our commuting travel. Faster modes of travel, such as high speed rail, enable us to work and live in distant locations, making long-distance commuting more and more commonplace.

The evidence suggests that by investing in faster travel options, the demand for travel increases (the so-called induced demand). This link seems insufficiently acknowledged when investment decisions are being taken about new and faster transport capacities. In fact, increasing the speed of public transport products and services is often perceived by public policy-makers as a guaranteed solution for environmental problems.

The example in Box 6 illustrates convincingly that as high-speed train connections between major cities become available, commuting distances, and the associated environmental impacts, increase.

Box 6: Understanding the consequences of high-speed rail

Even though originally intended for long-distance point-to-point connection between large cities[65], and as an alternative to car and air travel, recent developments show that high-speed rail increases suburban daily commuting. For example, on the Cologne-Rhein/Main connection, up to 95% of passengers surveyed were commuters[66].

The knock-on effects of this development include population movements from high-density urban centres into smaller towns and rural areas[67]. While this trend might be welcomed by many local communities as it contributes to their economic development, indirect systemic impacts include increased use of cars for local transport, growth of park and ride infrastructure, and higher impact through suburban housing developments.

In addition, direct emissions increase with speed. For example, the energy use and emissions per seat kilometre of a 200 km/h fast intercity train can be more than 50% higher in comparison to a conventional 140 km/h fast intercity train[68]. And if electricity for high-speed trains is generated from fossil fuels, travel by high-speed rail over a 600km sector can be as environmentally unfriendly as air travel[69].

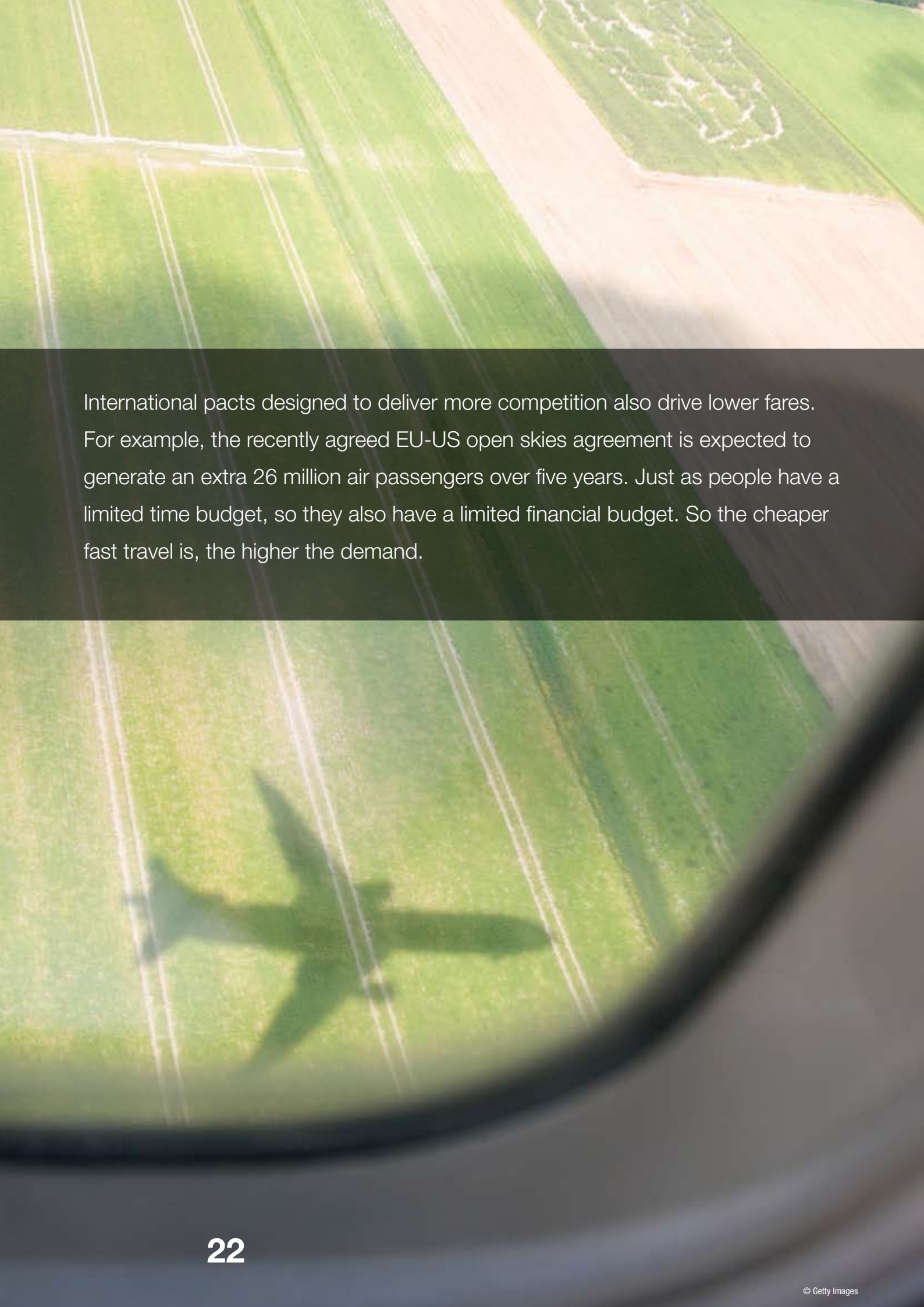
Of course travel speed is not the only driver for this trend. High house prices in urban areas and the need to adapt to the job market are only two other factors that influence these decisions. Nevertheless, the mere existence of faster travel options adds a former latent demand to the ever-growing problem of a hyper-mobile society.

Integrated transport as a stand-alone solution

Integrating different types of low-carbon transport, such as local buses, light rail, long-distance trains and cycling, to achieve wide coverage and a higher frequency of service can be an effective means to provide attractive low-carbon alternatives to car travel. But without the positive accompanying effect of other policies, it can induce demand for more mobility. It can, for example, indirectly contribute to suburban sprawl developments with population movements from high-density urban centres into smaller towns and rural areas. While integrated transport is highly rated as a solution for sustainable transport due to its advantages over cars, what's often not taken into account is that public transport can have considerable environmental impacts – for example inner city diesel buses[70] and infrastructure for high-speed trains (see Box 6).

As high-speed train connections between major cities become available, commuting distances, and the associated environmental impacts, increase.

So the integration of low-carbon transport alone does not necessarily have a positive effect on absolute emission levels. As a stand-alone solution, it is improving (and thereby in effect enhancing) the absolute capacity of transport infrastructure. This can lead to induced demand. Only if a modal shift from high-carbon to low-carbon transport solutions is assured (for example from a diesel car to local bus) without creating additional mobility, can systemic negative effects be avoided.



International pacts designed to deliver more competition also drive lower fares. For example, the recently agreed EU-US open skies agreement is expected to generate an extra 26 million air passengers over five years. Just as people have a limited time budget, so they also have a limited financial budget. So the cheaper fast travel is, the higher the demand.

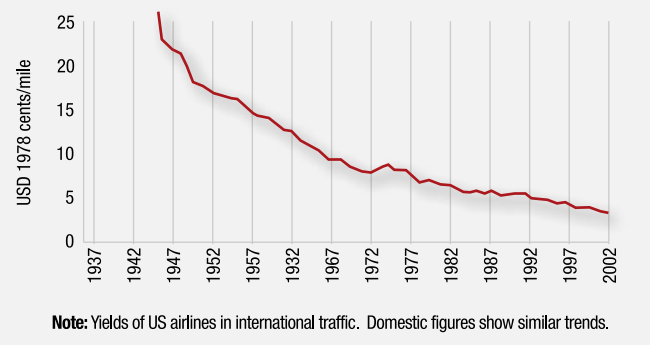
Decreasing cost of travel

The decreasing cost of travel is another underlying factor that increases the distances people travel. Compared with other modes, air travel is becoming more and more accessible due to its falling prices. As a result, new consumer habits are being created, such as short city breaks and second holiday residences in southern Europe.

The highly competitive prices of the low-cost carriers is a very important contributor from the supply side to the increase in personal travel[72]. In fact, the tendency towards lower prices is not new, but rather a continuation of a development since the beginning of commercial aviation (see Figure 15).

International pacts designed to deliver more competition also drive lower fares. For example, the recently agreed EU-US open skies agreement is expected to generate an extra 26 million air passengers over five years[73].

Figure 15: Rapid decrease in international flight prices



Note: Yields of US airlines in international traffic. Domestic figures show similar trends.

Source: EEA, 2005[71]

Just as people have a limited time budget, so they also have a limited financial budget. So the cheaper fast travel is, the higher the demand.

Efficiency measures are certainly a positive step, but they are far from solving the underlying problem of demand driven by both price and speed. As long as air travel is faster and cheaper than other modes, it will drive the demand for travel.

Urban sprawl

Poor spatial planning and urban sprawl are also increasing the demand for mobility. The expansion of the city into rural areas through the construction of new residential areas for the middle classes, accompanied by developments of out-of-town shopping malls and recreation centres, is generating demand for longer and more frequent travel.

Over the past 20 years, built-up areas have increased by 20%, while the population increased by only 6%[74]. Urban sprawl has indirectly been fuelled by EU cohesion and structural funds, which support infrastructure developments, resulting in improved transport links and increased personal mobility.

Furthermore, sprawling cities demand more energy supply, require more transport infrastructure and consume larger amounts of land. This damages the natural environment and increases GHG emissions[75].

Section 1.3 Major barriers to sustainable mobility

This section discusses some of the key barriers for transformational change towards sustainable personal mobility.

Box 7: Selected finance barriers

- The full external environmental/social/economic costs are not accounted for.
- Investors often demand a short-term return on investment (ROI), while the ROI of sustainable transport solutions is generally more long-term.
- Transport initiatives often require high upfront costs.
- Sustainable transport investments are often high-risk.

Markets do not reflect mobility's true cost

Market prices do not mirror the true cost of travel. As long as markets do not transparently reflect the actual social and ecological costs of different modes of transport, transformational change in personal will only be a remote possibility.

This means that decisions about travel and consumption are based on the "wrong prices" and mobility demand exceeds the ecological capacity of the planet. For example, in the case of flying, the cost of land-use impact, CO_2 emissions and noise pollution are not part of consumer decision-making at all when buying flight tickets.

Furthermore, because investors favour short-term returns, sustainable transport initiatives can seldom locate funding opportunities (see Box 7). Many schemes aimed at "soft" modes (such as cycling and walking) tend to have low cost/benefit ratios with key benefits often being related to human health, physical fitness and social wellbeing issues which are difficult to quantify. Finance is therefore often the key barrier to implementing such schemes, despite the fact that they are key contributors to integrated sustainable transport strategies[76].

Consumers are 'locked in'

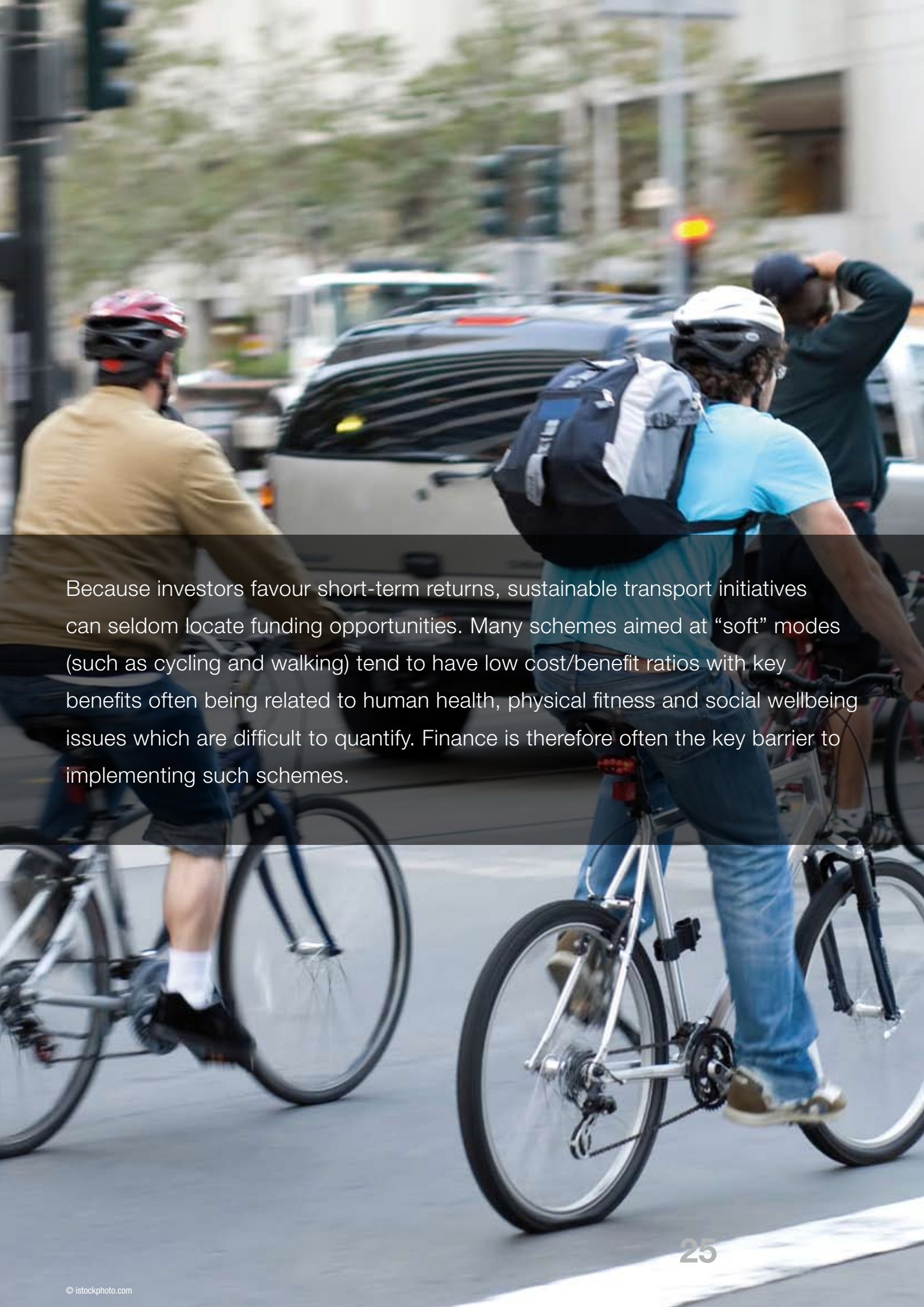
Most people are willing to consume in a sustainable manner. However, evidence suggests that they often find themselves with little choice but to continue with consumption patterns that are inherently unsustainable[77].

Box 8: Selected consumer barriers

- Low travel costs and marketing aimed at increasing mobility.
- Lack of appropriate behavioural change incentives (taxes, etc).
- Consumers locked into unsustainable choices through available infrastructure, urban planning decisions, etc.
- Demographic and labour market changes.

The situation applies very much to the consumption of mobility and the decisions on how to travel to shops and work places, and on where and how to travel to holiday destinations. Where no public transport is available, the car is often the only choice. As more and more shops are located outside our towns, car use for shopping purposes inevitably increases. Even if people are eager to choose a low-carbon transport mode, they are stuck with high-impact choices (see Box 8).

On a deeper level, sustainable choices do not always resonate with people's deeply held aspirations. Consumption is a primary way of expressing our status and identity and consumers are very conscious of how their purchases look to others. For many, cars represent a personal symbol of status and identity. These forces operating at the very core of consumer behaviour constitute a huge challenge to addressing the car culture[78].



Because investors favour short-term returns, sustainable transport initiatives can seldom locate funding opportunities. Many schemes aimed at “soft” modes (such as cycling and walking) tend to have low cost/benefit ratios with key benefits often being related to human health, physical fitness and social wellbeing issues which are difficult to quantify. Finance is therefore often the key barrier to implementing such schemes.

Therefore government policies that solely focus on information campaigns to educate the public about the environmental impacts of car travel, or information campaigns to encourage modal shift, haven't had the success that is needed. "In a world of information overload, it is not more information campaigns or leaflets that are needed"[79].

"Policies that seek to promote pro-environmental behavioural change will need to engage as much with the social context that shapes and constrains social action as it will with mechanisms of individual choice" – Tim Jackson, University of Surrey[80]

Governments failing to integrate 'footprint'

In general, policy-making on transport infrastructure takes a "predict and provide" approach, which sets out to predict what the future transport demand will be and provide the infrastructural capacity to satisfy it. Studies have shown that in the longer term (over three years), between 50% and 100% of additional road capacity is subsequently filled with induced traffic[81] (see Box 9).

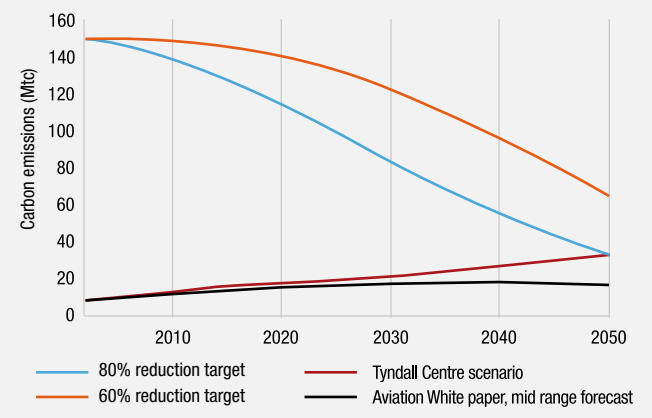
Box 9: Selected infrastructure barriers

- Long legacy of transport infrastructure causes unsustainable lock-in.
- Lack of cross-border coordination, which may make any proposed changes costly.
- Improvement and expansion of infrastructure, potentially increasing further demand (induced traffic).
- Urban planning (shopping centres, urban sprawl).

This trend is also played out in the aviation sector. The UK government's latest aviation White Paper set out a "predict and provide" policy framework that supports a major expansion in aviation activity and airport infrastructure developments, which would enable air passenger movements to increase from about 200 million in 2003 to about 470 million in 2030.

