



20 Percent Transport

VISIONING AND BACKCASTING
FOR TRANSPORT IN LONDON

VIBAT London

SEPTEMBER 2009



Building sustainable communities



HIGHER EDUCATION
FUNDING COUNCIL
FOR ENGLAND



20 Percent Transport

VISIONING AND BACKCASTING
FOR TRANSPORT IN LONDON

VIBAT London

EXECUTIVE SUMMARY

Halcrow Group
Oxford University (Transport Studies Unit)
Space Syntax

Dr Robin Hickman

Halcrow Group and Oxford University
(Transport Studies Unit)

Olu Ashiru

Takedo International and Halcrow Group

Professor David Banister

Oxford University (Transport Studies Unit)

SEPTEMBER 2009

Published by

Halcrow Group
Vineyard House
44 Brook Green
London
W6 7BY

<http://www.halcrow.com>
www.vibat.org
www.urbanbuzz.org

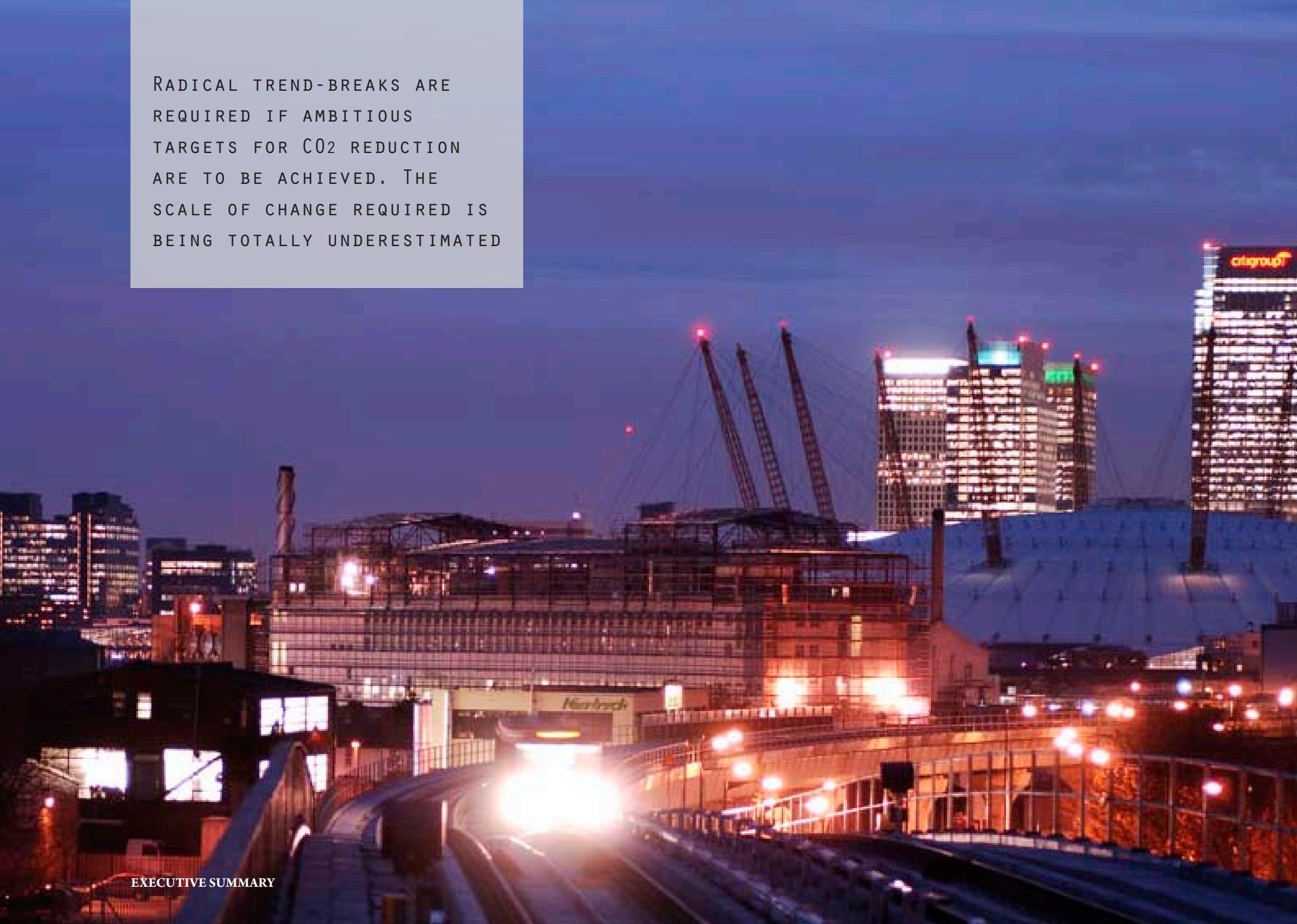
First published 2009
Further copies of this executive summary
are available from the Halcrow Group
A catalogue record for this book is
available from the British Library
ISBN: 978-0-9561971-0-8
© Halcrow Group

This publication may be reproduced free of charge
in any format or medium for non-commercial research,
private study or for internal circulation within an organisation
subject to the source being acknowledged. For any other
use of this material please write to the Halcrow Group.

Contents

01 Achieving carbon efficient transport: backcasting from London	2
02 The baseline	6
03 Images of the future	10
04 Packaging the policy levers	13
05 Potential policy packages and pathways	17
06 'Known unknowns': international air travel and 'enabling mechanisms'	25
07 Conclusions: backcasting from 2025	27
Acknowledgements	29

RADICAL TREND-BREAKS ARE
REQUIRED IF AMBITIOUS
TARGETS FOR CO₂ REDUCTION
ARE TO BE ACHIEVED. THE
SCALE OF CHANGE REQUIRED IS
BEING TOTALLY UNDERESTIMATED



01

Achieving Carbon Efficient Transport: Backcasting from London

Climate change and projected rises in greenhouse gas (GHG) emissions pose a major challenge for the world. Population growth, increased average incomes and material consumption mean that reducing emissions becomes very difficult. The transport sector contributes around 25% of carbon dioxide (CO₂) emissions in the UK, yet remains the only major sector that makes no contribution to emission reductions. Trend-breaking futures are required to help mitigate and adapt to the potential impacts of global warming.