If, as currently envisaged, the UK's GHG emissions were to be reduced by 60% by 2050, aviation could account for between 27% (UK aviation White Paper) and 67% (Tyndall Centre scenario based on current growth and technology trends) of all UK target emissions by that point. Were the target for 2050 to be 80%, as it is increasingly likely, aviation's emissions could account for up to 101% (Tyndall calculations) of all UK target emissions. To compensate for this growth of aviation emissions, and as illustrated in Figure 16, emissions reductions in other sectors would be needed in the order of 71%-100%. There is therefore a stark contrast between the government's GHG reduction targets and the reality of its policies[83].

Figure 16: Air transport policy is on a collision course with overall government targets on GHG emissions



Adapted from Tyndall Centre 2006[82]

In addition, planning policy is very often focused on local interests. For example, infrastructure with a potential local economic benefit is often favoured despite its often highly negative impacts on the environment.

This is caused by the interrelated barriers of a lack of strong leadership by policy-makers, coupled with the short-term focus of the political system and insufficient public support (see Box 10). However, exceptions such as the congestion charge in London show that strong government leadership can lead to initiatives that tackle the unsustainable growth in mobility demand.

Box 10: Selected public policy barriers

- Short-term outlook and focus of political systems.
- Conflict between economic growth targets and working towards sustainability.
- Lack of leadership/quality of leadership.
- Lack of public awareness/support.
- Lack of integrated planning and policies.

The introduction of the congestion charge in London was still a success in spite of the recent increase in congestion levels[84]. But here it becomes obvious that systemic approaches are needed to tackle the root causes of unsustainable mobility growth in the long run.

Resistance to change

Measured by revenue, nine of the top ten companies in the world operate in either the petroleum refining or motor vehicle sectors[85]. It is understandable, and a logical consequence of the enormous wealth concentrated in these few big players, that they have a strong resistance to change their business models. The financial incentives for these companies to stick to "business as usual" are significant barriers to change.

Some companies have used this power and influence to lobby against environmental regulation. This was played out in 2007, when the European Commission proposed a binding emissions target of 120 grams per kilometre for new cars sold in the EU (a 35% reduction). The call for a mandatory target arose from the failure of the car industry to achieve the voluntary target agreed in 1998. The German car industry lobbied intensively against the proposal and was supported by the German government which feared job losses in one of the country's main industries in times of high unemployment. Eventually the Commission bowed to this lobbying campaign and reduced its target[86].

It is a logical consequence of the enormous wealth concentrated in the oil and automotive sectors that they can be resistant to changing their business models.

In the fuel sector most oil companies, while investing some of their resources into renewable energy, continue with profitable "business as usual" practices. This has led some oil companies to lobby against environmental standards and to call for access to protected areas for further exploration and for permission to undertake ecologically harmful practices such as oil sands extraction[87]. Based on this kind of behaviour, it would seem that strategies to mitigate climate change are far from being embedded in their core business activities.

In addition, some oil companies have disseminated research against the feasibility of new transport technologies that would reduce oil dependency. The development of innovative transport technologies has also been stifled by transport companies – an example being General Motors' EV 1 electric car. In the late 1990s more than 800 EV1 vehicles were sold. Later, all were recalled. One reason was GM's desire to continue with its apparently more profitable "business as usual" strategy of selling combustion engine cars[88].

Marketing also plays a crucial role in preserving the car industry's business models. In 2003 its marketing expenditure was $19.2 billion, or 26% of the world's total advertising spend[89]. A large share of this budget was used to promote large, high-carbon vehicles such as SUVs – principally due to the higher than average profits to be made on them.

Many governments are also determined to defend the high share of the economy and the labour market for which the current transport business models are responsible. This is another important challenge to take into account when planning strategies for systemic change.

Marketing plays a crucial role in preserving the car industry's business models. In 2003 its marketing expenditure was $19.2 billion, or 26% of the world's total advertising spend. A large share of this budget was used to promote large, high-carbon vehicles such as SUVs – principally due to the higher than average profits to be made on them.

Section 1.4 The need for systemic change

Working for systemic change seems to be the most important, but least addressed, sustainability issue, largely because of the complexity in achieving it. However, new thinking and approaches have been developed to deal with this complexity and find effective solutions. These include systems thinking, collaboration, responsibility, and visionary, courageous leadership[90]. Systems thinking, in particular, is a very effective means to locate and develop a deep understanding of the underlying problems driving the impacts of passenger transport. It helps to avoid quick fixes – short-term solution traps which might be attractive but not effective in addressing underlying problems. But how do we recognise these traps that prevent transformational change?

Figure 17: Quick fixes – a systemic solution?

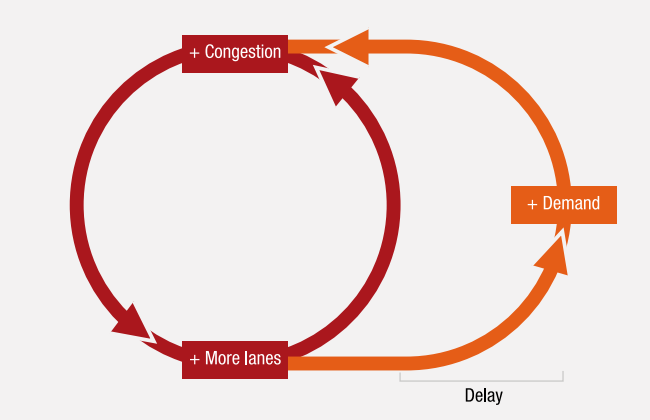
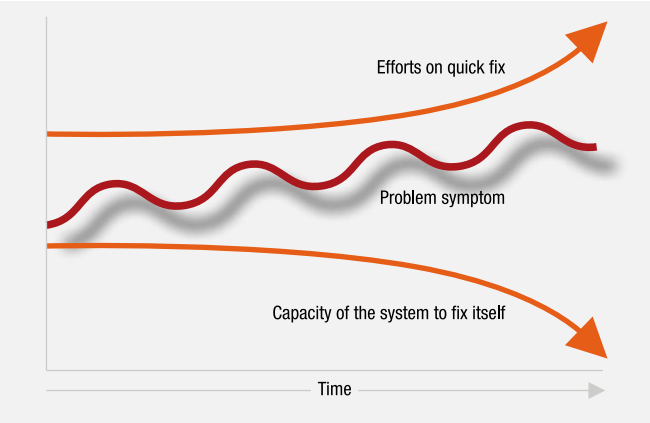


Figure 18: Quick fixes would not lessen the symptoms of the problem



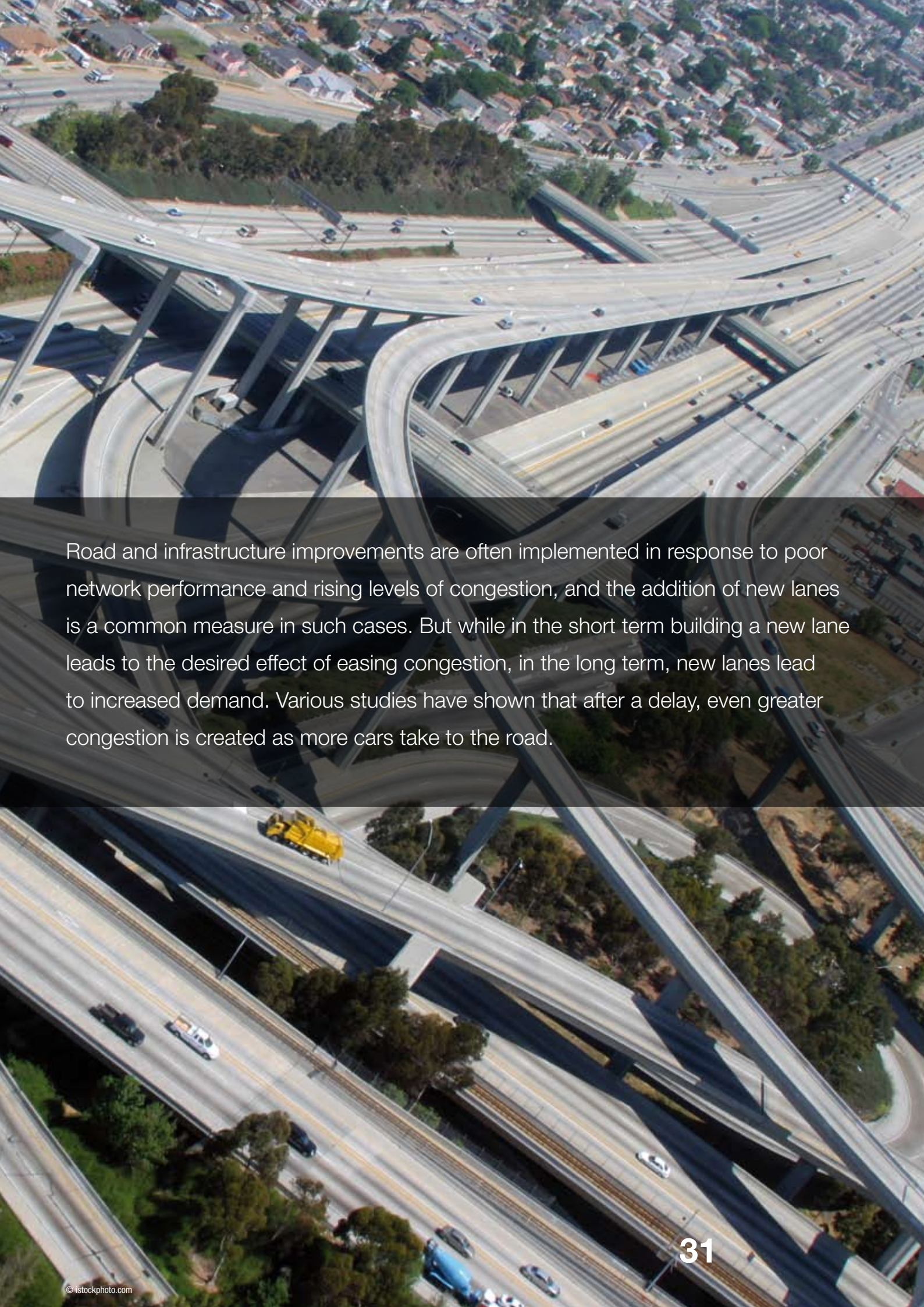
Source: Senge et al, 1994[92]

A good example to illustrate this is the impact of road and infrastructure improvements. These are often implemented in response to poor network performance and rising levels of congestion, and the addition of new lanes is a common measure in such cases. But while in the short term building a new lane leads to the desired effect of easing congestion, in the long term, new lanes lead to increased demand. Various studies have shown that after a delay, even greater congestion is created as more cars take to the road[91] (see Figure 17).

This is a typical example of a quick fix that fails – where a measure shows some effect in the short-term, but in the long-term leads to more of the same problem rather than addressing the problem fundamentally[92] (see also Figure 18). Systems thinking would bring about a deeper look into the causes of problems. Long-term systemic solutions often require broadening the scope and looking at the larger picture[93].

As noted, systemic change requires collaborative approaches to create effective solutions. For example, in the case of the congestion problem outlined above, public policy-makers could work with business by promoting financial incentives for public transport or teleworking from home in order to reduce the necessity of travelling altogether. To reach such fundamental solutions, companies, public policy-makers and society have to critically evaluate their roles and responsibilities. As this example demonstrates, a coalition of actors is required to overcome the scale of the personal mobility challenge.

"System change is based on the idea that committed leaders working together with larger society can find practical, reasonable ways to evolve our systems into sustainable forms. The goal is to do what humans always do – improve – [and] to combine ideas from the past that worked with new ideas, then develop something new and better"
Frank Dixon, Global System Change (2006)



Road and infrastructure improvements are often implemented in response to poor network performance and rising levels of congestion, and the addition of new lanes is a common measure in such cases. But while in the short term building a new lane leads to the desired effect of easing congestion, in the long term, new lanes lead to increased demand. Various studies have shown that after a delay, even greater congestion is created as more cars take to the road.

One Planet Mobility is part of WWF-UK's vision for a One Planet Future where we achieve a world in which people and nature thrive within their fair share of the Earth's resources.

One Planet Mobility is based on the belief that different sectors of society should share the responsibility for operating within the ecological limits of our one planet. Partnerships between business, government and civil society are required to bring about change in the fundamental factors that drive environmental impact.

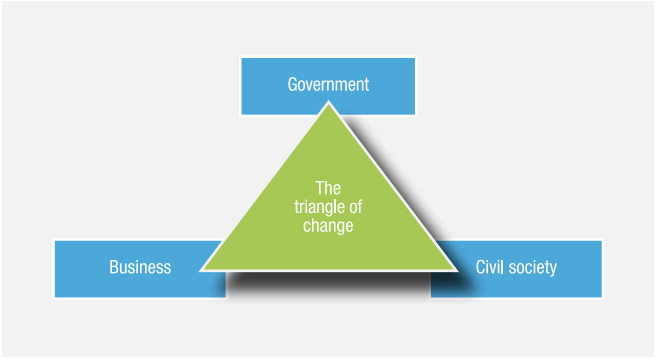
Chapter 2 The One Planet Mobility approach: partnerships for change

Section 2.1 The One Planet Mobility philosophy

OPM is part of WWF-UK's vision for a One Planet Future where we achieve a world in which people and nature thrive within their fair share of the Earth's resources.

OPM is based on the belief that different sectors of society should share the responsibility for operating within the ecological limits of our one planet. Partnerships between business, government and civil society (the "triangle of change") are required to bring about change in the fundamental factors that drive environmental impact (see Figure 19). It is only through their collaboration that the complexity of the issues can be well understood and unravelled and that well-focused actions can be effectively identified to create significant change.

Figure 19: The triangle of change



Source: Adapted from UK Sustainable Consumption Roundtable 2006[95]

Building on this philosophy, a group of decision-makers and change agents in the area of personal mobility were brought together in OPM to catalyse and inspire systemic change for personal mobility within planetary limits.

They worked towards this aim through developing three major areas of collaboration – capacities, relationships and solutions – as described in Box 11.

Box 11: Framework of One Planet Mobility

Capacities
Processes to strengthen the capacity of participating individuals and teams to bring about innovation and change in the complex system of personal mobility.

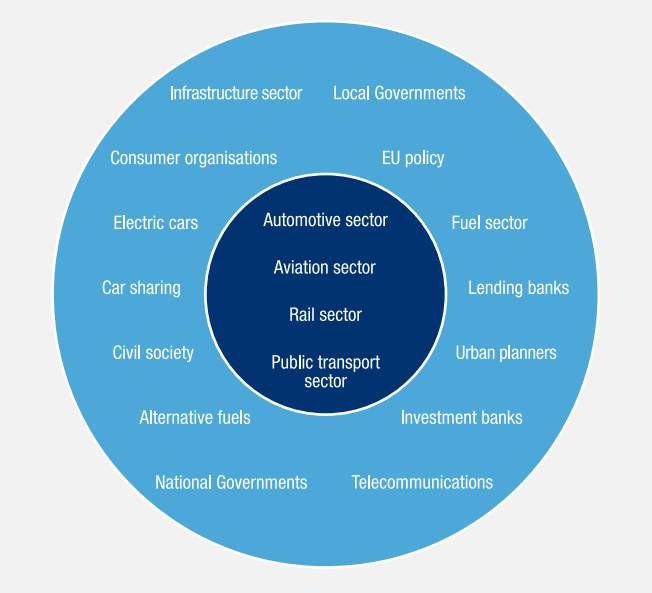
Relationships
High-trust relationships among participating leaders and their organisations that will enable them to continue to develop and implement changes in the area of personal mobility.

Solutions
Systemic, scalable, sustainable initiatives that can substantially address the adverse environmental and social impacts of personal mobility (with a focus on opportunities for business).

Inspired by "Birth of the Bhavishya Alliance – Learnings and Insights" (Balasubramanian et al, 2007)[96]

Section 2.2 Participants of One Planet Mobility

Figure 20: Stakeholders - decision makers and change agents in the area of personal mobility



More than 30 organisations from 11 European countries participated in the OPM project.

At the core were transport companies including aviation, automotive, public transport and train manufacturers and operators. Organisations that influence the system of personal mobility, either through the provision of capital or in setting the policy framework for transport, also joined the project, as did telecommunication companies, electric car and biofuel companies and car sharing providers.

During the process WWF looked for links and synergy between the sectors that could be strengthened and expanded to address the systemic change in personal mobility.

"One Planet Mobility brought together an influential and diverse group of stakeholders from the transport sector in Europe. This was a unique opportunity to build new relationships, learn about the challenges facing transport from different perspectives and to collaborate on innovative solutions"
Justin Keeble, Head of Sustainability Advisory Services, Arthur D. Little. Participant in OPM

Section 2.3 A framework for change

The participants of the OPM project were brought together in a process of six workshops between April 2007 and January 2008 held in Germany and the UK.

The process aimed to create a shared learning space, within which the highly diverse participants could become capable of operating as a collective intelligence and developing breakthrough innovations[97].

The phases of the process were:

Phase 1: Understanding the system of mobility
The participants developed a shared "map" of the systemic barriers and levers for OPM, seen through the lenses of infrastructure, consumers, investors and policy-makers. They assessed where interventions could be most effective in reducing the impact of personal mobility.

Phase 2: Developing collaborative solutions
Sub-groups were formed of people with mutual interests and/or influence in pursuing a particular solution area (named a "prototype"). These sub-groups included organisations from a variety of sectors, allowing them to pool intelligence and understand the actions required to implement their prototypes.

Phase 3: Moving towards implementation
Joint action plans were developed to enable participants to scale up these solutions.