This executive summary draws on findings from the VIBAT London study (Visioning and Backcasting for Transport in London*). The study considers the pathways towards a 60% reduction in transport CO₂ emissions by 2025, and an 80% reduction by 2050, on 1990 levels. The ultimate goal is thus **20% transport**: a transport system that facilitates a high quality of life within London, yet emits just 20% of CO₂ emissions based on 1990 levels.

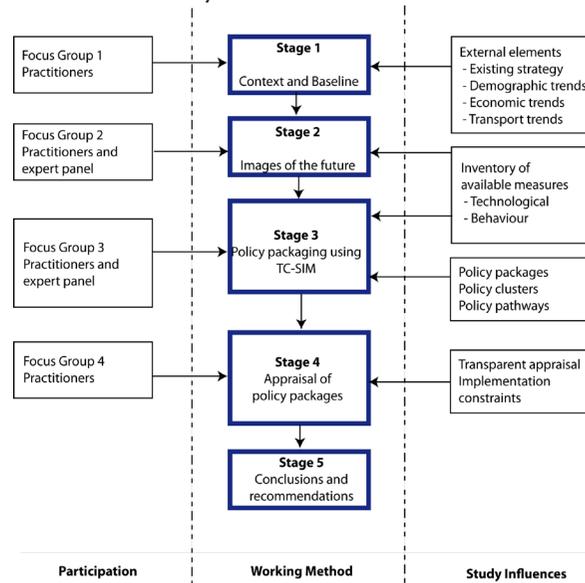
THE TRANSPORT
SECTOR REMAINS
THE ONLY MAJOR
SECTOR THAT MAKES
NO CONTRIBUTION
TO EMISSION
REDUCTIONS

London is used as a case study and a simulation model of the city is developed to examine and test potential future scenarios for different levels of application of different policy packages.

London provides a very interesting case study as per capita transport emissions, particularly in inner London, are the lowest in the UK. There are already impressive efforts to fund and develop sustainable transport measures.

*The VIBAT London study reports are hosted on www.vibat.org, along with outputs from the wider VIBAT series of studies. The transport and carbon simulation model (TC-SIM) can also be viewed via the VIBAT website.

Figure 2: The VIBAT London Study Process



Futures studies have been increasingly used in the last few decades to illustrate what might happen to society in adapting to challenging future trends and targets. This study follows a backcasting study approach (Figure 3). Backcasting has been developed as a particular niche of futures analysis, as a complementary method to forecasting and scenario building. It is a methodology particularly suitable for analysing topics that require trend-breaks – e.g. sustainable transport. There was a particularly

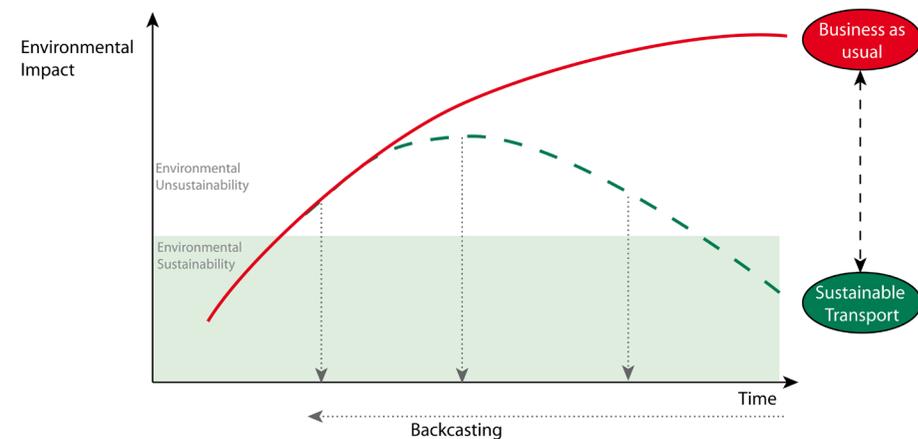
strong backcasting debate in Sweden in the 1980s over energy futures. Much of the initial working methodology was developed in this period (Johansson et al., 1983). The well-known OECD project on Environmentally Sustainable Transport (EST – OECD, 2000) and the EU-POSSUM project (POSSUM, 1997; and Banister et al, 2000) introduced the backcasting methodology to the transport planning field in Europe. It has since been used in the VIBAT-UK study (Hickman and Banister, 2006) and elsewhere.