“I have learned a lot, especially as regards how to have fruitful discussions and getting people interested in collaborating in ways they first didn’t see as an opportunity. I have also expanded my personal network of people I can rely on for help when needed. Overall, a great positive experience for me as a person and for my work”

Josefin Fogelberg, Sustainable People Transportation Project Manager, IKEA. Participant in OPM

Chapter 3 Leveraging sustainable mobility

Section 3.1 Key leverage points for sustainable mobility

One of the major objectives of OPM was to develop solutions that have the potential to be transformational. For that purpose, stakeholders discussed the possible 'levers' for transforming the current system of personal mobility. Levers can be regarded as actions that address the barriers, or fundamental solutions rather than quick fixes within the existing system. Some of these systemic actions have been taken forward as "prototypes" (see Chapter 4). An overview of the levers identified by the stakeholders is listed in table 1.

Table 1: Levers to achieving systemic change

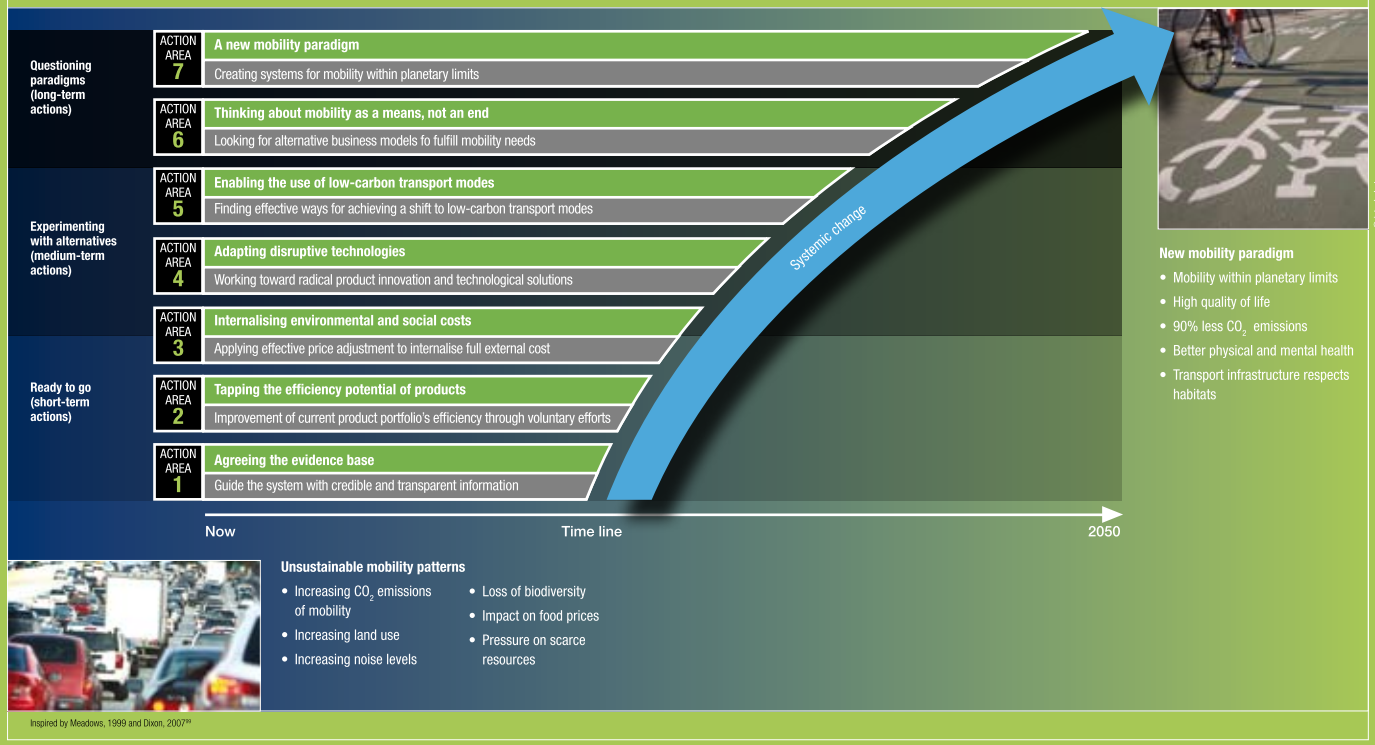
Cross-cutting themes	Levers	Description/Examples
Finance	• Carbon and emissions trading – full internalisation of the external (environmental, social, economic) costs. • Potential for funding 'leapfrogging'. • Understanding and investing in initiatives that will be winners in a low-carbon future. • Exploration of land value capture to finance sustainable infrastructure/initiatives to accompany future development.	• Aviation is gradually becoming cheaper, but it is increasingly failing to address its environmental impacts. Proposals have been made to include aviation in the EU Emissions Trading Scheme (ETS). It is currently proposed that from 2012, emissions from all flights arriving in and departing from the EU will be covered.
Policy making	• Growing public mandate to take decisive action on climate change. • Establish carbon limits (personal and international). • Other stakeholders looking to government for action (including corporate lobbying). • Opportunity to position the EU as leader in sustainable transport.	• The European Commission published a Green Paper on Urban Transport in September 2007, posing questions and launching a debate with a view to developing a European policy vision on urban mobility. Core elements of sustainable mobility identified included making town and city transport systems more fluid, greener, 'smarter', more accessible and safer.
Consumption	• Growing public concern regarding the environmental impact of transport. • Opportunity to create cultural change: quality of life/ slow travel, etc. • Consumers willing to change, provided they are given the right incentives by government and business.	• The London 2012 Olympic Games campaign is an example of promoting sustainable development and sustainable transport. The Olympic Delivery Authority (ODA) has set ambitious targets of aiming for all spectators travelling to the Games by public transport, cycling or on foot.
Infrastructure	• Sustainability could lead to more long-term thinking about infrastructure development. • Create infrastructure for slow travel. • Use ICT as a means to reduce travel. • Opportunity to make more sustainable use of existing infrastructure (car lanes becoming bike lanes, etc).	• City of Freiburg, Germany demonstrates careful land use and transport planning to promote the use of sustainable transport, particularly the introduction of a car-free residential area. This initiative has encouraged residents to be less car-dependant, supported by additional incentives such as annual tram passes and charges for parking spaces.

Section 3.2 A step approach for change

A portfolio of solutions addressing these different leverage points is required. It became clear in the project that depending on the level of agreement among stakeholders, different types of collaborative actions can be initiated[98]:

- **Ready to go**: These are actions stakeholders agree upon. They can be realised in the short term.
- **Experimenting with alternatives**: Stakeholders only agree roughly on these actions. Experimentation and pilot projects to test assumptions are needed. Success can be achieved in the medium term.
- **Questioning paradigms**: Problems that question mainstream beliefs and paradigms require informed deliberation. Examples showing the benefits of the new paradigm will be needed. Implementation of change will take time.

Figure 21: The journey to systemic change – actions for sustainable personal mobility



Inspired by Meadows, 1999 and Dixon, 2007[99]

“There were many different opinions amongst the stakeholders of One Planet Mobility on what were the right solutions for sustainable mobility. This framework for change provides a pragmatic and inclusive way for dealing with this complexity and lays out a systematic way forward towards sustainable mobility”
Udo Sieverding, Head of Energy Group, Nordrhein-Westfalen Verbraucherzentrale (consumer organisation). Participant in OPM

Figure 21 illustrates how the different actions towards sustainable personal mobility can be aggregated into seven areas. The higher the level of difficulty of agreement among stakeholders, the more experimentation and discussion is needed before the action leads to the desired outcome. However, an Action Area high on the ladder does not mean that it cannot be tackled in the short term. Although full implementation will take time, some actions in each Action Area can and need to start in the short term.

"Climate change is a top priority strategic issue for National Express. The provision of robust, transparent information on the environmental impacts from different transport modes is key to making clear comparisons and for giving companies leading on sustainability a clear competitive advantage"

Nick Coad, Group Environment Director, National Express Group. Participant in OPM

The action areas are discussed in detail below, along with recommendations for the key actors in the triangle of change – business, government and civil society.

Action Area 1 – Agreeing the evidence base

Reaching an agreement on the evidence base of impacts and drivers of personal mobility is the first step towards systemic change.

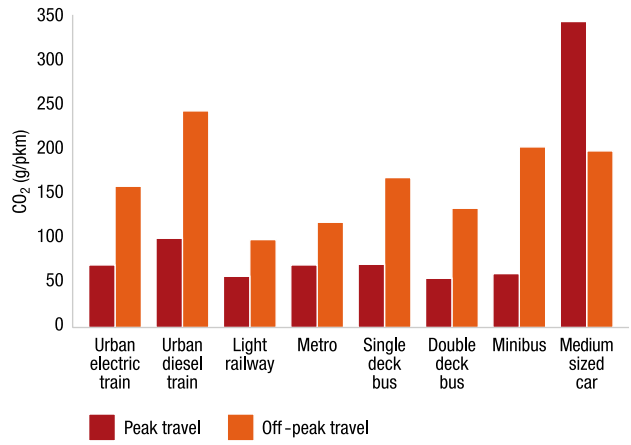
It became clear at the beginning of the One Planet Mobility process that stakeholders wanted more clarity and transparency about the actual impacts of the different transport modes and different technologies, as well as a deeper understanding on the drivers of personal mobility. This was seen as an essential first step in informing the debate on effective actions for change.

There are many different and sometimes contradictory claims about the impacts of transport modes, with data very often interpreted in different ways by different actors. Suggested solutions might not have full credibility and be faced with scepticism unless there is a common reference point. Prevention of bias towards a single company or mode of transport is essential for transparency. As illustrated in Box 12, interpretation of data on various modes of transport can significantly differ when based on assumptions such as sources of energy, type of fuel, efficiency of fuel use, exact distance travelled, occupancy rates, etc.

A credible and transparent information base and agreed standards for reference can be powerful tools for companies that want to develop a competitive advantage for their low-carbon mobility solutions. This is an essential step for companies eager to be leaders in sustainable mobility.

Examples such as the carbon calculators of SNCF (National Railway of France) and Voluntary Carbon Standard* show that companies are increasingly using information about their carbon emissions to position themselves as environmentally friendly mobility providers and gain market share. Although this demonstrates real business value in environmental information, so far there is much confusion about the data used and its lack of credibility. Robust standards and increased transparency can provide the industry with public recognition, increase consumer trust and eventually add to brand value. Such platforms can also encourage clearer judgements by financial markets of the market value of companies with leading low-carbon portfolios.

Box 12: Peak and off-peak CO_2 emissions for urban transport



Source: Potter, 2003[100]

Box 12: Comparing the GHG emissions from passenger transport
The figure below attempts to illustrate the range of CO_2 emissions for various urban passenger transport modes. In this mode comparison, the variances in vehicle occupancy that take place during peak and off-peak periods have been taken into consideration. The figures can only be used to indicate the potential CO_2 emissions by modes, as data has been collated from a wide variety of public transport operators. Also data is not specific to a particular journey for comparison purposes and, among other inconsistencies, the occupancy levels (peak/off-peak) have been assumed.

* The Voluntary Carbon Standard intends to provide a robust new global standard for voluntary offset projects. It ensures that carbon offsets bought by businesses and consumers can be trusted and have real environmental benefits.

Public authorities or international governmental agencies can take the lead in setting up or facilitating such information clearance mechanisms. For example, the European Environment Agency (EEA) is well placed to endorse and give credibility to methodological approaches.

Box 13: Critical actions for agreeing the evidence base

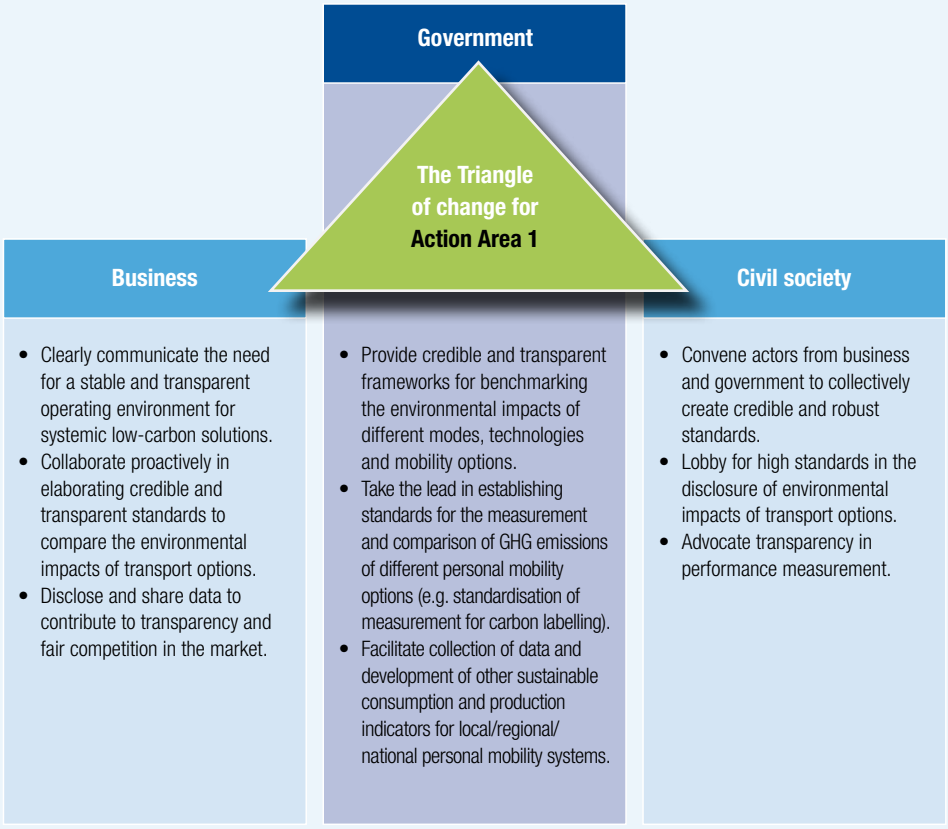
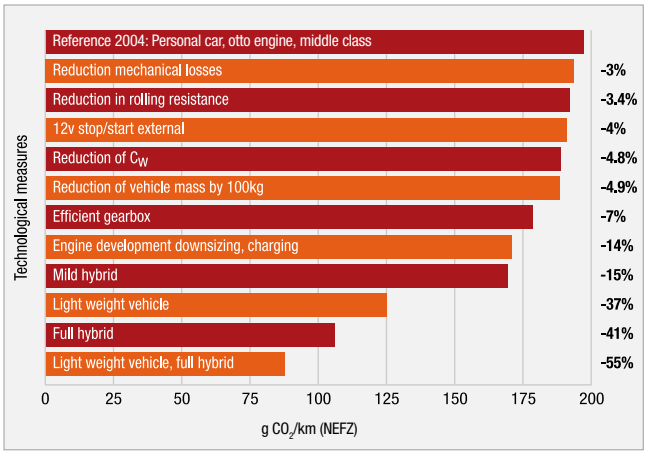


Figure 22: Reduction potential (g CO_2 /km) of various technological measures for cars



Source: S. Schmidt, 2005[101]

Action Area 2 – Tapping the efficiency potential of products

As outlined in the previous chapter, efficiency gains in transport have been absorbed by the increased weight and bigger size of vehicles (for more comfort and safety) and by the rising demand for mobility.

However, when OPM stakeholders discussed solution areas it became obvious that there was strong agreement about the huge potential for life cycle emission reductions with existing technologies that are still untapped (see Figure 22 for reduction potentials). According to Mobility 2020, the UK government's Business Taskforce on Sustainable Consumption and Production report (2007), if the efficiency of an average car were doubled and if consumers could choose from a range of travel options, then CO_2 emissions per km could be reduced by 60% by 2020.

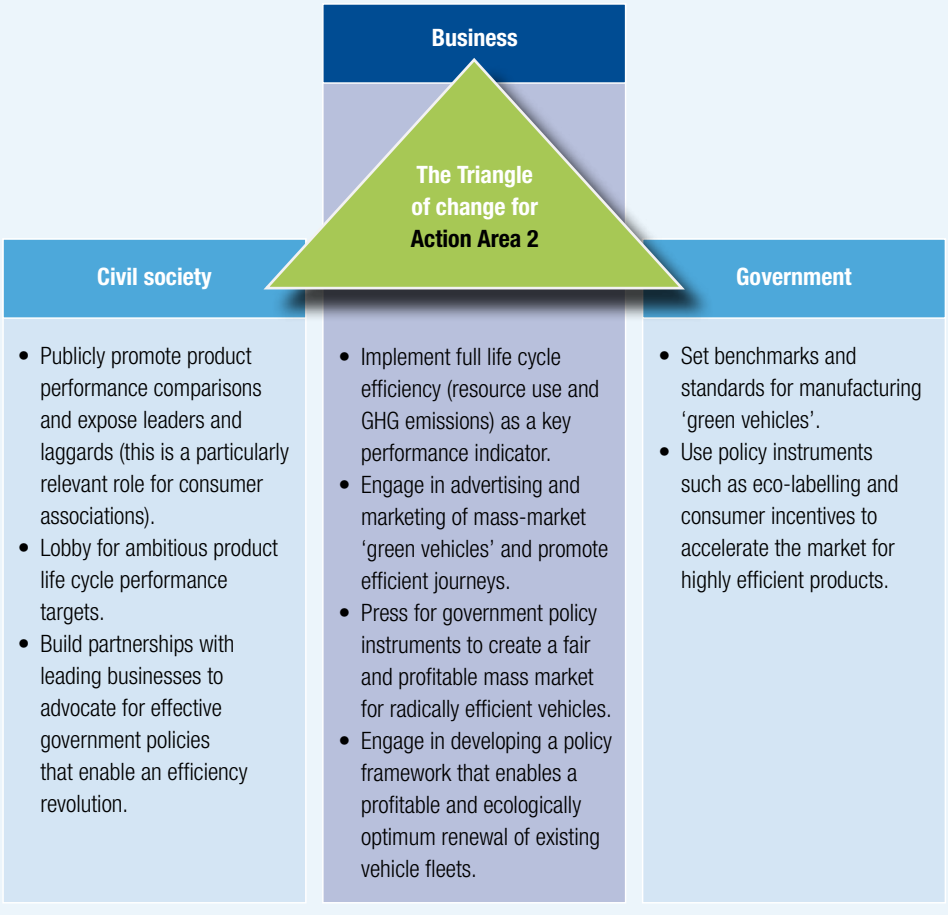
Vehicle manufacturers in the OPM project acknowledged that the efficiency of the in-use phase of vehicles had not been their major focus in the past and that safety and increasing comfort had been higher on the agenda.

The business case for CO_2 efficient vehicles and stewardship of the full life cycle is increasingly clear. According to an analysis by the management consultancy Arthur D. Little, the outlook for the new car market in 2012 shows that vehicle segments with a very high CO_2 footprint could run a risk of up to 50% sales loss, depending on the region and the selected scenario[102].

After-sales markets also represent a large potential for new CO_2 related business models. For example, by developing profitable after-sales products such as eco tuning* and CO_2 checks, automotive manufacturers can address current and future market demands, and increase their brand image with respect to environmental awareness and progress[103].

Tapping this huge potential requires a multi-stakeholder effort. Each manufacturer is required to coordinate its supply chain so that product performance improvements can be made throughout the life cycle of the product. Public authorities need to set the right economic framework (including the use of taxes, regulations, subsidies and standards) to make it happen.

Box 14: Critical actions for tapping the efficiency potential of products



* Vehicle improvements/adjustments to achieve increased fuel efficiency.

Action Area 3 – Internalising environmental and social costs

During the OPM stakeholder process, there was wide consensus that external environmental and social costs have to be internalised*. It was felt to apply not only to GHG emissions but also to other environmental damages such as land-use, air pollution and material use for infrastructure.

The rationale is that companies and consumers would respond effectively and efficiently to price adjustments, and that investment would flow into low-carbon solutions. That is why the One Planet Mobility Alliance includes the internalisation of costs in its guiding principles (See Section 4.2).

All over the world, business leaders frequently state that carbon markets need to be expanded. For example, with the Bali Communiqué (2007) of the Corporate Leaders Groups on Climate Change, 150 global companies stated, "We believe that an enhanced and extended carbon market needs to be part of a framework to tackle climate change as it offers the necessary flexibility, allows for a cost-effective transition and provides financial support to developing countries". Similarly, easyJet and British Airways are favouring the inclusion of the airline industry in the European carbon markets[104].

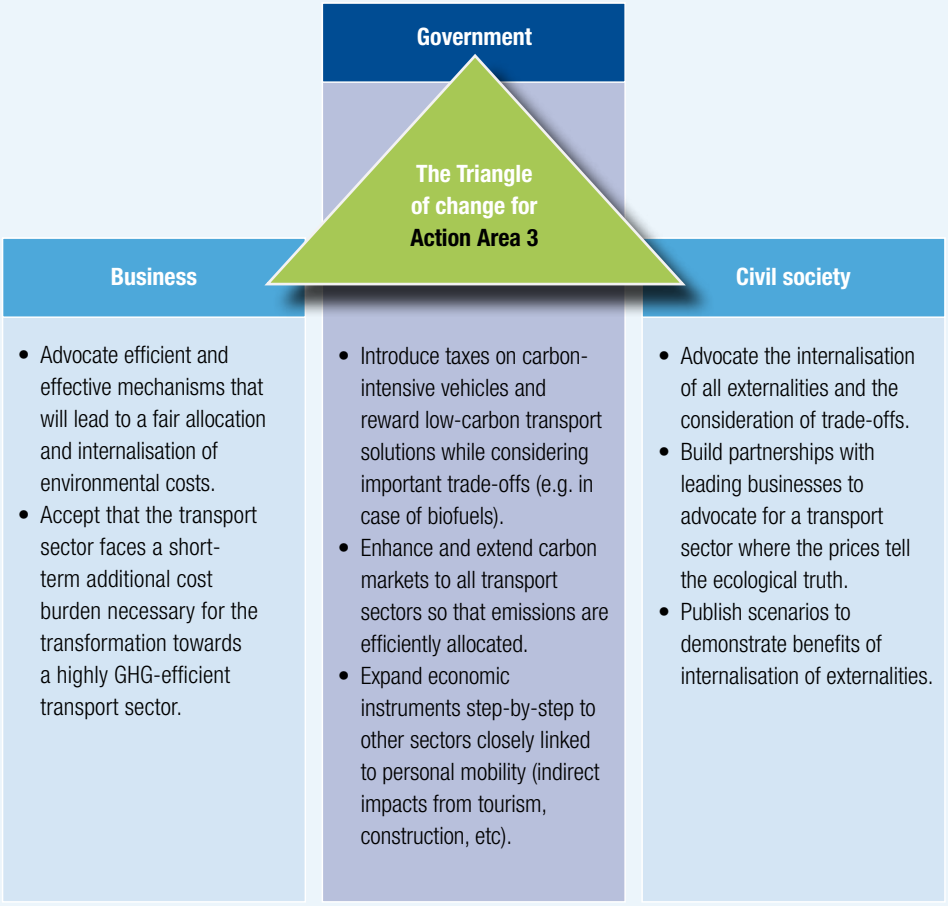
As discussed in Section 1.4, putting a predictable price on GHG is the key factor in moving markets. If markets were to send clear signals to producers, investors and consumers, the role governments need to play in shifting to low-carbon solutions could be reduced. Cost internalisation can come in many forms, including caps on carbon, vehicle taxes designed according to ecological criteria, and standards for energy efficient fuels and low-carbon vehicle technologies[105].

Despite "in-principle" agreement on the issue, difficulties with full and fair cost allocation are a major barrier. First, finding the true cost is a not an easy task for markets or governments. Learning from the current carbon pricing discussions, many trade-offs need to be taken into consideration. For example, how can loss of biodiversity be judged against development benefits? Should environmental benefits be favoured over socio-economic development or vice versa?

Moreover, global political will and leadership is an essential factor in putting economic instruments in place. The European Union, for example, tried in the early 1990s to implement a carbon tax by asking the public to directly pay for the costs of reducing global warming. But it was not feasible for reasons of competitiveness, unless the United States would do so as well. Even so, this idea is brought back to the agenda from time to time. For example, in 2008 President Nicolas Sarkozy stated, "We need to profoundly revise all our taxes and charges. The aim is to tax pollution – notably fossil fuels – more, and tax work less"[106].

* Internalisation of externalities: Process of incorporating environmental impacts into the market decision-making process through pricing or regulatory interventions.

Box 15: Critical actions for internalising environmental and social costs



Business

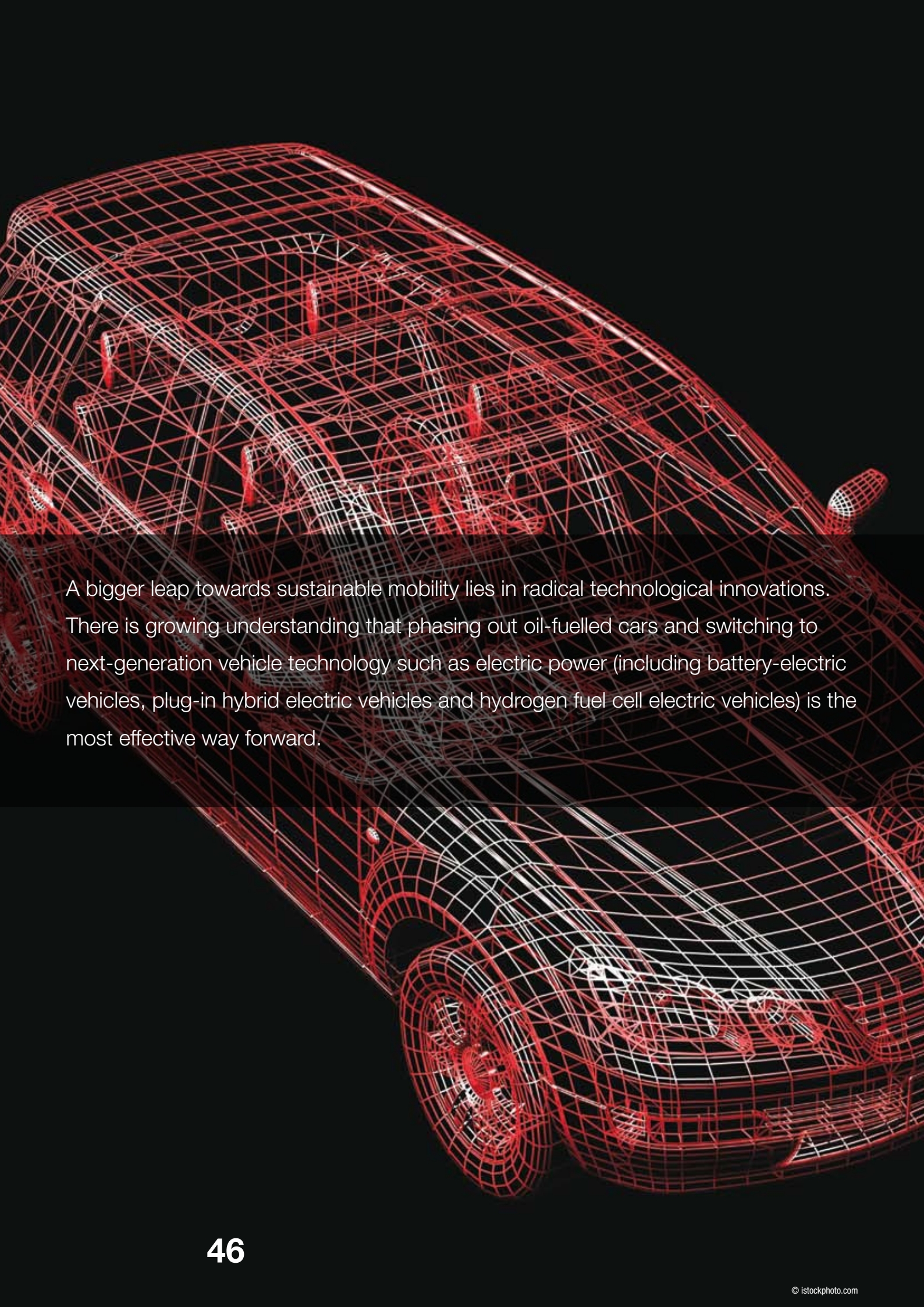
- Advocate efficient and effective mechanisms that will lead to a fair allocation and internalisation of environmental costs.
- Accept that the transport sector faces a short-term additional cost burden necessary for the transformation towards a highly GHG-efficient transport sector.

Government

- Introduce taxes on carbon-intensive vehicles and reward low-carbon transport solutions while considering important trade-offs (e.g. in case of biofuels).
- Enhance and extend carbon markets to all transport sectors so that emissions are efficiently allocated.
- Expand economic instruments step-by-step to other sectors closely linked to personal mobility (indirect impacts from tourism, construction, etc).

Civil society

- Advocate the internalisation of all externalities and the consideration of trade-offs.
- Build partnerships with leading businesses to advocate for a transport sector where the prices tell the ecological truth.
- Publish scenarios to demonstrate benefits of internalisation of externalities.



A bigger leap towards sustainable mobility lies in radical technological innovations. There is growing understanding that phasing out oil-fuelled cars and switching to next-generation vehicle technology such as electric power (including battery-electric vehicles, plug-in hybrid electric vehicles and hydrogen fuel cell electric vehicles) is the most effective way forward.

Action Area 4 – Adapting disruptive technologies

Transport has seen many performance improvements such as aerodynamic optimisation, switching to alternative fuels and the reduction of vehicle weight through use of alternative metals. But set against the scale of the ecological challenge, these are only piecemeal actions.

As explained in Section 1.2, efforts aimed at efficiency gains can eventually increase emissions. For example biofuel, with its direct and indirect effects, in many cases produces more emissions than conventional fossil fuels. A bigger leap towards sustainable mobility lies in radical technological innovations. There is growing understanding that phasing out oil-fuelled cars and switching to next-generation vehicle technology such as electric power (including battery-electric vehicles, plug-in hybrid electric vehicles and hydrogen fuel cell electric vehicles) is the most effective way forward.

In the OPM stakeholder process, there was agreement about the need for disruptive technologies, but not about which ones to pick. This rough agreement requires innovative experiments and further assessments to identify the next technology generation.

To start a transition process towards disruptive technology change, it is necessary to address the key underlying issues that are preventing the breakthrough of radically new technologies. Fundamentally, for disruptive transport technology to flourish, companies need to grasp the urgency of going beyond oil substitutes.

Logically a key factor that would accelerate the adoption of new clean energy technologies is government action to get the prices right for GHG emissions. If all life cycle emissions were priced correctly, a level playing field would be created for new low-carbon technologies.

In addition, it is important that government does not unintentionally erect new barriers to new technologies. For example, the proposed EU metric for a mandatory target for vehicle emissions – gCO_2/km – is not meaningful for grid-connected vehicles, whereas an energy efficiency metric such as kWh/km is essentially technology-neutral.

The adoption of disruptive technologies such as electric cars requires and ultimately might also drive large-scale behavioural change: “Driving electric leads you to develop a new appreciation of fuel costs and emissions. You accelerate slowly and brake gently to eke power out of the battery. You travel more slowly, more safely, and more efficiently. You re-evaluate your journey lengths, which in turn makes you question whether the journey is even necessary. You search out local services, within easy reach and away from out-of-town dual carriageways. Driving electric is more than owning a new car – it should become a commitment to a less intensive form of motoring”[107].

Only a coalition of players can expand radical innovations that are currently limited to niche markets. Each actor has to play its role. Governments need to provide clear incentives to businesses and consumers for adoption of these innovations, such as the Dutch Green Funds Scheme, a tax incentive that has been used by the Dutch government since 1995 to encourage environmentally friendly initiatives in renewable energy, organic farming and sustainable housing (see Box 16).

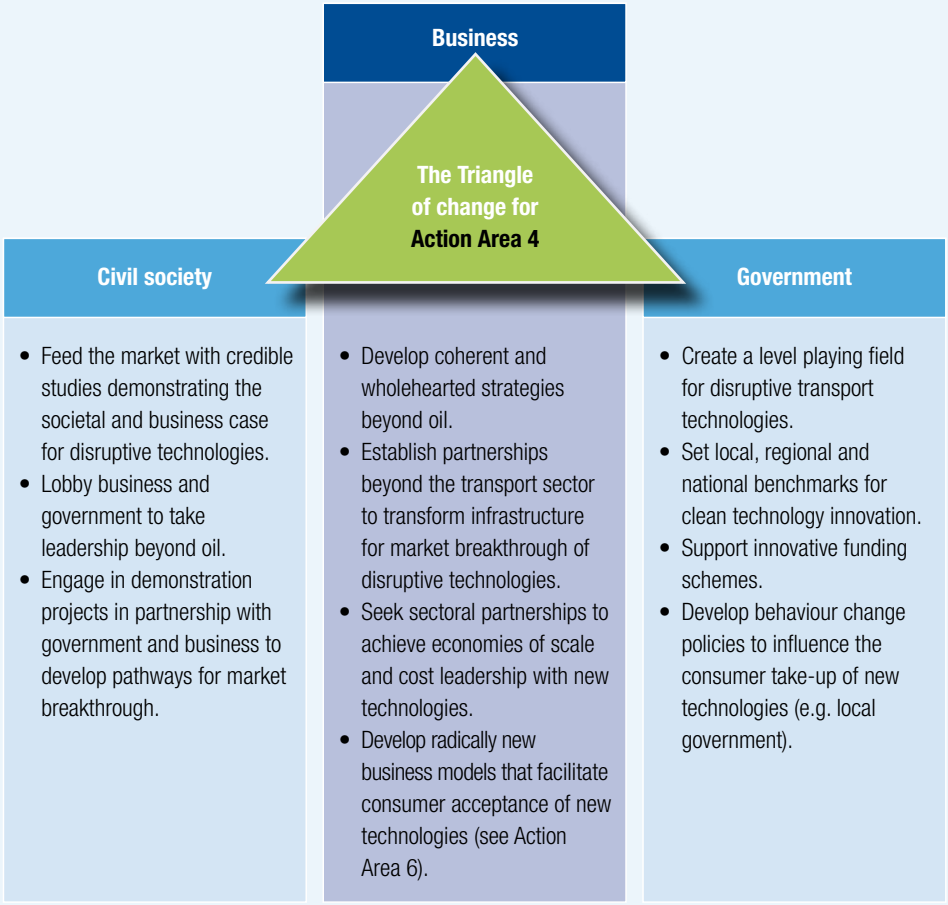
Box 16: Policy powering green technology – Dutch Green Funds Scheme

Investing in the Green Funds Scheme means that individual investors – private consumers – lend their money to banks at a lower interest rate, which is compensated by a tax incentive (environmental tax credit). The government provides the necessary legislation, supervises the banks issuing green funds or offering green savings, and ensures that green projects are properly assessed against its own ecological criteria. The green banks can then offer cheaper loans to environmental projects and thereby improve their financial condition.

Source: SenterNovem, n.d.[108]

Once the barriers are collectively overcome, business benefits can be vast. From accelerating the electrification of automotive transport, a wide range of companies such as utilities, technology companies and renewable energy suppliers can expect profits. Currently new market potential such as that from the emerging Lifestyles of Health and Sustainability (LOHAS) market are only partly capitalised upon. According to Arthur D. Little, the new car market potential of LOHAS already amounts to more than one million cars per annum worldwide. It is expected that this segment will grow strongly[109].

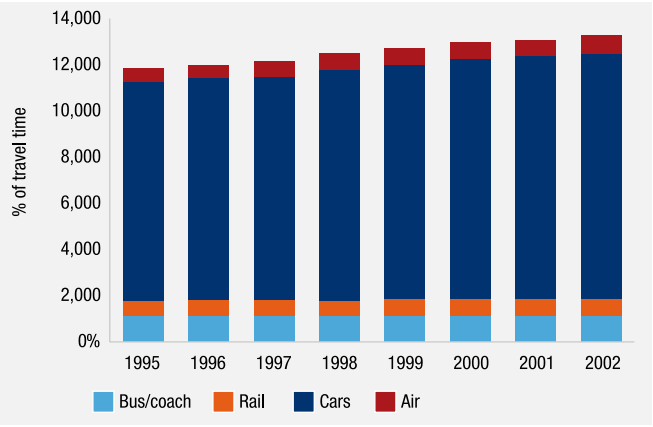
Box 17: Critical actions for adapting disruptive technologies



Action Area 5 – Enabling the use of low-carbon transport modes

Stakeholders from the different transport sectors participating in the One Planet Mobility project agreed that, as a principle, the transport mode with the lowest environmental footprint possible should be used. Enabling the use of low-carbon public transport and non-motorised transport such as cycling and walking has therefore become a common goal for many city governments. Yet the reality shows that in most European countries and major cities the share of public transport has been shrinking over the last decades[110] (see Figure 23).