BACKCASTING IS A METHODOLOGY PARTICULARLY SUITABLE FOR ANALYSING TOPICS THAT REQUIRE TREND-BREAKS

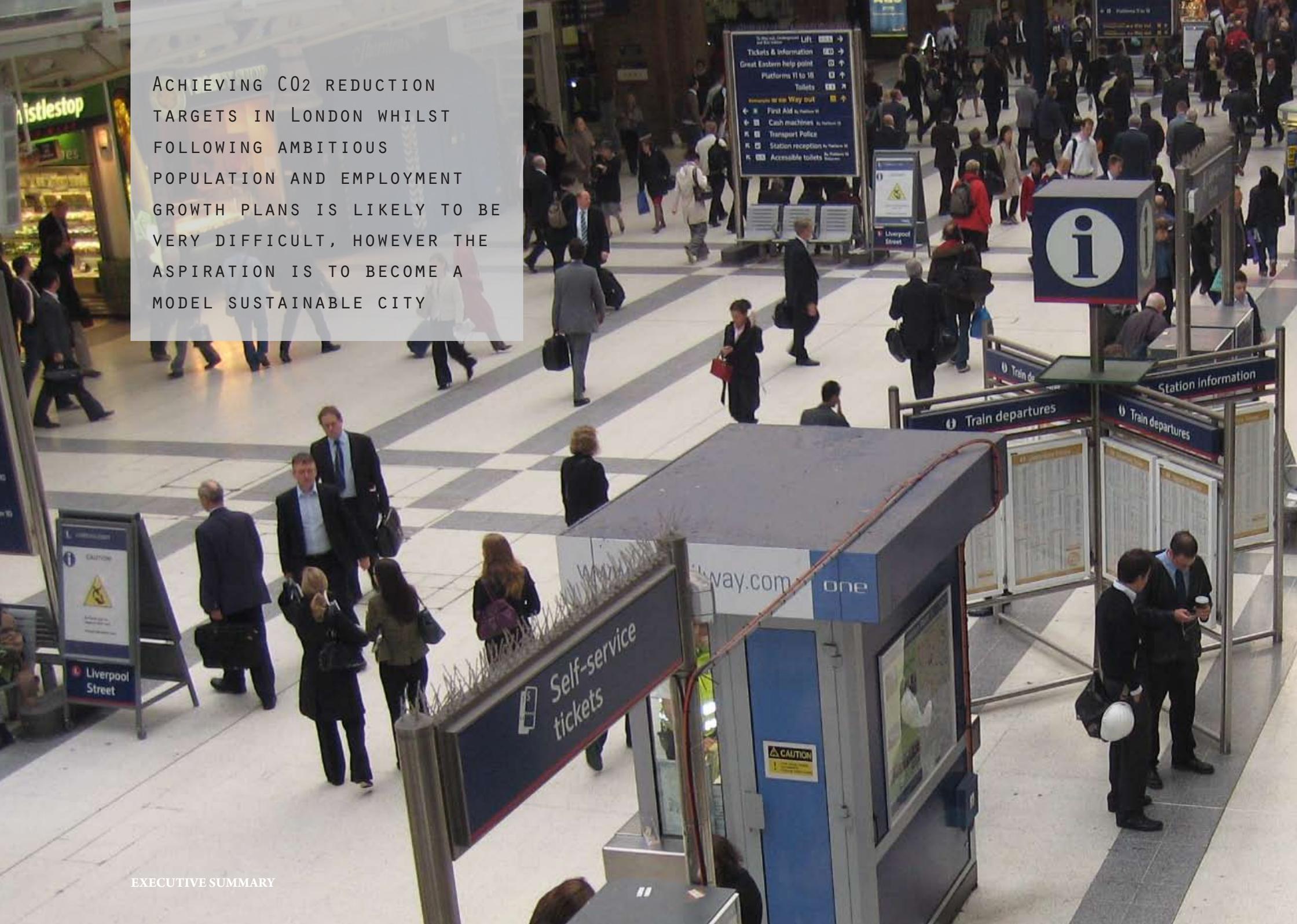
The backcasting methodology seeks to develop a policy pathway to an agreed trend-break future. Instead of starting with the present situation and projecting prevailing trends (forecasting), the backcasting approach designs images

of the future, representing desirable solutions to societal problems, and ‘casts back’ to the present. A policy pathway, or programme, is then developed to achieve this desirable future.

Figure 3: The Backcasting Study Approach



ACHIEVING CO2 REDUCTION TARGETS IN LONDON WHILST FOLLOWING AMBITIOUS POPULATION AND EMPLOYMENT GROWTH PLANS IS LIKELY TO BE VERY DIFFICULT, HOWEVER THE ASPIRATION IS TO BECOME A MODEL SUSTAINABLE CITY





02

The Baseline

London is aiming to become a ‘model’ sustainable city that can combine population growth with economic prosperity and a fair society, but at the same time reduce its carbon emissions. Current levels of emissions (2006) in London are around 44 MtCO₂ (million tonnes of carbon dioxide). Achieving large reductions in carbon emissions, whilst retaining economic and quality of life goals, is likely to be difficult, even with a static population and employment base. Add in large population and economic growth and the task to reduce aggregate emissions becomes considerable. London’s population is expected to grow by 23% to 9 million in 2050 from 2006 levels, and the economy will grow by between 100% and 150% over the same period (GLA, 2004).

To help tackle this great challenge, a large amount of strategic forward planning and analysis has been carried out by the public agencies in London. Transport for London has produced Transport 2025 (T2025) (TfL, 2006a) and the Mayor’s Transport Strategy (TfL, 2006b). The Greater London Authority has produced the London Plan (GLA, 2004) and Climate Change Action Plan (CCAP) (GLA, 2007). The new Mayor has recently produced his initial vision for transport in London (Way to Go – GLA, 2008), which will be translated into a revised Transport Strategy for London. The headline CO₂ reduction targets adopted for London are as follows:

- T2025: a 30% reduction in CO₂ emissions by 2025, across all sectors, on a 1990 base;
- CCAP: a 60% reduction in CO₂ emissions by 2025, across all sectors, on a 1990 base.

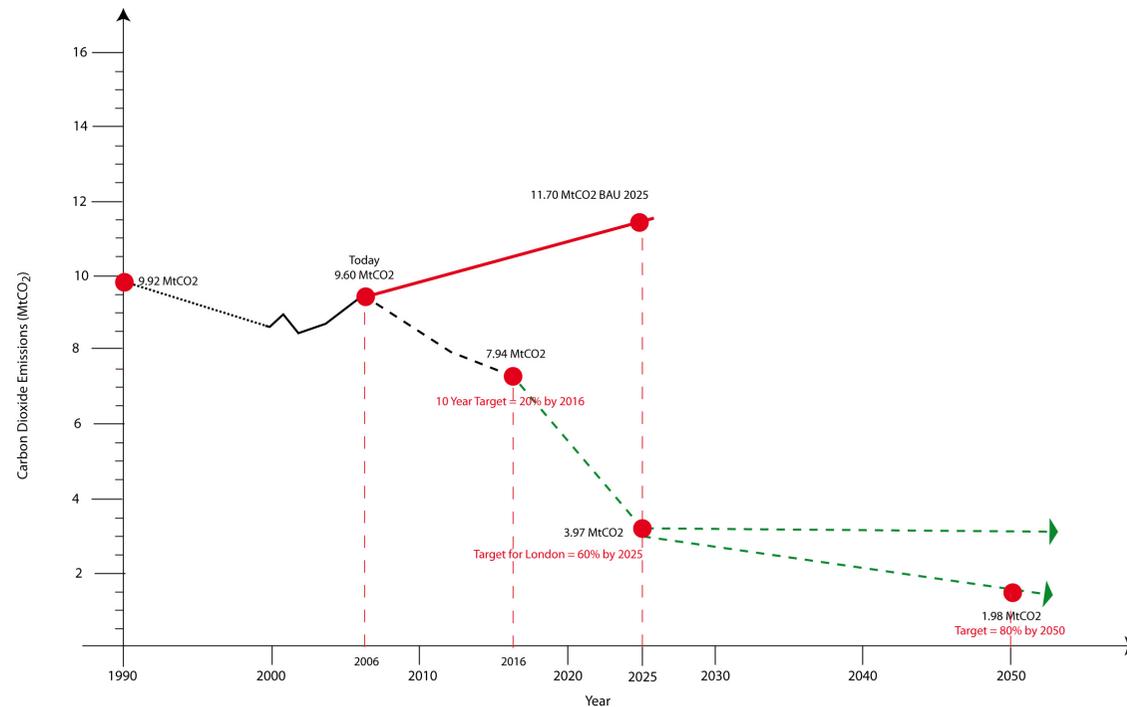
The strategic aspiration for a 60% reduction in CO₂ emissions by 2025 is thus very ambitious, albeit with no specific transport sector target (Table 1 and Figure 4).