Figure 23: Shrinking share of public transport in Europe



Source: Eurostat, 2005[111]

The lack of integration of public transport services and the existence of out-of-town shopping centres are among the reasons why people find it difficult to use more public transport. Also, people are often stuck in "bad habits": once they have bought a car, they continue using it because they are simply used to doing so.

However, examples show that a high level of low-carbon travel is possible[112]: in Freiburg, Germany, 60% of trips are taken either by public transport or non-motorised modes. The need for a much higher share of public transport is obvious in light of the carbon reductions needed in the near future and the growing demand for transport. How and to what extent this can be achieved is still not commonly agreed and requires leadership and experiments.

"Freiburg has one of the highest rates of public transport use and cycling and walking in Europe. As a result, it is consistently recognised as one of the cities with the highest quality of life in Germany. Nevertheless we recognise the challenge in reaching even higher levels of $C0_2$ emissions reductions to mitigate catastrophic climate change, but we see this as a positive opportunity to further enhance the quality of life in the city" Dr Peter Schick, Transport Department, Freiburg City Government. Participant in OPM

There are significant opportunities for collaboration between public transport providers and city governments to enable this to happen – for example, by connecting new neighbourhoods with public transport from their inception to avoid people getting stuck in unsustainable travel patterns. In addition, local governments can help embed public transport use by informing travellers of the social and environmental benefits of their travel patterns.

An opportunity for collaboration with a potential business benefit for public transport providers is the connection of large out-of-town shopping centres to the public transport network. Here, partnerships between retailers and transport operators can show leadership and increase the number of shoppers travelling by public transport.

Additional features such as intelligent journey planners can add significant comfort to the public transport experience and help people save time and money. There is a huge business potential for IT and public transport companies in this segment (see Figure 25 in Action Area 6).

Improving access to, and better integration of, public transport is an area where further stakeholder collaboration is required. This includes the need to improve access to capital for the huge investments required in new infrastructure. But these are no silver bullet solutions. Complementary measures are required to make sure that the use of public transport is substituting individual motorised transport and not adding impact through additional induced demand.

Achieving behaviour change towards the increased use of low-carbon public transport, and making this happen quickly without huge investments in new infrastructure and without increasing the total demand for mobility, would be the ideal situation. However, current strategies are more

focused on expanding metro systems and building high-speed rail networks. Apart from creating additional environmental impact (construction), new transport infrastructure is extremely costly and risks inducing demand, as has been explained. A creative solution here can be making use of existing infrastructure. Exclusive motorway lanes for coaches with a simultaneous reduction of the number of cars on these would be one interesting example. This was discussed in the OPM project as an excellent business opportunity for coach operators (see Section 4.1).

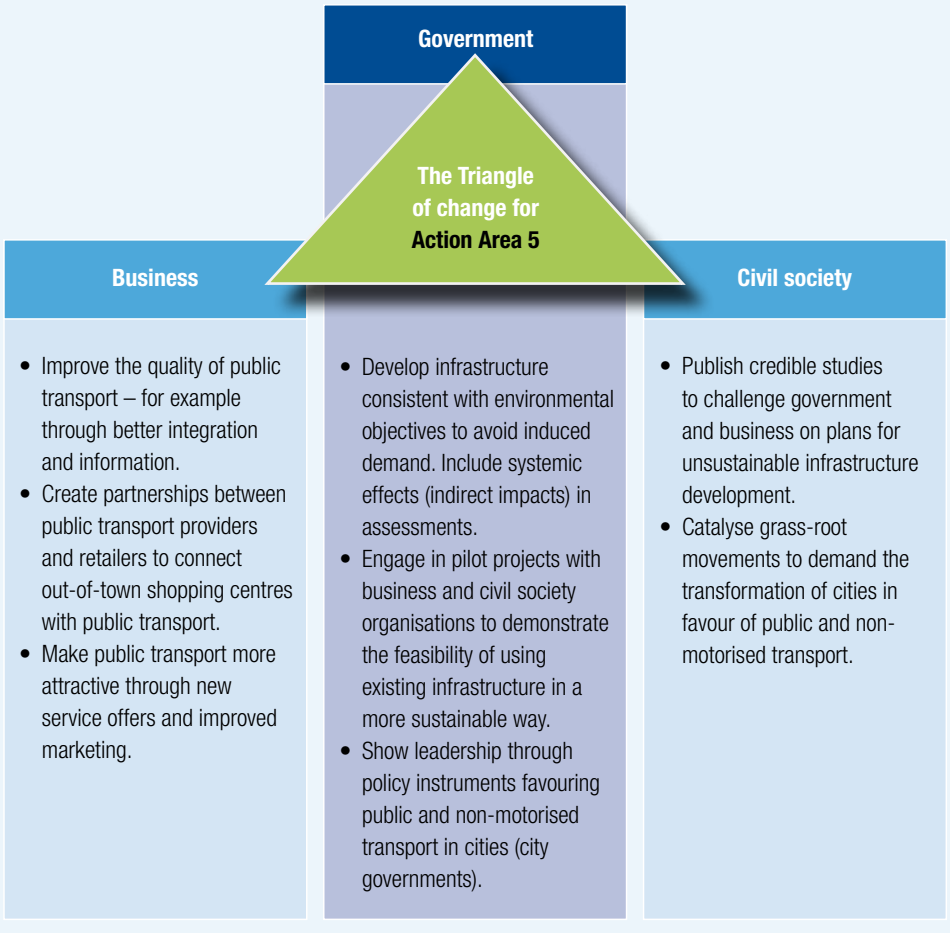
Box 18: TransJakarta Bus Rapid Transit system

Since opening in 2004, TransJakarta has expanded to seven corridors (physically separated bus-only lanes) and now serves more than 160,000 passengers a day. Travel time across the entire corridor has dropped by one hour during the peak period. More than 20% of TransJakarta passengers have switched from using private cars for some trips, and carbon dioxide emissions alone are being reduced at the rate of 20,000 metric tons a year.

Source: Institute for Transportation and Development Policy, 2007[113]

Other opportunities would be the creation of car-free cities with massive use of streets by buses and bicycles. This is also a way to achieve a modal shift without the need to build new infrastructure. A good application would be establishing low-cost systems such as the TransJakarta Bus Rapid Transit system (see Box 18).

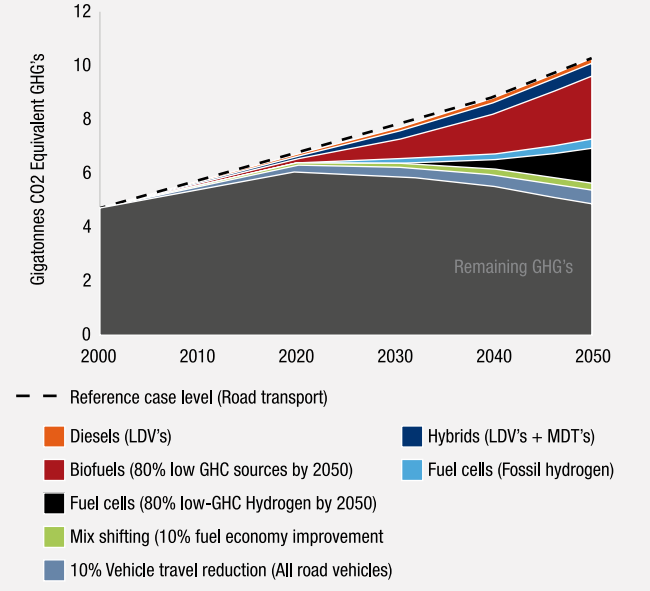
Box 19: Critical actions for enabling the use of low-carbon transport modes



Action Area 6 – Thinking about mobility as a means, not an end

Over the course of the OPM project it became clear that the application of highly efficient and new disruptive vehicle technologies, together with the wider use of low-carbon public transport modes, will not be sufficient to achieve sustainable mobility. As several studies show, the "business as usual" trajectory of the demand growth for personal mobility outweighs the GHG reduction potential of technological solutions. For example, according to a scenario for road transport in WBCSD's report Mobility 2030, the best case scenario for technological solutions for 2050 would achieve a reduction of CO_2 emissions only to the levels of 2000 (see Figure 24).

Figure 24: Best case scenario for GHG reductions for road transport



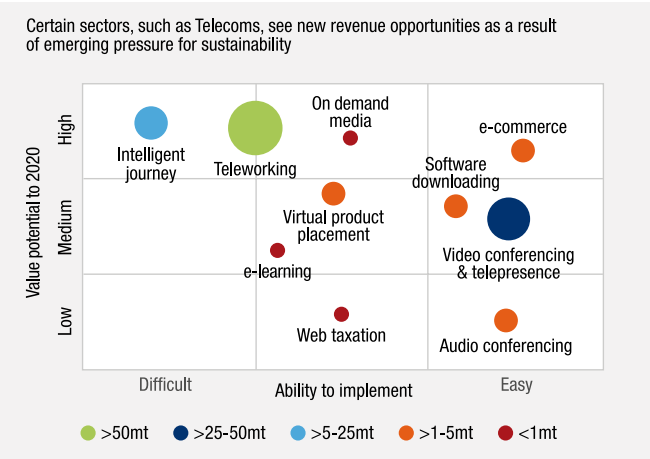
Source: WBCSD, Mobility 2030[114]

Terms such as "demand reduction" and "travel avoidance" are often not part of the mix of solutions for sustainable mobility. Some participants also felt uncomfortable talking about demand as they saw it as an intrusion into the right of people to freely decide to travel whenever and wherever they liked.

A key question to be answered here is whether mobility is a need in itself, or whether people are mobile to achieve access to something else. In some cases mobility is certainly the final aim – such as driving a convertible for pure pleasure. But most people travel to go to their place of work or education, for shopping, or to access key services such as hospitals. The way in which people access these services and activities needs to be assessed and potential alternatives identified.

Eventually, new learning and experimentation is required to develop alternative solutions for the demand people want to satisfy by making use of mobility services. New ideas need to be tested via flagship experiments[115] and current usage systems have to be challenged[116].

Figure 25: Business opportunity potential in sectors that reduce the need to travel



Source: Arthur D. Little & WWF, 2007 (The Carbon Margin)[117]

Videoconferencing allows business people to avoid travelling long distances – and the latest high-definition technology now offers a tremendously improved user experience. The carbon saving opportunities can be huge (see Figure 25), especially for service companies, for whom 50% or more of their carbon footprint stems from business travel[118].

Additional benefits from these solutions can be increased work productivity due to better work-life balance, reduced jetlag, and increased collaborative working with colleagues in remote locations. According to "Travelling Light: Why the UK's biggest companies are seeking alternatives to flying", a new report by WWF, 89% of companies surveyed believed that videoconferencing, if used well, could enhance their productivity[119].

Furthermore, schemes such as teleworking from home or telecommuting can improve employee performance, bring social benefits such as reduced stress, and contribute to stronger family ties and unity[120].

Governments need to put incentives in place to overcome resistance to change and to increase the uptake of videoconferencing – for example with financial incentives*.

* Enhanced Capital Allowances (ECAs), applied in the UK, enable businesses to claim 100% first-year capital allowances on their spending on qualifying plant and machinery.

Videoconferencing allows business people to avoid travelling long distances – and the latest high-definition technology now offers a tremendously improved user experience. The carbon saving opportunities can be huge, especially for service companies, for whom 50% or more of their carbon footprint stems from business travel.

Another opportunity area might be the provision of better access to shopping and leisure facilities, and in return reducing the need for travelling long distances.

For example, retailers could consider alternatives to locating their businesses in suburban areas or on the outskirts of cities. For this, they would need support from visionary local authorities and city planners, who would work towards integrated development projects and discourage businesses building activity centres out of town[121]. Smarter land-use projects can promote new business models such as retailers making more use of online shopping and enhanced delivery services while using less space for displaying their goods.

A shift to more service-oriented business models can also be a strategy to reduce the number of cars without compromising access to individual transport when needed. Car sharing schemes are a good example.

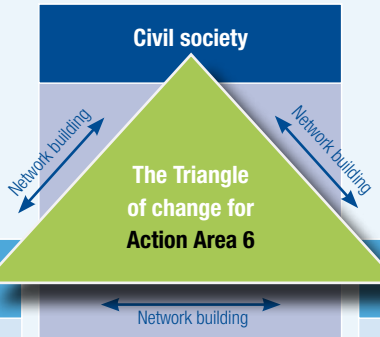
Building on the car sharing business model, vehicle manufacturers could become providers of mobility services. They would retain ownership of vehicles and update them according to the latest technology. This would enhance the in-use lifetime of the vehicles, leading to huge environmental and business benefits.

This is already happening in practice. Project Better Place is a group of investors that goes even one step further, copying the mobile phone industry's successful business model for the introduction of electric cars. Consumers will pay a monthly fee for the use of vehicle, infrastructure, electricity and maintenance service[122].

"We see real business opportunities in creatively re-thinking the concept of transport for our carbon and resource constrained world"
Ben Reason, Partner, live:work.
Participant in OPM

Box 20: Critical actions for thinking about mobility as a means, not an end

Challenging the transport sector's current business models and developing successful new products and services for demand reduction is not an easy task. It requires the building of networks among key actors in the triangle of change.



Government

- Minimise the need for mobility through smart urban planning and mixed land use.
- Support businesses to reduce their work and commuter travel through incentive schemes.
- Engage/collaborate with business and civil society in projects aimed at developing, testing and proofing new business models that can reduce the demand for mobility.

Civil society

- Engage in demonstration projects with business to proof new business models and leadership strategies aimed at reduced mobility.
- Create credible studies to challenge government on land use and urban planning policies.

Business

- Invest in ICT business models that substitute demand for travel with access solutions (e.g. teleworking, videoconferencing).
- Develop strategies to reduce own business travel and incentivise teleworking.
- Explore alternative shop locations (e.g. town centres) or online shopping to reduce mobility (retailers).
- Consider new business models, e.g. becoming providers of mobility services and retaining ownership of vehicles instead of selling them.

Action Area 7 – A new mobility paradigm

As shown throughout this report, the growth of mobility has so far outstripped society's attempts to tackle its unsustainable footprint. Although the approaches outlined in Action Areas 1 to 6 have the potential to mitigate a large part of the environmental impact caused by mobility, the pressure for more people travelling further and more frequently is high, especially if considered in the global context where the desire of people in developing countries to copy western lifestyles and mobility patterns is growing. The risk is therefore high that sustainable mobility will not be achieved without questioning our fundamental beliefs and paradigms.

It becomes increasingly likely that the paradigm of our materialistic societies, where growth is the norm and more is better, is at odds with environmental limits. Ultimately, it will not be possible for everybody in the world to live a European lifestyle. This would require the existence of three planets.

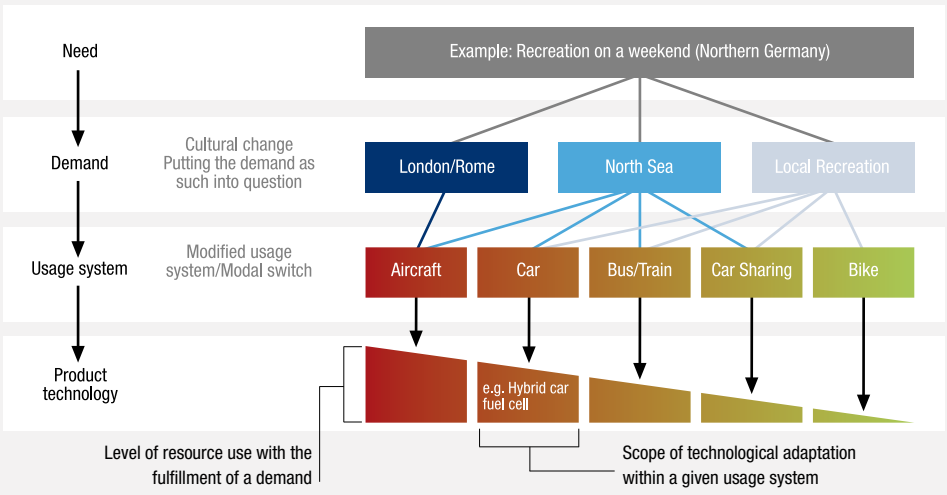
A paradigm shift away from "more is better" towards "less can be better" could therefore be a more effective way to live in harmony with nature and secure the natural resources necessary for coming generations.

This highest level of systemic change towards achieving sustainable mobility patterns is unsurprisingly the most difficult one. As became clear in the OPM project, this is not an area of common agreement – views about the need for a paradigm shift differ significantly. This kind of change is long-term and requires informed deliberation among all societal actors.

WWF's new report, Weathercocks and Signposts[123], is aimed at starting a serious debate on the need for a radical change agenda and the importance of values in it.

Tactics to inform this deliberation include gathering credible evidence of how current mobility patterns could be transformed towards slower and less travel, more low-carbon public transport and more cycling and walking, while simultaneously increasing quality of life. Governments, businesses and society should start the debate about a new mobility paradigm. The assumption that more mobility is a good thing is widely accepted, but as discussed in Section 1.1, mobility-driven lifestyles come with a social cost. Therefore asking whether quality of life can be increased with less mobility can be a way forward.

Figure 26: The potential of impact reduction through demand substitution

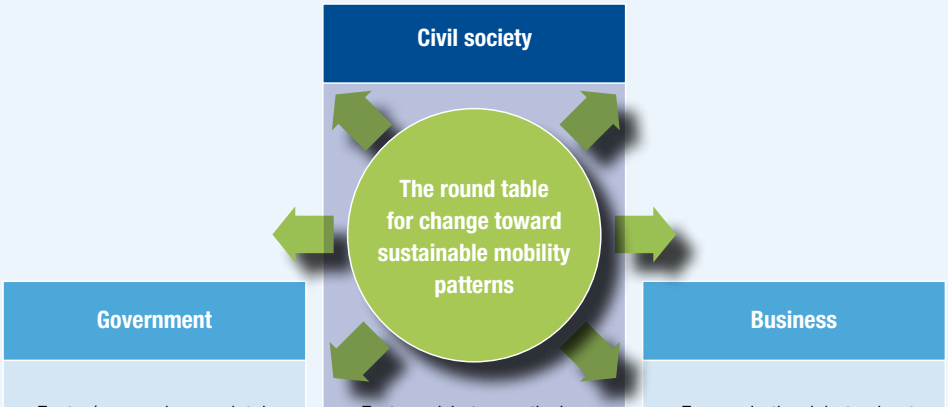


Adapted from Paech, 2005[124]

A shift to a new paradigm will not be smooth for everybody. Some traditional business models will have to change, but new opportunities will emerge. Mobility services that enhance the quality rather than the quantity of the travel experience can show a way forward when looking for business opportunities in the new mobility paradigm. This could mean that new business opportunities would substitute an existing demand rather than generate a new one[125] (see Figure 26).

For example, an opportunity of creating value for people, business and the planet in the new paradigm could be a holiday offer to a European destination with travel by a high-standard train service. The planet, too, would also be a winner because this would substitute another long-distance holiday with a higher footprint.

Box 21: Critical actions for a new mobility paradigm



Government

- Foster/engage in a societal debate about the fundamental questions of consumer society and the need for economic and mobility growth.
- Foster a societal debate on the link between wellbeing and mobility (as well as consumption in general).

Civil society

- Foster a debate questioning the fundamental assumptions of the current societal model and the possibilities to reduce hyper-mobility through engagement with people's intrinsic values.
- Engage in demonstration projects, perhaps in partnership with pioneering city governments, to demonstrate that radically less motorised mobility is feasible and can increase quality of life.
- Engage and foster grass root movements such as slow cities and slow holidays and learn how these lifestyles can be mainstreamed.

Business

- Engage in the debate about the need to question demand and the possibilities to influence it.
- Experiment with business models and strategies that would support a paradigm shift – i.e. sufficiency strategies where service and product offers aim at substituting a demand with higher impact.

Chapter 4 Multi-stakeholder innovation

4.1 Development of prototypes

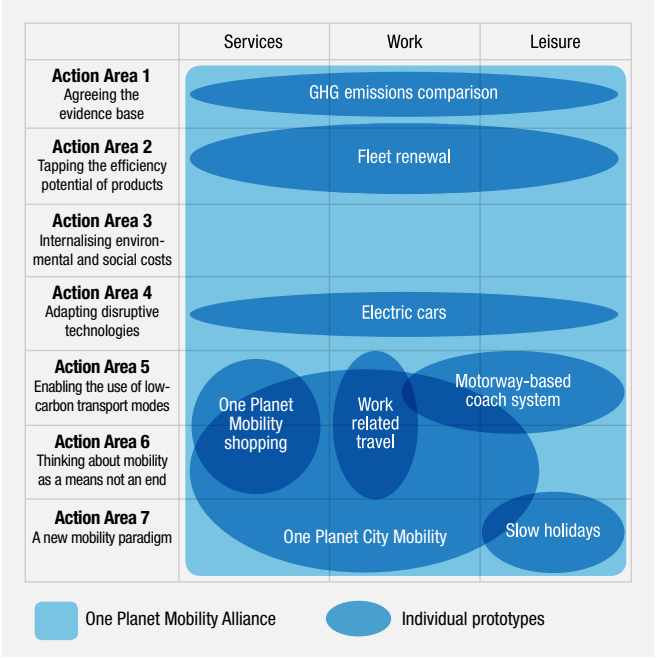
In line with the project's purpose of catalysing transformational change, participants in the One Planet Mobility project worked on the development of prototypes – collaborative projects that utilise some of the key leverage points (as described in previous Action Areas). All these prototypes have been assessed in terms of their potential for transformational change.

As acknowledged, there are no silver bullets for transformational change. The OPM prototypes don't represent the complete portfolio of actions needed for sustainable mobility, but they are designed to address fundamental drivers and underlying issues of our current systems and therefore have more chance of success than most of the quick fixes. The prototypes exemplify an approach that if replicated, scaled up and expanded to other leverage points, they could lead to systemic change in personal mobility.

Working groups and prototypes

At the second workshop held in July 2007, participants split into three learning groups: energy efficiency and sustainable technologies; urban transport; and medium to long distance travel. They generated prototype ideas from the perspective of how to address systemic barriers and levers. Each group made a short list of potential prototypes and worked on elaborating the ideas into projects. Through the consecutive three meetings during 2007, the prototypes were narrowed down to eight ideas. Figure 27 shows how these eight prototypes relate to the seven Action Areas for systemic change and how they cut across the three main purposes for travel: services (such as shopping, school and hospital), work-related travel, and leisure and holiday travel. The eight prototypes are described in detail below.

Figure 27: Action areas addressed by eight prototypes



Prototype 1: GHG emissions comparison

Where comparisons of GHG emissions have been made between personal transport modes, the assumptions and parameters used often differ (by mode, journey being compared, number of occupants etc.) This leads to distortions and misinterpretations of the emissions comparison, preventing the effective use of data.

Box 22: Prototype 1 – GHG emissions comparison

Project description

This prototype will highlight some of the impacts of travelling by various modes for particular journeys in terms of GHG emissions, making more informed comparisons possible. The project will be based on existing comparison studies in Europe, identifying what they do and do not provide. A key output of the research will be a report to raise awareness of the gaps and identify the key elements of future GHG comparison frameworks.

Activities will include updating the evidence base on GHG emissions from personal transport modes and comparisons, and demonstrating how current comparisons and the assumptions/parameters used may lead to misinterpretations of the data relating to various modes. The prototype will also begin to develop a mode comparison framework, considering the types of parameters that would need to be included.

The participants therefore agreed to set up a project that strengthens the information base of GHG emissions. It aims to investigate existing comparisons of emissions between personal transport options, and it will develop a reliable method by which more accurate comparisons could be made, taking into account a range of important factors.

In the long term, it is anticipated that this prototype may lead to the development of tools for inter and intra-modal comparisons aimed at individuals and businesses, so as to facilitate the sustainable choices of personal transport.

Prototype 2: Fleet renewal

Box 23: Prototype 2 – Fleet renewal

Project description
This project will work with four modes – air, rail, bus and car – to create a strategic direction for fleet renewal based on understanding the whole life cycle. It aims to create the following three important outputs:

- a robust understanding of fleet renewal cycle and the creation of a 'decision tree' for identifying optimal renewal/retrofit/recycling options from both environmental and financial perspectives;

- recommendations on policy instruments and new business models for encouraging optimal fleet renewal; and

- a pilot project of bus fleet renewal in Istanbul.

Vehicle and aircraft manufacturers are increasingly committed to reducing emissions. At the Geneva International Automobile Show in March 2008, car-makers presented an unprecedented range of new car models aimed at reducing emissions drastically[126]. Airbus is also committed to reducing CO_2 emissions from its planes by half until 2020[127].

However, these environmental improvements have a very slow effect on the average fleet performance since there are no (or very few) mechanisms to directly control the existing fleets. Furthermore, many old vehicles and aircraft are exported to developing countries – but there is little information or control on how those fleets are used through their entire life cycle.

OPM participants who discussed this prototype agreed that a difficulty for fleet owners is the lack of information on the optimal fleet renewal cycle – when is the best time to replace the vehicle and what kind of renewal options (retrofit, recycle, scrap etc.) can minimise full life cycle impacts. The general feeling was that there was a need for a framework that facilitates appropriate decision-making for fleet renewal.

It also became clear that a multi-stakeholder consensus needs to be established in terms of what voluntary and/or regulatory mechanisms (sticks and carrots) should be in place to achieve the optimal level of fleet renewal effectively.

"In Istanbul there is tremendous potential to improve the efficiency of existing bus fleets. Our survey shows that busses are responsible for approximately 90% of PM emissions in Istanbul. We need to identify the most effective ways to renew our fleet. This prototype provides an opportunity to develop the right policies and put them into practice"
Sibel Bülay, Director, WRI EMBARQ Istanbul. Participant in OPM

“Electric cars are more efficient than conventionally fuelled vehicles and have the potential to be powered from renewable sources. This makes them an essential part of any One Planet Mobility solution. So far, cities have not systematically incentivised the uptake of electric vehicles. Through collaborative working, this pilot project aims to better understand the barriers to change and work on solutions to dismantle them”

Craig Simmons, Director, Best Foot Forward. Participant in OPM

Prototype 3: Electric cars

Box 24: Prototype 3 – Electric cars

Project description

The first step of this project will be a review of past experiences of policy instruments intended to promote the use of electric cars. A project plan will then be developed to introduce a comprehensive policy package to be applied by city governments. With sponsorship from an electric car manufacturer, a pilot project will be rolled out in a partner city. Possible measures include the use of electric cars in the government's fleet and car sharing schemes, the introduction of lower parking charges for electric cars and the installation of power points around the city.

Liquid hydrocarbon fuels derived from crude oil currently provide 95% of the primary energy consumed in the transport sector worldwide. These fuels have caused significant environmental and social impacts, notably through their contribution to global warming as well as the degradation of biodiversity and local communities from where they are extracted and refined. Far from being close to depletion, new and more harmful oil is increasingly being extracted from oil sands and coal. This will worsen the impact of oil use.

Incremental efficiency improvements will no longer suffice but the shift towards radically different technologies that are far less reliant on oil are key to achieving a vision of OPM.

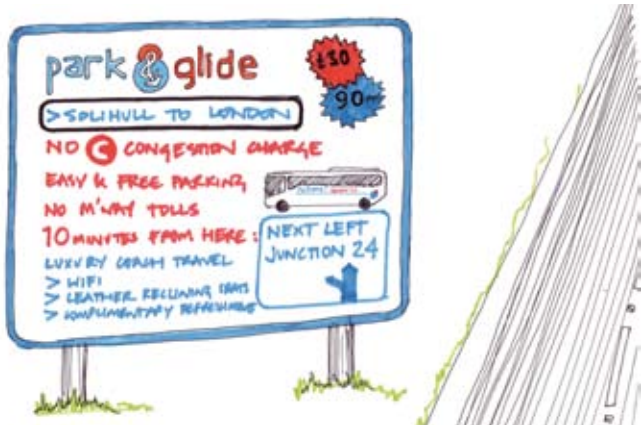
The grid connection of cars (i.e. battery-electric vehicles and plug-in hybrid vehicles) is one of the most promising ways to achieve this, since it will benefit from a higher energy (and CO_2) efficiency compared with the use of combustion engines and from future diversification of renewable energy sources[128].

However, while many European cities have experimented with the use of grid-connected cars, uptake by drivers has not taken off. The main barriers are the technological deficiencies in grid-connected cars (cost, range etc.), the lack of enthusiasm for their development among manufacturers, and the lack of recharging points.

This project aims to build a series of case studies of European cities that apply a systematic approach to increasing the use of grid-connected cars. The participants hope that these success stories will help expand the market for grid-connected cars and achieve the critical mass of their use on a global level.

Prototype 4: Motorway-based coach system

Box 25: Prototype 4 – Motorway-based coach system



Project description

This prototype will aim to demonstrate that coach travel can effectively replace cars on inter-city travel and that an alternative low-carbon use can be found for the existing motorway infrastructure.

A pilot project can be set up for a motorway route between two cities. The hypothesis to be tested is that a systemic approach and collaboration between the public sector, business and civil society (the triangle of change) can achieve the behavioural change towards low-carbon transport. In this pilot project, coaches can travel on coach-only or high occupancy lanes of a trial motorway route, whereas cars have to use the remaining lanes and may be charged (road pricing) in order to avoid more congestion on these lanes and support a shift to coach usage. This arrangement would require strong leadership from government.

A role for a coach operator could be to consider alternative business models – for example making coaches attractive for broader society by increasing the comfort of travel and stations. Local government and public transport companies could support the modal shift by providing better connections with local public transport to coach stations.
The UK could be an appropriate context setting for this project as an extensive road and motorway system is in place and there are several large coach companies that could potentially have an interest in the business opportunity of this prototype. In addition there is increasing demand for inter-city travel which alternatively would be satisfied by adding new lanes to motorways and expanding the rail network.

In the UK, coach travel is perceived as an uncomfortable and slow travel mode mainly used by low-income passengers. This prototype can directly address this by increasing speed and improving comfort while increasing the cost of car travel.

One of the barriers to a rapid transition towards radically lower carbon-intensive types of transport is the fact that most developed countries have a dense network of roads and motorways which, in Europe alone, are used by some 250 million cars[129]. A component of the One Planet Mobility vision is the switch from individual transport to low-carbon mass transport. Inter-urban transport can happen via trains and coaches. A massive switch from car to train would mean costly dismantling of motorways and roads and the resource-heavy construction of new rail track. While this might certainly be a sensible option in many places, another possibility is the use of motorways for a radical increase in coach travel to replace car usage. This would have the advantage of much lower investment costs, being achieved quickly and with low additional environmental impact compared with, say, the construction of rail track.

Prototype 5: Work-related travel

Box 26: Prototype 5 – Work-related travel

Project description
The prototype proposes the following work packages:

- Elaborate some key initial steps for organisations to reduce the impact from work-related travel – for business travel and commuting. Provide a compelling rationale for the business case.

- Put these initial steps and current best practice into the longer-term perspective of the need for One Planet Mobility. Provide a perspective of the required changes in work-related travel that can be anticipated in Europe where carbon emissions need to be reduced by around 80% by 2050, and point out the strategic (business model) implications.

- Organise an event (or a series of events) for strategic senior management to show and discuss the results of the work. Use posters showing the step approach and videos showing the message of two CEOs committed to reducing work-related travel and appealing to a senior audience to join the '80% challenge'.

"The UK Government recognises the importance of reducing the impact of work-related travel and of collaborating with businesses and other partners to achieve this"
UK Department for Transport.
Participant in OPM

As the urban sprawl has expanded and the economy has globalised further, both frequency and distance of work-related travel have rapidly increased. There are already a number of options to avoid work-related travel and reduce its impacts, such as videoconferencing, teleworking and car sharing.

Some initiatives such as the Department for Transport's (UK) National Business Travel Network (NBTN) have already been established to share and promote best practice among businesses, and encourage organisations to take them up. However, for a wider take-up there are barriers to overcome:

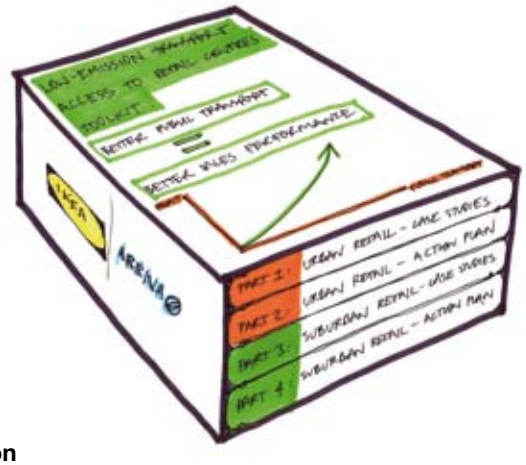
- Resistance to change internal systems or working practices;
- Lack of internal coordination or direction;
- Lack of understanding of the benefits and the business case for action.

This project aims to provide a compelling business case from a short-term "low-hanging fruit" perspective as well as to show how much business models will be affected in the long term by the need for work-related travel reduction.

The prototype can build on the work currently undertaken through WWF's One in Five Challenge, which aims to reduce business air travel through the use of videoconferencing[130].

Prototype 6: One Planet Mobility shopping

Box 27: Prototype 6 – One Planet Mobility shopping



Project description

Project activities will include identifying the environmental impacts of various business model scenarios and locations, and evaluating these business models, followed by a case study application. Existing research concerning the impacts of shopping store location on mode choice and related environmental impacts will be summarised. The case studies will consider how to develop economically feasible public transport models for suburban shopping, and how to develop a business case for an inner-city location for a major retailer.

A key environmental issue related to shopping is sustainable access to stores and distribution of goods. This is particularly true given that shopping is one of the main reasons for travel. For example, in 2006 21% of trips and 13% of travelled miles in the UK were linked to shopping[131].

This prototype considers how shopping travel can be made more sustainable by studying three elements; location, better accessibility (through smarter transport solutions) and alternative business models such as online shopping and deliveries.

The project is expected to identify tools and instruments to promote sustainable shopping, and to produce recommendations for national, regional and local government, businesses (especially retailers), and public transport operators regarding sustainable shopping practices related to travel.