This study develops and explores likely pathways towards these targets - a 60% reduction in transport CO₂ emissions by 2025, and an 80% reduction by 2050, on 1990 levels. The ultimate goal is thus 20% transport.

Table 1: CO₂ Projections and Targets for London, excluding Aviation (MtCO₂)

Scenario	1990	2006	2025	2050
BAU projection (cross sectoral)	45.1	44.3	51.0	
BAU projection (ground transport)	9.9	9.6	11.7	
T2025 target (cross sectoral) 30% reduction by 2025 on a 1990 baseline			31.6	
CCAP target (cross sectoral) 60% reduction by 2025 on a 1990 baseline			18.0	
VIBAT London target (ground transport only) 60% reduction by 2025 on a 1990 baseline 80% reduction by 2025 on a 1990 baseline			4.0	2.0

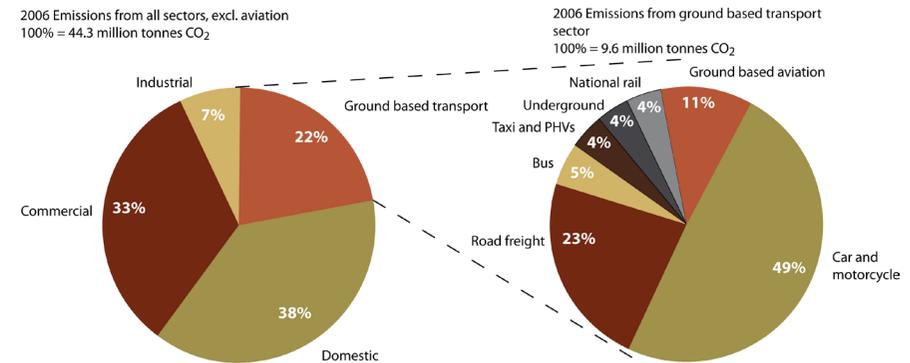
Figure 4: CO₂ Baseline, Projection and Target (Ground Transport)



Within London, the transport sector accounts for 22% of ground-based transport CO₂ emissions (9.6 MtCO₂) (Figure 5). This proportion rises dramatically if aviation is included. The allocation for London, as used in the Climate Change Action Plan (GLA, 2007), is that half of emissions from all flights landing at London airports are allocated to London residents' emissions. This results in the aggregate transport emissions rising to 48%. Within the ground-based transport sector, car-based CO₂ emissions (49%) and road freight (23%) dominate.



Figure 5: Transport CO₂ Emissions Disaggregated



The policy response at the UK level has been extremely slow in development. Top-down target setting has gradually produced more stringent policy targets, but in all cases international aviation is excluded. In the UK, the Kyoto Protocol (1997) seeks to achieve a 12.5% reduction in six GHG below 1990 levels over the period 2008-2012. The Protocol expires in 2012 and negotiations are ongoing for a replacement agreement. The UK domestic target was for a 20% reduction of CO₂ emissions below 1990 levels by 2010 (DETR, 2000). Current projections are that this target will not be met without the purchase of permits through the EU Emissions Trading Scheme.

An 80% CO₂ emissions reduction target, on a 1990 base, has recently been adopted by the Department for Energy and Climate Change (2008). The new Climate Change Act (2008) means this has become legally binding.

The striking feature of all these targets is the huge gap between BAU projections and the emissions reduction targets. Achieving this scale of change is likely to be very difficult as it involves substantial new thinking, on both the range and scale of all policy interventions.

FUTURE DRIVERS?
TECHNOLOGICAL DEVELOPMENTS
NEED TO BE TARGETED TOWARDS
ACHIEVING SUSTAINABILITY
OBJECTIVES

03

Images of the Future

The second stage of the VIBAT London project develops alternative images of the future, images that offer a trend-break towards 'sustainable transport' relative to the BAU projection. Two images are developed, drawing on previous futures work, particularly the VIBAT-UK study (Hickman and Banister, 2006) and the DTI Foresight Intelligent Infrastructure Futures study (DTI Foresight, 2006).

A number of drivers of change are taken into account, such as: changing demographic and household structures, including an ageing, yet more active population (greater demand for mobility - passengers and goods);

increasing world trade and globalisation, emergence of networked organisations, clusters and supply chains, yet the rising importance of local provision (complex flows); rapid technological developments and the emergence of 'digital natives' (the new generation growing up accustomed to technology); taxation increasingly based on resource consumption rather than income; yet decline in the power of national governments and distrust in institutions (ability to influence change); increasing awareness of sustainability issues and demand for change; and the gradual emergence of radical solutions to climate change.



Perpetual Motion

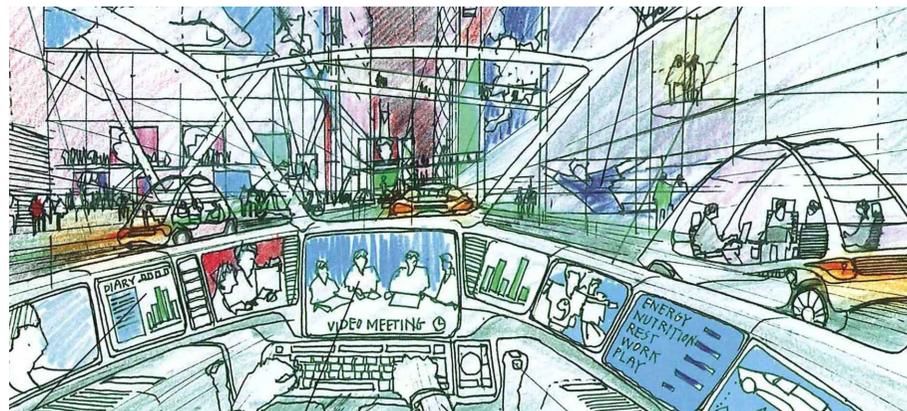
London is developed with a strong emphasis on technological change (Figure 6). The demand for transport remains strong and mobility, including air travel, continues to grow. There is a ready acceptance of new technology, both in the home and the workplace, but particularly in transport with a keen desire to overcome the consequences of CO₂ emission increases through clean technology. However, this concern is not backed up by major lifestyle changes; only marginal changes occur using information and communication technologies (ICT) to reduce the need to travel for certain activities (e.g. some use of teleconferencing and home shopping). Mobility levels remain unaffected; particularly travel by private car in the suburbs.

The main aim of transport policy is to achieve the required CO₂ emissions target with a minimum of change in terms of behaviour. Car traffic still grows and dominates in terms of modal share, with trip lengths increasing and occupancy levels remaining about the same as in 2000. The main changes are in pushing hard on hybrid technologies and alternative fuels so that the overall average emissions profile of the total car stock reduces to 100 gCO₂/km or below in 2025.

There is also considerable investment in alternative fuels to reduce the carbon content of existing internal combustion engines (ICEs) and the non-electric parts of hybrids. Niche electric vehicles also have a limited role for low speed vehicles in central London, provided that their source of energy is renewable. The cost of fuels rises overall, but this increase falls increasingly on those car users that continue to consume fossil fuels. New materials are used to make vehicles lighter.

Although behavioural change is also acknowledged as being important, the general view is that little lifestyle change is required, apart from clear pricing signals to encourage less fuel consumption and a switch to cleaner technologies.

Figure 6: Perpetual Motion



Perpetual motion – the danger is that the environmental gains made by more efficient technologies are outweighed by mobility growth. (Image - Foresight, 2006)

Good Intentions/Urban Colonies

London develops with a strong emphasis on environmental and wider sustainability objectives (Figure 7). Economic and social considerations are still important, but they are not pursued at the cost of environmental goals. Slowly, the importance of designing the urban environment for less travel and efficient use of resources achieves great importance. Over time, technology systems become essential to deliver carbon efficiency.

Within London, the central activity zone is an important centre for growth, but growth is also concentrated in the suburbs, with local, polycentric growth. Societal benefits accrue from a society integrated more at the local level. People in this scenario are environmentally aware and more careful in their use of resources.

This image is also market driven, but has a much stronger social and environmental emphasis, and is focused on improving quality of life. The transition to the technological society is moderated by greater social intervention. The economy is a knowledge-based economy, producing specialist products for hi-tech businesses. It is accepted that behavioural change is the essential basis needed to address the required CO₂ emissions targets, however technology is also important – there is realism though in terms of expected application.

but these are more than compensated for by the increase in shorter more local trips. The desire for less travel (and distance for freight distribution) links in with the greater social awareness and conscience of the population, and the importance of community and welfare objectives. The lock-in to car dependency (as found in image 1) is broken with social priorities pushing for greater use of public transport and other clean modes of transport.

There is less dependence on technological solutions, but cars become cleaner over the period (130 gCO₂/km or below for the total car stock by 2025) through new taxation and pricing incentives to use more efficient and cleaner technologies, with tax reductions for not owning a car or for participating in car sharing schemes. Real fuel prices increase over the period; increases in oil prices are an effective enabler to achieving carbon efficient transport.

Figure 7: Good Intentions



Good intentions and urban colonies – technological gains make travel much more efficient, but mobility is held at current levels. ‘Unnecessary’ travel is limited. (Image - Foresight, 2006)

In the transport sector, the expectation in this image is that there will be a slight reduction in the total amount of travel distance by each person in 2025 and again to 2050, but the effect of this will be offset as population will have increased in London. The main reduction has not taken place in the number of trips made, but in the length of trips. The distribution has changed, with some growth in long distance trips,



04

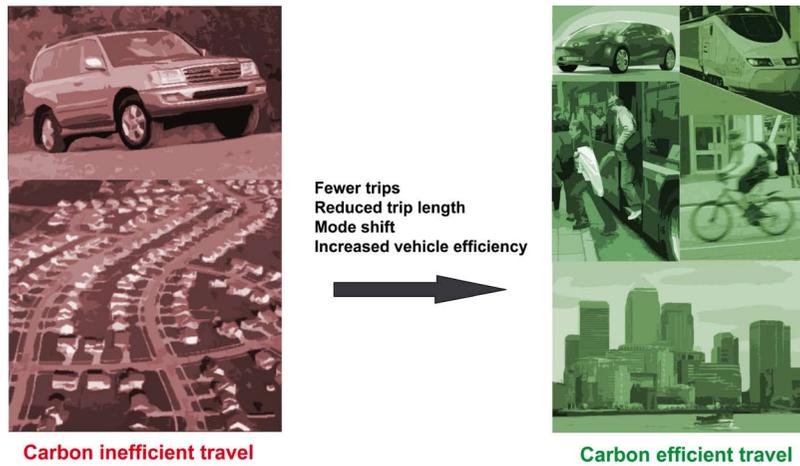
Packaging the Policy Levers

A wide range of policy levers are available to help reduce transport CO₂ emissions and move towards the images of the future. Moving from carbon inefficient travel to carbon efficient travel means realising fewer trips, reduced trip lengths, mode shift and increased vehicle efficiency (Figure 8).

MOVING FROM CARBON INEFFICIENT
TRAVEL TO CARBON EFFICIENT
TRAVEL MEANS REALISING FEWER
TRIPS, REDUCED TRIP LENGTHS,
MODE SHIFT AND INCREASED
VEHICLE EFFICIENCY

The study has reviewed over 150 individual policy interventions that may help reduce transport CO₂ emissions. Individual measures work best within packages, allowing complementary measures to work together and mitigation impacts to be quantified.

Figure 8: Towards Carbon Efficient Travel



A transport and carbon simulator (TC-SIM) has been developed to help explore the packaging of policy options. TC-SIM is a participation tool which includes a scenario building and policy discussion platform, with a spatial base for London, around which decisions concerning possible future scenarios and policy packages can be made. The 12 policy packages (PP) considered cover:

- PP1: Low emission vehicles;
- PP2: Alternative fuels;
- PP3: Pricing regimes;
- PP4: Public transport;
- PP5: Walking and cycling;
- PP6: Strategic and local urban planning;
- PP7: ICT;
- PP8: 'Smarter choice' soft measures;
- PP9: Ecological driving and slower speeds;
- PP10: Long distance travel substitution;
- PP11: Freight transport;
- PP12: International air travel.