“Barcelona is continuously working to improve its sustainable transport policies. Climate change is top of our agenda and we now want to engage in initiatives that make a real difference in reducing the $C0_2$ emissions from transport and demonstrate our leadership on climate change”

Pau Noy, Safe Sustainable Mobility Foundation, Barcelona. Participant in OPM

Prototype 7: One Planet City Mobility

Box 28: Prototype 7 – One Planet City Mobility

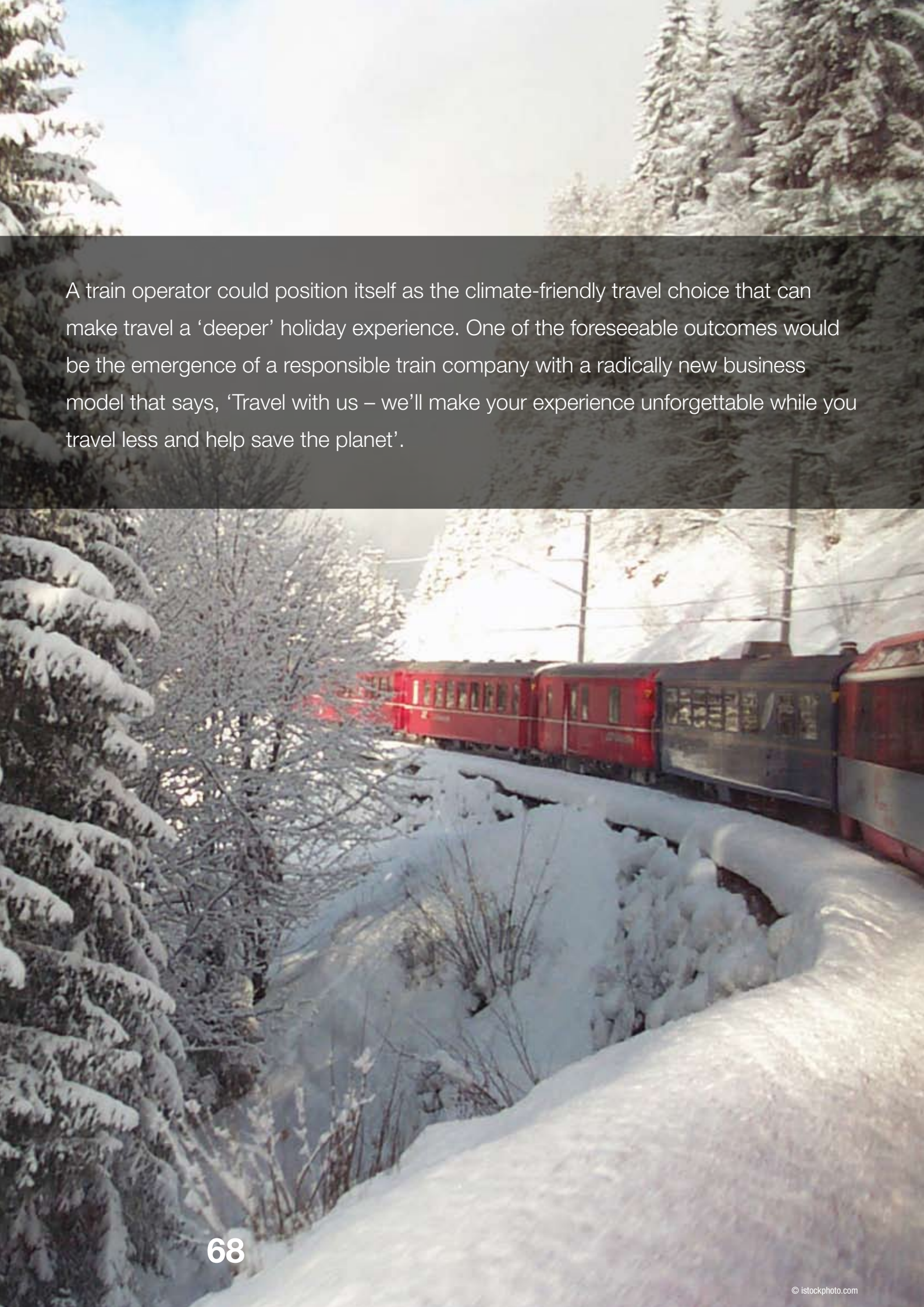
Project description

The project will use a methodology based on material flow analysis and carbon footprint to assess the baseline environmental impact data for each partner city with specific application to mobility. New software will be used to explore alternative development scenarios for each city and then create a cohesive vision for sustainable mobility. This will be tested by key decision-makers from the participating cities including representatives from business and civil society. Finally it will develop strategic approaches, set targets and facilitate activities to meet the challenge and to inspire a wider audience of stakeholders through a series of engagement tools.

A range of initiatives exist to reduce the environmental impact of urban transport. These include the exchange of best practice and benchmarking processes. However, there is a lack of comprehensive data, as well as a paucity of strategies on a local or regional level to establish long-term sustainability targets and develop scenarios on how to best achieve these targets.

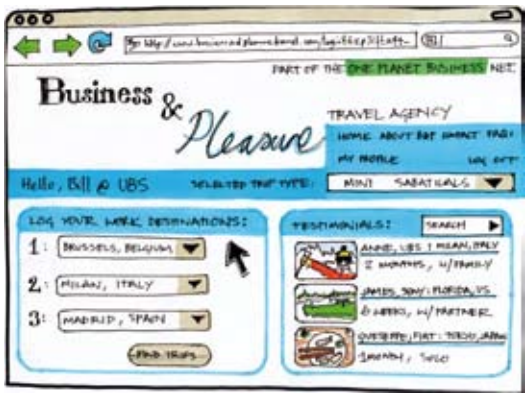
With these gaps in mind, OPM participants agreed that a project to develop a vision for sustainable urban mobility in 2030 would be a promising strategy for transformational change. It will incorporate scenarios based on mobility and sustainability data from partner cities including carbon footprint, and on wider transport decision-making such as strategies to attract international tourists.

A train operator could position itself as the climate-friendly travel choice that can make travel a ‘deeper’ holiday experience. One of the foreseeable outcomes would be the emergence of a responsible train company with a radically new business model that says, ‘Travel with us – we’ll make your experience unforgettable while you travel less and help save the planet’.



Prototype 8: Slow holidays

Box 29: Prototype 8 – Slow holidays



Project description
The idea of this prototype is to explore business models within the slow travel paradigm, and to set up pilot projects that can be scaled up and mainstreamed. A partnership between business, government and civil society will be used to remove the barriers for change and to make slow holidays an easy and attractive choice.

As part of this project, a train operator could position itself as the climate-friendly travel choice that can make travel a 'deeper' holiday experience. One of the foreseeable outcomes would be the emergence of a responsible train company with a radically new business model that says, 'Travel with us – we'll make your experience unforgettable while you travel less and help save the planet'.

European travel destinations may collaborate to make the travel experience as seamless as possible with local public transport and sustainable holiday experiences.
The project will also explore what changes to the work-life pattern are necessary for slower and longer travel, and how to engage with companies willing to pilot new approaches. It may also analyse what is needed to enable the smooth connection of different national rail networks in Europe.

"Poland is rapidly adopting western mobility patterns. In order to avoid the environmental impacts of these trends, there is a need for large-scale behaviour change. Ideas such as 'slow holidays' demonstrate real ways to change our concept of leisure travel"
Marcin Grabek, Vice-Director, Legal Department, Polish Ministry of Infrastructure. Participant in OPM

Holiday and leisure-related travel* makes the biggest contribution to personal mobility's CO_2 emissions[132]. Air travel is growing fast and is one of the biggest challenges for sustainable mobility. For overseas travel, no major technical fixes seem to be on the horizon, apart from the incremental efficiency of aircraft. Modal switch is only viable for niche groups such as adventure travellers going to Beijing from London by coach. Changing holiday travel patterns seems to be one of the hardest tasks, but given the evidence it is necessary to stop the current exponential growth of high-carbon holiday travel.

If people would take more time to discover different cultures with fewer trips per year, this would result in a radical reduction of mobility impacts from holiday travel. And if they would travel in Europe by train instead of by air, they would probably travel shorter distances. It is likely that travel would become less stressful and new travel patterns, such as combining work with leisure trips, could become more common.

The barriers to achieving this, however, are not easily overcome. It would require a considerable consumer behaviour and lifestyle change and would ultimately mean a cultural paradigm shift. Nevertheless, as the need to act against climate change seems to appeal to more people, it is worth exploring new business opportunities for this slow holiday paradigm.

* De La Fuente Layos (2007) pinpointed leisure travel as the main travel purpose (for both measures, time and distance). The carbon statistics as well as the main transport statistics use only inland transport. International aviation is excluded. This leads to lower carbon emissions than in reality[133].

Box 30: WWF reflections

WWF considers the ideas and subsequent implementation of these prototypes to be one of the most significant outcomes of the OPM project. They are currently at different stages of their development. Some of them have strong interest from stakeholders to be implemented. Others require participation from additional stakeholders or still need to secure funding.

There is potential to develop more collaborative projects through future follow-up activities (see Section 4.2). WWF will continue to support the project participants as further progress is made towards transformational change.

4.2 Towards a One Planet Mobility Alliance

Previous chapters reveal why more and closer partnerships between business, government and civil society are imperative if profound changes to personal mobility are to be made. The inertia of the current system is huge and the interests at stake are high – so the case for change requires strong and credible voices.

The One Planet Mobility project was a starting point in a process that is intended to lead to a long-term cross-sectoral partnership of agents – a One Planet Mobility Alliance – that can collectively represent a strong voice for change.

Box 31: Guiding principles for sustainable mobility

- Personal mobility is an important source of CO_2 emissions (a major GHG) and resource consumption and must make a significant contribution to achieving a One Planet Future.
- External environmental and social costs have to be internalised in order to achieve sustainability (e.g. energy prices/infrastructure investment shall reflect their true ecological costs).
- In general terms, the strategies to achieve One Planet Mobility are:
  - **Modal shift**: Shift to the most environmentally friendly mode possible and choose non-motorised transport where feasible;
  - **Travel reduction**: Improve accessibility to key services and activities and reduce frequency and length of journeys for mobility within One Planet limits; and
  - **Radical technology shift**: Achieve the rapid market penetration of radically GHG-efficient and resource-light vehicle technologies and transport systems.

Participants recognised this and acknowledged that more time and commitment would be required to make a real difference through developing and implementing action plans for change. The Alliance would be based on the concept and the guiding principles of sustainable mobility that were developed during the stakeholder process (see Box 31).
Its main purposes will be:

- **Innovation:** To develop new, cross-sectoral solutions that reduce the ecological impact of personal mobility while improving people's quality of life. This process has been started through the prototypes and would be further pursued.

- **Advocacy:** To use members' collective influence to advocate changes to market frameworks. This means we are working with governments, financial markets, industry and consumers to promote change.

- **Leadership:** To show progressive leadership by committing to reduce the life cycle impact of members' own vehicles/mobility service.

The scope of the alliance is currently under discussion. Changes may be sought in policy, the finance system, cross-sector agreements and outreach to consumers.

The collective work on innovation and advocacy could enable Alliance members to take full advantage of their progressive strategies to prosper in the future. The Alliance would help participating organisations to further develop and succeed with their sustainable business models that would otherwise not be able to compete in the market.

Conclusion

As this report shows, the seemingly unstoppable growth of high-carbon mobility patterns makes transport the only sector in Europe whose GHG emissions are still increasing.

Only through understanding the deeper drivers of this situation, such as urban sprawl, decreasing travel costs and increasing speed, can we embark on a route towards sustainable mobility.

The mobility sector requires a radical transformation far beyond pure technological fixes. This implies questioning deeply-held beliefs and assumptions.

Clearly, an extremely resourceful and carbon-efficient transport system, increasingly independent from oil, will play a crucial role.

But we will only start tackling this issue if we understand that the Earth's resources and capacity to absorb waste doesn't allow the current demand growth of mobility to continue. Indeed, more mobility doesn't always mean more quality of life for people or, in the case of business, more profits.

It will require large-scale behaviour change, and governments and business will need to support and guide people to adopt less harmful mobility patterns.

One Planet Mobility has outlined the actions that can lead towards this transformation. Some can be implemented now; others require experiments to demonstrate their feasibility. For a long-term paradigm shift, informed deliberation will be needed to question mainstream beliefs.

The triangle of change (collaboration between government, business and civil society) is essential to develop meaningful solutions and to put them into practice.

One Planet Mobility kick-started partnerships for change between these key actors. Together they have identified real opportunities for initiating systemic change, ranging from retailers reducing the impact from shopping travel to making sustainable use of existing infrastructure for motorway coach travel.

The scale of the ecological threats facing humanity requires leaders from all sectors of society to take urgent action.

We have started a journey to systemic change.

We invite other leading organisations to join us.

To find out more:
visit www.wwf.org.uk/oneplanetmobility
or contact Michael Narberhaus, mnarberhaus@wwf.org.uk

References

1 IPCC (2007): Fourth Assessment Report. Climate Change 2007. Synthesis Report.

2 UNEP (2007): Global Environment Outlook: Environment for development (GEO-4).

3 Tukker, A. (2005): Leapfrogging into the future: developing for sustainability. International Journal of Innovation and Sustainable Development 2005 – Vol. 1, No.1/2 pp. 65-84.

4 WWF (2006): Living Planet Report 2006.

5 WWF & SustainAbility (2007): One Planet Business – Creating Value Within Planetary Limits. 2007 First Edition.

6 WWF (2006): Living Planet Report 2006.

7 ippr, RSPB and WWF (2007): 80% Challenge: Delivering a low-carbon UK. Institute for Public Policy Research (ippr), Royal Society for the Protection of Birds (RSPB) & WWF.

8 Defra (2006): Avoiding Dangerous Climate Change. Scientific Symposium on Stabilisation of Greenhouse Gases, February 1st to 3rd, 2005, Meteorological Office, Exeter, United Kingdom. Conference Report.

9 WWF & SustainAbility (2007): One Planet Business – Creating Value Within Planetary Limits. 2007 First Edition.

10 Millennium Ecosystem Assessment (2005): Millennium Ecosystem Assessment Report.

11 KPMG (2008): Climate Changes Your Business – KPMG's review of the business risks and economic impacts at sector level. KPMG International. Available: http://www.kpmg.com/SiteCollectionDocuments/Climatechang_riskreport.pdf

12 KPMG (2008): Climate Changes Your Business – KPMG's review of the business risks and economic impacts at sector level. KPMG International. Available: http://www.kpmg.com/SiteCollectionDocuments/Climatechang_riskreport.pdf

13 Dixon, F. (2006): System Change – The Greatest Challenge and Opportunity Facing Business. August 22, 2006. Published on CSRwire.com

14 WWF & SustainAbility (2007): One Planet Business – Creating Value Within Planetary Limits. 2007 First Edition.

15 ippr, RSPB and WWF (2007): 80% Challenge: Delivering a low-carbon UK. Institute for Public Policy Research (ippr), Royal Society for the Protection of Birds (RSPB) & WWF.

16 German Government (2007). Speech by Angela Merkel, Chancellor of the Federal Republic of Germany, at the United Nations General Assembly. 25 September 2007, New York. Available: http://www.bundesregierung.de/nn_6566/Content/EN/Reden/2007/09/2007-09-25-bk-un-vollversammlung__en.html

17 Meadows, D. (1999): Leverage Points Places to Intervene in a System. The Sustainability Institute.

18 WWF & SustainAbility (2007): One Planet Business – Creating Value Within Planetary Limits. 2007 First Edition.

[19] WWF & SustainAbility (2007): One Planet Business – Creating Value Within Planetary Limits. 2007 First Edition.

[20] EEA (2008 d, upcoming) Environmental impacts of European consumption and production patterns and European Topic Centre for Resource and Waste Management NAMEA database. http://eea.eionet.europa.eu/Public/irc/eionet-circle/etc_waste/library?l=/na

[21] Eurostat (2007a): Panorama of Transport, Eurostat Statistical Books, Eurostat/EC Luxembourg. Available: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-DA-07-001/EN/KS-DA-07-001-EN.PDF

[22] Kendall, G. (2008): Plugged-in – The end of the oil age. WWF, Brussels.

[23] ETC/RWM (2007): Environmental Input-Output Analyses based on NAMEA data A comparative European study on environmental pressures arising from consumption and production patterns ETC/RWM working paper 2007/2.

[24] EIPRO-Study (2006): Environment Impact of Products Analysis of the life cycle environmental impacts related to the final consumption of the EU-25. Main report IPTS/ESTO project.

[25] Eurostat (2007a): Panorama of Transport, Eurostat Statistical Books, Eurostat/EC Luxembourg. Available: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-DA-07-001/EN/KS-DA-07-001-EN.PDF

[26] Eurostat (2007a): Panorama of Transport, Eurostat Statistical Books, Eurostat/EC Luxembourg. Available: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-DA-07-001/EN/KS-DA-07-001-EN.PDF

[27] Eurostat (2007b): Passenger mobility in Europe: Europeans spend most of their travel time in cars. Statistics in focus. Transport 87/2007 ISSN 1977-0316

[28] Eurostat (2007b): Passenger mobility in Europe: Europeans spend most of their travel time in cars. Statistics in focus. Transport 87/2007 ISSN 1977-0316

[29] WWF & SustainAbility (2007): One Planet Business – Creating Value Within Planetary Limits. 2007 First Edition.

[30] Johansson, et al. (2008): Exporting a high or low carbon future. Assessing CO2 emissions by including systemic effects (supporting infrastructure), using a service perspective and a dynamic approach. Industrial Ecology, KTH.

[31] Kato, H; Shibahara, N; Motohiro, O; Yoshitsuga, H. (2005): A life cycle assessment for evaluating environmental impacts of inter-regional high-speed mass transit projects, Journal of the Eastern Asia Society for Transportation Studies, Vol 6, pp 3211-3224, 2005

[32] Lähteenoja, S.; Lettenmeier, M.; Saari, A. (2006). Transport MIPS - The natural resource consumption of the Finnish transport system. The Finnish Environment 820en, Ministry of Environment, Finland. Available: http://www.ymparisto.fi/default.asp?contentid=265959&lan=FI&clan=en

[33] Adams, J. (2005): “Hyper-mobility: a challenge to governance” in Lyall, C. and Tait, J. (Editors), New Modes of Governance: Developing an Integrated Policy Approach to Science, Technology, Risk and the Environment, Ashgate, Aldershot.

[34] Adams, J. (2005): “Hyper-mobility: a challenge to governance” in Lyall, C. and Tait, J. (Editors), New Modes of Governance: Developing an Integrated Policy Approach to Science, Technology, Risk and the Environment, Ashgate, Aldershot.

[35] Adams, J. (2005): “Hyper-mobility: a challenge to governance” in Lyall, C. and Tait, J. (Editors), New Modes of Governance: Developing an Integrated Policy Approach to Science, Technology, Risk and the Environment, Ashgate, Aldershot.