Image – LowCVP

Application of a range of policy packages can then seek to meet the gap between BAU projections and strategic targets or aspirations (Figure 9).

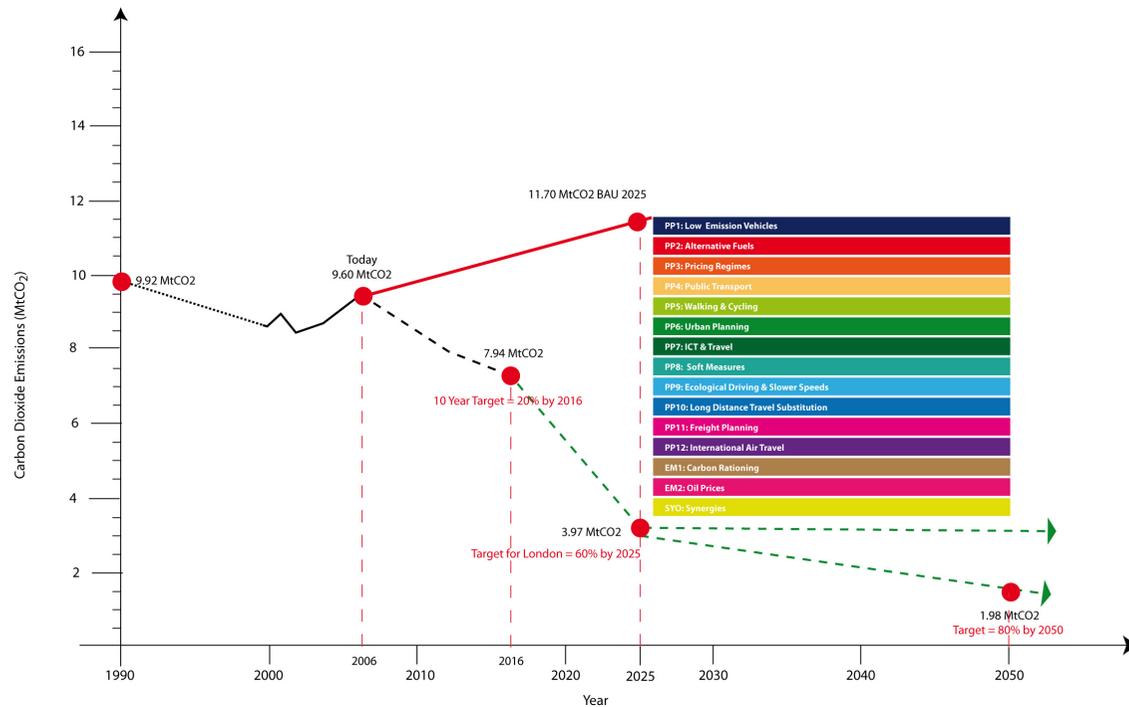
There are therefore many interventions to help bridge the gap. Each policy package can be selected at a variety of levels of intensity of application – typically a ‘low’, ‘medium’ or ‘high’ level of application. The assumption in terms of background traffic growth is that traffic grows year on year as an extrapolation of recent trends.

Relative to the rest of the UK, London is different in that traffic growth has been limited in recent years, and it appears to have reached the top of the ‘S’ curve of traffic growth. In London, there are substantially lower levels of CO₂ emissions in transport than for equivalent populations elsewhere, as car ownership levels are lower and the use of public transport is much higher.

The BAU application is assumed to be the Reference Case (Scenario 1) in T2025 (TfL, 2006a). This broadly represents the current fully funded investment strategy for TfL and is thus the best representation of current BAU. It does however represent a significant amount of funding – approximately £2-7 billion per annum to 2025 (TfL, 2006a).

The modelling behind TC-SIM has been developed to allow quantification of the potential impacts of a range of policy interventions in multiple combinations. It uses and combines a variety of data sources, including London Travel Survey (LTS) modelling runs, a spreadsheet of transport CO₂ emissions developed by TfL, a vehicle fuel penetration spreadsheet developed for Defra and a number of other databases (for more details see TC-SIM modelling assumptions paper - Ashiru, Hickman and Banister, 2009).

Figure 9: Policy Packages to Bridge the Gap





05

Potential Policy Packages and Pathways



Image – LowCVP

Techno-Optimism

A 'techno-optimist' scenario is used to illustrate the result of focusing on technological options to reduce transport CO₂ emissions. PP1 low emission vehicles, PP2 alternative fuels and PP7 ICT are the policy packages with the greatest 'technological' focus. It is argued by many that this position is illustrative of policy development at the UK level (the King Review, 2007;

Eddington, 2006). Even the most recent publications (CCC, 2008) give little consideration to policy packages such as pricing, public transport, walking and cycling, urban planning, ICT, smarter choices, slower speeds and ecological driving, freight planning, etc. These appear fundamental to reducing CO₂ emissions in transport.

The result is that only a narrow range of policy measures are being employed, including voluntary and mandatory (from 2012) car emission agreements, some limited fiscal tinkering, a renewable fuels target and other 'low intensity' application of the wider measures discussed above.

The background to the techno-optimist scenario is that mobility is allowed to grow. Traffic grows year on year as an extrapolation of recent trends.

The result of a low level application of technological change (assuming a 150 gCO₂/km average total car fleet, 1000 gCO₂/km average total heavy goods vehicle fleet (fully loaded), 4% alternative fuels by 2025) is a contribution reduction in transport

CO₂ of just 6% (Figure 10). A higher intensity technological ambition (100 gCO₂/km car fleet, 800 gCO₂/km heavy goods vehicles, 15% alternative fuels) achieves a 23% reduction in transport CO₂. This latter level of implementation is, however, unlikely based on current vehicle penetration rates and difficulties with supplying alternative fuels to the mass market.

The scenario results illustrate the potential for vehicle technology to achieve CO₂ reduction targets in London if pushed hard (through regulation) or left to the voluntary actions of motor manufacturers and individual choice. There is still a substantial shortfall against the headline target if the higher levels of application are achieved.

Figure 10: TC-SIM Relying on Technological Change - “Realistic”



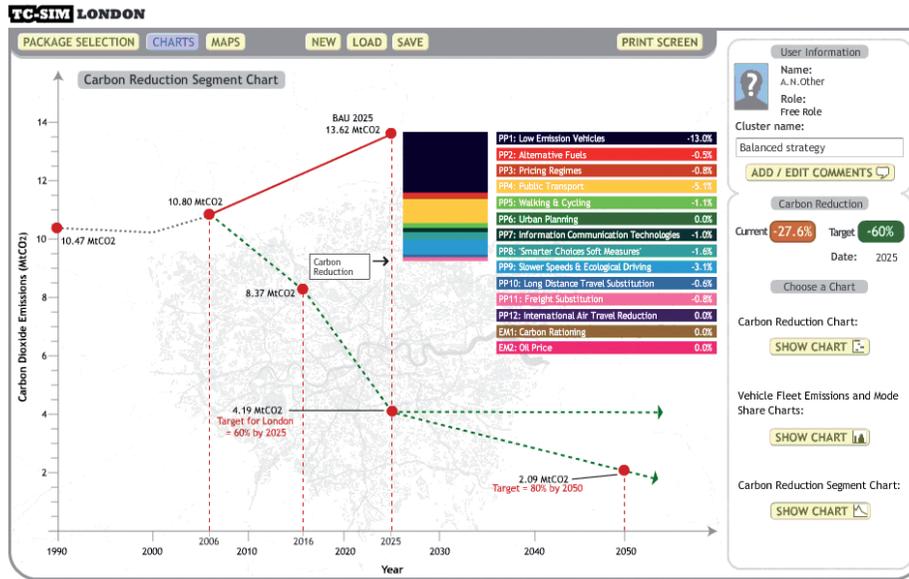
Acting Across the Range of Potential Interventions

A more balanced policy package is developed using a range of policy levers (technological and behavioural), and hence is broadly targeted at Image 2 Good Intentions/Urban Colonies. Application of the packages is tempered by realism in terms of current trajectories or levels of investment (Figures 11, 12 and Table 2).

Figure 11: TC-SIM “A Balanced Strategic Policy Package”



Figure 12 : Balanced Package Segmentation



Notes.
 Within the BAU for London, the T2025 Reference Case (Scenario 1) is normally used
 Baseline projection includes international short haul air (for London)
 Modelling using TC-SIM v.3.

Table 2: CO₂ Projections and Targets for London, excluding Aviation (MtCO₂)

Policy Package	Level of Application	% of VIBAT London Target by 2025
PP1 Low Emission Vehicles	Medium: 120 gCO ₂ /km average total car fleet; 900 gCO ₂ /km average total heavy goods vehicles (fully loaded)	13.0%
PP2 Alternative Fuels	Low	0.6%
PP3 Pricing Regimes	BAU/medium – BAU congestion charging scheme; medium parking charging	0.8%
PP4 Public Transport	Medium – medium investment strategy; medium fare reduction	5.1%
PP5 Walking and Cycling	Medium	1.0%
PP6 Urban Planning	BAU	-
PP7 ICT	Medium	1.0%
PP8 Smarter Choice Soft Measures	Medium	1.6%
PP9 Slower Speeds and Ecological Driving	Medium	3.1%
PP10 Long Distance Travel Substitution	Medium	0.6%
PP11 Freight Transport	Medium	0.8%
Progress against VIBAT London Target (60% reduction against BAU 2025)		27.6%

A number of points are made against the levels of policy package application under the more balanced package.

PP1 Low Emission Vehicles: this package is extremely important to the goal of reducing transport CO₂ emissions, since most emissions are related to car use. There are some difficulties with the current level of implementation (in terms of technological penetration); hence major efforts need to be made in developing a range of incentives for manufacturing and purchasing low emission vehicles for the mass market. A medium level of application is assumed in the TC-SIM modelling – a 120 gCO₂/km average total car fleet and 900 gCO₂/km average total heavy goods vehicle fleet (fully loaded) by 2025. Clearly there is much more potential here and mandatory targets need to be developed to provide an incentive for the motor industry to apply a higher level of technological implementation. The history of application in this area is one of missed opportunity.

PP2 Alternative Fuels: again there is some difficulty in implementing this policy package (including concerns concerning the use of biofuels and wider alternative fuels in terms of land take and knock on effects). A low level of application is assumed, and there is little impact in terms of CO₂ reduction at the mass market scale.

THE HISTORY OF
APPLICATION WITH
LOW EMISSION
VEHICLES IS
ONE OF MISSED
OPPORTUNITY

PP3 Pricing Regimes: congestion charging or area-wide road pricing could potentially make a substantial difference to CO₂ emissions if applied on a London-wide scale. The BAU application assumes the current congestion charge scheme is operated (with the western extension in the current version of TC-SIM). There is more potential here. Road pricing could be operated for the whole of London as part of a UK-wide pricing scheme, and also on an environmental basis (i.e. the charging relates to the carbon emissions profile of the vehicle and the number of passengers). This would give clear signals to consumers to switch to more efficient cars or to other modes of transport. There are, however, political difficulties with implementing this package, hence the modelling assumes only a BAU application of the congestion charge (the current scheme) and a medium application of parking charging (a tightening of the current parking supply and higher charging).



PUBLIC TRANSPORT
INVESTMENT
IS CRITICAL
IN ALLOWING
CONSUMERS TO
CHOOSE CARBON
EFFICIENT MEANS
OF TRAVEL

PP4 Public Transport: public transport investment is critical in allowing consumers to choose carbon efficient means of travel. There is already an extensive public transport network in London, with massive investment plans in Transport 2025 (TfL, 2006a). The BAU application assumes that the Reference Case (Scenario 1) in T2025 is implemented. This is broadly all currently funded projects, not including Crossrail. It therefore includes capacity and frequency upgrades on the Underground, National Rail and Docklands Light Railway. More investment could be considered, as represented in Scenario 4 in T2025, or even beyond. This might include Crossrail and potentially wider schemes such as Crossrail 2 (a north-south pan-London link), additional tram routes and demand responsive public transport in the suburbs. The modelling assumes a medium intensity investment in public transport (T2025 Scenario 4, Full Programme) and a medium level of fare reduction.