[36] International Transport Forum 2007: Investment in Transport Infrastructure 1992-2005. http://www.internationaltransportforum.org/ statistics/investment/overview.htm

[37] New Economics Foundation – NEF (2007): The European (Un)happy Planet Index: An index of carbon efficiency and well-being in the EU. NEF and Friends of the Earth. Available: http://www.neweconomics.org/gen/uploads/zeyhlcuhtfw0ge55lwnloi4520082007141551.pdf

[38] EEA (2007a): Europe’s Environment – The Fourth Assessment. State of the environment report No 1/2007

[39] EEA (2008a): Climate for a transport change. TERM 2007: indicators tracking transport and environment in the European Union. EEA Report/No 1/2008

[40] EEA (2008a): Climate for a transport change. TERM 2007: indicators tracking transport and environment in the European Union. EEA Report/No 1/2008

[41] EEA (2008a): Climate for a transport change. TERM 2007: indicators tracking transport and environment in the European Union. EEA Report/No 1/2008

[42] EC (European Commission) (2001): European Transport Policy for 2010: Time to decide. Luxembourg: Office for Official Publications of the European Communities. Available: http://ec.europa.eu/transport/white_paper/documents/doc/lb_texte_complet_en.pdf

[43] EEA (2008b): Greenhouse gas emission trends (CSI 010) - Assessment published Feb 2008.

[44] IPCC (2007): Fourth Assessment Report. Climate Change 2007. Synthesis Report.

[45] EEA (2007c): Transport and environment: on the way to a new common transport policy. TERM 2006: indicators tracking transport and environment in the European Union. EEA Report/No 1/2007.

[46] EEA (2008a): Climate for a transport change. TERM 2007: indicators tracking transport and environment in the European Union. EEA Report/No 1/2008

[47] EEA (2008a): Climate for a transport change. TERM 2007: indicators tracking transport and environment in the European Union. EEA Report/No 1/2008

T&E (European Federation for Transport and Environment) (2007): Regulating CO2 emissions of new cars. Background Briefing. October 2007. Available: http://www.transportenvironment.org/Pages/Cars-and-CO2/

[48] Bongardt, D.; Kebeck, K. (2007): New governance or symbolic policy? – Evaluation and recommendations for the agreement between the European Commission and the automobile industry. ECEEE 2007 Summer Study Saving Energy Just do it!

[49] Throne-Holst, H. (2003): The Fallacies of Energy Efficiency: The Rebound Effect? Paper presented at the Strategies for sustainable energy technology workshop in Trondheim, Arranged by the SAMSTEMT programme of the Norwegian Research Council, November 20-21, 2003. Available: http://www.sifo.no/files/file54378_trondheim_paper_nov2003.pdf

[50] EEA (2008a): Climate for a transport change. TERM 2007: indicators tracking transport and environment in the European Union. EEA Report/No 1/2008

[51] Enerdata (2006): Energy Efficiency Indicators. CD-ROM energy efficiency and consumption data for EU-15.

[52] Enerdata (2006): Energy Efficiency Indicators. CD-ROM energy efficiency and consumption data for EU-15.

[53] EEA (2005). Household consumption and environment. EEA Report/No 11/2005.

[54] Herring, H. (2006): Rebound Effect. The Encyclopaedia of Earth.

[55] European Commission (2007): Communication from the Commission to the Council and the European Parliament. Renewable Energy Road Map. Renewable energies in the 21st Century: building a more sustainable future. COM (2006) 848 final. Brussels, 10 January 2007.

[56] The Guardian. (2008): Food crisis will take hold before climate change, warns chief scientist. Available: http://www.guardian.co.uk/science/2008/mar/07/scienceofclimatechange.food

[57] Taylor, J. (2007): How the rising price of corn made Mexicans take to the streets. The Independent, 23 June 2007. Available: http://www.independent.co.uk/news/world/americas/how-the-rising-price-of-corn-made-mexicans-take-to-streets-454260.html

[58] Oxfam (2007): Signing Away The Future How trade and investment agreements between rich and poor countries undermine development. Oxfam Briefing Paper 101. Available: http://www.oxfam.org/en/files/bp101_regional_trade_agreements_0703

[59] Zimmer, W.; Fritsche, U. (2008): Klimaschutz und Straßenverkehr. Effizienzsteigerung und Biokraftstoffe und deren Beitrag zur Minderung der Treibhausgasemissionen. Kurzstudie für die Friedrich-Ebert-Stiftung, Bonn. ISBN: 978-3-89892-916-5.

[60] DTI (2007): Meeting the Energy Challenge. A White Paper on Energy http://www.berr.gov.uk/files/file39387.pdf

[61] BBC (2007a): 'EU car CO2 fight only beginning'. By Stephen Mulvey, BBC News Channel, 7 February 2007.

[62] EEA (2007a): Europe's Environment – The Fourth Assessment. State of the environment report No 1/2007

[63] Schafer, A. (1998): The Global Demand for Motorized Mobility. Transportation Research A, 32(6), 455-477.

[64] Theobald, William F. (2005): Global Tourism. Elsevier.

[65] FAZ (2006): 'Mehr ICE-Züge nach Köln'. by Christian Siedenbiedel. Frankfurter Allgemeine Zeitung (FAZ). 31 August 2006.

[66] Demuth, N. (2004). Der ICE als Pendler- und Vorortzug? Die ICE-Bahnhöfe Montabaur und Limburg – Impulse für Wohlstandortwahl, Wohnsiedlungsentwicklung und berufliche Mobilität. Masters Thesis Work. University of Trier.

[67] International Herald Tribune (2007): 'With high-speed train, Italy on track for increasing real estate prices'. By Eric Sylvers, International Herald Tribune, 6 December 2007.

[68] van Wee, Bert, Robert van den Brink and Hans Nijland (2003): 'Environmental impacts of high-speed rail links in cost–benefit analyses: a case study of the Dutch Zuider Zee line' Transportation Research Part D: Transport and Environment Volume 8, Issue 4, July 2003, pp. 299-314

[69] Kemp, R. (2004): Environmental impact of high-speed rail. Institution of Mechanical Engineers High Speed Rail Developments 21 April 2004.

[70] Gommers, M. (1999): Towards the Green Environment. Comparison of Environmental Impacts of Urban Public Transport and Automobiles. Working Paper 1999.6 Fondazione Eni Enrico Mattei.

[71] EEA (2005). Household consumption and environment. EEA Report/No 11/2005.

[72] EEA (2005). Household consumption and environment. EEA Report/No 11/2005.

[73] International Trade Administration (ITA) (2007): the Impact of the 2007 US-EU Open Skies Air Transport Agreement. ITA Occasional Paper no. 07-001, May 2007. Available: http://trade.gov/media/publications/pdf/openskies_2007.pdf

Booz Allen Hamilton (2007): The Economic Impacts of an Open Aviation Area between The EU and the Us. Executive Summary. January 2007. Prepared for: Directorate General Energy And Transport European Commission.

[74] EEA (2006a): Urban Sprawl in Europe. EEA Briefing 2006/4. Available: http://reports.eea.europa.eu/briefing_2006_4/en/eea_briefing_4_2006.pdf

[75] EEA (2006b): Urban sprawl – Europe's ignored environmental challenge. EEA News release. 24 November 2006. http://nfp-bg.eionet.eu.int/ncesd/eng/inform1.htm

[76] SQW (2007): Valuing the benefits of cycling: A report to Cycling England. Available: http://www.cyclingengland.co.uk/viewer.php?fd=225

[77] UK Sustainable Consumption Roundtable (2006): I will if you will. Towards sustainable consumption.

[78] Mont, O.; Emtairah, T. (2007). Systemic Changes for Sustainable Consumption and Production. Proceedings: Changes to Sustainable Consumption, 20-21 April 2006, Copenhagen, Denmark. Workshop of the Sustainable Consumption Research Exchange (SCORE!) Network.

[79] Demos and Green Alliance (2004) Carrots, sticks and sermons.

[80] Jackson, T. (2005): Motivating Sustainable Consumption. Centre for Environmental Strategy, University of Surrey, January 2005.

[81] Litman, T (2007): Rebound Effects: Implications for Transport Planning, TDM Encyclopaedia, VTPI, CA. Available: http://www.vtpi.org/tdm/tdm64.htm

[82] Tyndall Centre for Climate Change Research (2006): Growth Scenarios for EU & UK Aviation: Contradictions with Climate Policy. By Anderson, K.; Bows, A.; Upham, P. Working Paper No 84.

[83] Anderson K., Bows A., Upham P. (2006): Growth scenarios for EU & UK aviation: contradictions with climate policy. Tyndall Centre. Available: http://www.tyndall.ac.uk/publications/working_papers/wp84.pdf

[84] Transport for London (2008): Congestion Charging Impacts monitoring, Sixth Annual Report, July 2008

[85] Kendall, G. (2008): Plugged-in – The end of the oil age. WWF, Brussels.

[86] Corporate Europe Observatory (2007): Car industry flexes its muscles, Commission bows down Briefing paper, Corporate Europe Observatory (CEO), 16 March 2007.

[87] Kendall, G. (2008): Plugged-in – The end of the oil age. WWF, Brussels.

WWF and The Co-operative Group (2008): Unconventional Oil: Scraping the bottom of the barrel? Available: www.panda.org/oilsands

[88] Paine, Chris (2006): Who killed the electric car? A lack of consumer confidence... or conspiracy? Documentary film.

[89] Automotive News Europe: http://www.autonews.com/section/ANE

[90] Dixon, F. (2007): Sustainable Systems Implementation – Building a Sustainable Economy and Society. Published on CSRwire.com and GlobalSystemChange.com.

[91] Litman, T. (2007): Rebound Effects: Implications for Transport Planning, TDM Encyclopaedia, VTPI, CA. Available: http://www.vtpi.org/tdm/tdm64.htm

[92] Senge, P. (2006) [original 1990]: The Fifth Discipline: The Art and Practice of the Learning Organization (rev. ed.). New York: Doubleday.

[93] Pratt, N. (2007): A Systems Perspective on Sustainability – Contributing to Sustainability Science, University Witten/Herdecke (thesis).

[94] Senge, et al. (1994): The Fifth Discipline Fieldbook Strategies and Tools for Building a Learning Organization. Doubleday.

[95] UK Sustainable Consumption Roundtable (2006): I will if you will. Towards sustainable consumption.

[96] Balasubramanian, G. et al. (2007): Birth of the Bhavishya Alliance – Learnings and Insights. Version 2.3.

[97] Scharmer, O. (2007): Theory U. Leading from the Future as it Emerges. The Social Technology of Presencing, Society of Organisational Learning

[98] Tukker, et. al. (2007): Fostering Change to Sustainable Consumption and Production – An Evidence Based View. A Note from the Field based on a SCORE! Policy brief distributed at the Third Expert Meeting of the 10 Year Framework of Programmes on Sustainable Consumption and Production (SCP), Stockholm, Sweden, 26-29 June 2007. Journal of Cleaner Production.

[99] Meadows, D. (1999): Leverage Points Places to Intervene in a System.
The Sustainability Institute.

[100] Dixon, F. (2007): Sustainable Systems Implementation – Building a Sustainable Economy and Society. Published on CSRwire.com and GlobalSystemChange.com.

[100] Potter, S. (2003): Transport Energy and Emissions: Urban Public Transport. Department of Design and Innovation Faculty of Technology the Open University Great Britain.

[101] Schmid, S.A. 2005. Benchmark for future vehicle concepts. Presentation at ‘Verkehrstechnischer Tag des DLR 2005’, Berlin. Revised 2008 by the author.

[102] Arthur D. Little (2007): CO2 @ automotive OEMs – What to do in the short term?
By Stefan Lippautz, Nick Toone and Simon Schnurrer.

[103] Arthur D. Little (2007): CO2 @ automotive OEMs – What to do in the short term?
By Stefan Lippautz, Nick Toone and Simon Schnurrer.

[104] British Airways (2008): Air transport and climate change. Available: http://www.britishairways.com/travel/crglobalwarm/public/en_gb

easyJet. (2008): Consumers to lose out as European Parliament calls for higher airfares and more “green tape”. easyJet presents three-point strategy to make aviation more environmentally efficient. Available: https://www.easyjet.com/EN/News/make_aviation_more_environmentally_efficient.html

[105] Schallaboeck et al. (2007): Schallaboeck, Karl Otto et al (2007): Klimaschutz und PKW Verkehr: Einordnung Aktuell Diskutierter Ansaetze. Available: http://www.wupperinst.org/de/publikationen/entwd/index.html?&beitrag_id=550&bid=160

[106] BBC (2007b): Sarkozy details green France plan. BBC News. 25 October 2007. http://news.bbc.co.uk/1/hi/world/europe/7062577.stm

[107] Anslow, M. (2007): It is electrifying. The Ecologist. Available: http://www.theecologist.org/pages/archive_detail.asp?content_id=927

[108] SenterNovem. (n.d.): Green Funds Scheme. http://www.senternovem.nl/greenfundsscheme/index.as

[109] Arthur D. Little (2007): CO2 @ automotive OEMs – What to do in the short term? By Stefan Lippautz, Nick Toone and Simon Schnurrer.

[110] Eurostat (2005): Eurostat statistics from Eurostat website data section (previously known as New Cronos database). European Union energy and transport in figures – 2004 http://dataservice.eea.europa.eu/atlas/viewdata/viewpub.asp?id=1503

[111] Eurostat (2005): Eurostat statistics from Eurostat website data section (previously known as New Cronos database). European Union energy and transport in figures – 2004 http://dataservice.eea.europa.eu/atlas/viewdata/viewpub.asp?id=1503

[112] EEA (2008a): Climate for a transport change. TERM 2007: indicators tracking transport and environment in the European Union. EEA Report/No 1/2008.

[113] Institute for Transportation and Development Policy (2007): Jakarta Bus Rapid Transit. Available: http://www.itdp.org/index.php/projects/detail/jakarta_brt%20

[114] WBCSD (2004): Meeting the Challenges of Sustainability. The Sustainable Mobility Project. Full Report 2004. Available: http://www.wbcsd.org/web/publications/mobility/mobility-full.pdf

[115] Tukker, et. al. (2007): Fostering Change to Sustainable Consumption and Production – An Evidence Based View. A Note from the Field based on a SCORE! Policy brief distributed at the Third Expert Meeting of the 10 Year Framework of Programmes on Sustainable Consumption and Production (SCP), Stockholm, Sweden, 26-29 June 2007. Journal of Cleaner Production.

[116] Paech,N. (2005): Nachhaltiges Wirtschaften jenseits von Innovationsorientierung und Wachstum, Metrolpolis Verlag.

[117] Arthur D Little. (2007): The Carbon Margin. Translating Carbon Exposure into Competitive Advantage. By David Lyon, Melissa Barrett, Davide Vassallo and Romeu Gaspar. Available: http://kunden.fleishman.de/adl/pictures/ADL_CM.pdf

[118] WWF (2008a): Travelling light – Why the UK’s biggest companies are seeking alternatives to flying. One Planet Future. http://www.wwf.org.uk/filelibrary/pdf/travelling_light.pdf

[119] WWF (2008a): Travelling light – Why the UK’s biggest companies are seeking alternatives to flying. One Planet Future. http://www.wwf.org.uk/filelibrary/pdf/travelling_light.pdf

[120] Johnson, R. P. (1994): Ten Advantages to Telecommuting: In the Areas of Conserving Energy, Protecting the Environment, Promoting Family Values, and Enhancing Worker Safety. Available: http://www.orednet.org/venice/rick/telecommute/telebenefits.html.

[121] EEA (2008b): Greenhouse gas emission trends (CSI 010) – Assessment published February 2008.

[122] Project Better Place (2008): Business Model. http://www.projectbetterplace.com/project-better-place/business-model

[123] WWF (2008b): Weathercocks and Signposts. Available at: http://www.wwf.org.uk/strategiesforchange

[124] Paech,N. (2005): Nachhaltiges Wirtschaften jenseits von Innovationsorientierung und Wachstum, Metrolpolis Verlag.

[125] Paech,N. (2005): Nachhaltiges Wirtschaften jenseits von Innovationsorientierung und Wachstum, Metrolpolis Verlag.

[126] International Herald Tribune (2007): 'With high-speed train, Italy on track for increasing real estate prices'. By Eric Sylvers, 6 December 2007.

[127] Airbus (2007): "Airbus commits to ambitious environmental targets and calls for sector to become Eco-Efficient", Airbus press release, 14 July.

[128] Kendall, G. (2008): Plugged-in – The end of the oil age. WWF, Brussels.

[129] ACEA (European Automobile Manufacturer's Association) (2006): Vehicles in use. Available: http://www.acea.be/index.php/news/news_detail/vehicles_in_use/

[130] WWF (2008a): Travelling light – Why the UK's biggest companies are seeking alternatives to flying. One Planet Future. http://www.wwf.org.uk/filelibrary/pdf/travelling_light.pdf

[131] Department of Transport (2007). Transport Statistics Great Britain. 2007 Edition. Available: http://www.dft.gov.uk/162259/162469/221412/217792/2214291/TSGB2007Final_linksV12.pdf

[132] Eurostat (2007b): Passenger mobility in Europe: Europeans spend most of their travel time in cars. Statistics in focus. Transport 87/2007 ISSN 1977-0316

[133] Commission for Integrated Transport (2007): Transport and Climate Change. Advice to the Government from the Commission from Integrated Transport. http://www.cfit.gov.uk/docs/2007/climatechange/pdf/2007climatechange.pdf

To find out more:

visit www.wwf.org.uk/oneplanetmobility

or contact Michael Narberhaus, mnarberhaus@wwf.org.uk

The following organisations were among more than 30 organisations that participated in the One Planet Mobility project:

The views expressed in this report do not necessarily represent those of individual participating organisations.

Process design and facilitation:

The mission of WWF is to stop the degradation of the planet's natural environment and to build a future in which humans can live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- reducing pollution and wasteful consumption

WWF-UK

Panda House, Weyside Park
Godalming, Surrey GU7 1XR
Telephone: 01483 426444
Fax: 01483 426409

Website: www.wwf.org.uk

for a living planet