PP5 Walking and Cycling: similarly, investment in walking and cycling facilities and in the streetscape and public realm makes carbon efficient means of travel more attractive, particularly for short journeys. There is already a fairly extensive walking and cycling network in London, yet aggregate walking and cycling mode shares remain low relative to the best examples in Europe. The BAU application assumes that the Reference Case (Scenario 1) in T2025 is implemented, with the current funded walking and cycling projects being implemented. The modelling assumes a medium intensity investment in walking and cycling (T2025 Scenario 4, Full Programme) – a higher level of investment than BAU. Although the CO₂ reduction potential of walking and cycling is not large under this scenario, investment is critical for other urban liveability objectives.

PP6 Urban Planning: this package focuses on using urban structure to support sustainable transport, with efforts directed at both strategic and local scales. Strategically, urban structure is used to support public transport use through higher density development being clustered around an upgraded public transport system. More locally, urban areas are master-planned to vastly improve their urban design quality, attractiveness for living and working. There is complementary heavy investment in walking and cycling facilities and streetscape design. The BAU application assumes that the Reference Case (Scenario 1) in T2025 is implemented. This represents the urban strategy of the London Plan (GLA, 2004) – some polycentric thickening of densities, with most effort made in central London, and some investment in improved streetscapes, again mostly in central London. The modelling reflects this level of application. There is much more potential with this policy package.

PP7 ICT: the scope for CO₂ reduction from this package seems limited. A complex adaptation of social interaction is more likely than a simple substitution of travel. The modelling assumes a medium intensity application of ICT, but the impacts are not great in terms of transport CO₂ reduction. The benefit here is in developing flexible working lifestyles (homeworking) which breaks the tendency to commute 5 days a week, often by car.



MORE EFFICIENT
DRIVING STYLES
HAVE THE
POTENTIAL FOR
SUBSTANTIAL
IMMEDIATE AND
LONG TERM
BENEFITS IF TAKE
UP IS HIGH IN
TERMS OF REDUCED
SPEEDS AND
CHANGED DRIVING
STYLES. THE
DIFFICULTY IS
IN ENFORCEMENT

PP8 'Smarter Choice' Soft Measures:

this option includes investment in workplace and school travel plans, personalised travel planning programmes and future changes in car ownership (including leasing and car clubs), car sharing and travel awareness initiatives. These are critical supporting measures to other packages, but they also have an important impact on reducing CO₂ emissions in their own right. The BAU application assumes that the Reference Case (Scenario 1) in T2025 is implemented. This broadly represents all funded projects. There is more potential if funds were made available for a greater intensity of application of this package. The modelling assumes a medium intensity application of soft measures to reduce travel CO₂ emissions. It should be noted, however, that impacts may be less than often forecast due to diminished returns when spread beyond the initial enthusiastic take up.

PP9 Slower Speeds and Ecological

Driving: this option has the potential for substantial immediate and long term benefits if take up is high in terms of reduced speeds and changed driving styles. Slower speeds have the potential to provide extensive savings with some 15-20% reduction in CO₂ emissions, if a maximum speed limit of 80 km/hr is introduced on motorways and trunk roads, with lower speeds on other roads such as residential roads. Effective compliance is a critical issue and is likely to impact on end CO₂ reduction impacts. Lower speeds need to be combined with awareness programmes and better driving techniques to reduce fuel use. The BAU application assumes that speed limits remain the same and there is little funding of driver skill initiatives. There is more potential if funds were made available for a greater intensity of application of this package. The modelling assumes a medium intensity application of this package to reduce travel CO₂ emissions. However, the impacts are less than often expected due to enforcement difficulties.

PP10 Long Distance Travel

Substitution: there is some limited potential for long distance travel substitution of rail to air (e.g. Eurostar) but the savings here are not likely to be substantial. Only travel within the London boundary is considered, hence the longer journey effects are not included. The BAU application assumes that only existing high speed train services operate. There would be more potential if a network of services was built. The modelling assumes a medium intensity application of this package; however the CO₂ reduction impacts remain small.

PP11 Freight Transport: freight transport is covered tangentially in several of the other policy packages, but this package concentrates on the freight sector as a whole with a series of measures targeted at reducing CO₂ emissions. Different applications of the policy package draw from changed handling factors (the number of links in the supply chain), reduced length of haul, improved rail mode share, reduced empty running, improved fuel efficiency and choice of fuel/power source (McKinnon, 2007). The modelling assumes a medium intensity application of the package; however the CO₂ reduction impacts remain small, as only distribution within the London boundary is included.

The result of the above balanced implementation strategy is a reduction in transport CO₂ emissions in the order of a 28%, relative to the 60% reduction target against a 2025 BAU. Good progress has been made against the target (a 50% achievement rate), but much stronger application of the policy packages is required.

This provides a very important conclusion. Realising the ambitious strategic targets is likely to be very difficult. A substantial investment in vehicle technologies, infrastructure and behavioural measures is already assumed, and this may be optimistic, as these initiatives have often been delivered individually and not in a mutually reinforcing way.

Achieving a 20% transport system (an 80% reduction in transport CO₂ emissions) is a huge challenge. Potential pathways towards this are explored in the background VIBAT London reports (Hickman et al, 2009). Considerable further efforts are required in terms of developing the incentives and mechanisms for a trend break in the delivery of carbon efficient transport. The most difficult future area is probably in engaging the public to deliver substantial behavioural change. This discussion has hardly started. High intensity application of all policy measures is required, if we are to achieve the ambitious headline targets. The challenge of delivering such a trend break is currently being seriously underestimated.

THE MOST DIFFICULT FUTURE AREA IS
IN ENGAGING THE PUBLIC TO DELIVER
SUBSTANTIAL BEHAVIOURAL CHANGE.
THIS DISCUSSION HAS HARDLY STARTED

An interesting and important dimension here is how policy packages should be best grouped together to form a mutually supporting, synergetic strategy. Urban planning, for example, might be used well to support a higher public transport, walking and cycle mode share. Some policy packages may not work well together. The modelling should theoretically be able to deal with:

- Positive and negative interactions and synergies between policy packages/enabling mechanisms;
- Double counting of policy benefits;
- Positive and negative multiplier effects (greater or less than the sum of the parts);
- Positive or negative snowball effects over time, and the trigger points where these effects can be identified.

Synergies and additionality effects are poorly understood in the literature. There is little available evidence on these issues – some of the ongoing research behind the VIBAT studies is currently assessing likely effects. Conceptually, it is not difficult to identify where the most promising positive benefits of policy packaging may take place, but the real difficulty is in obtaining empirical evidence that can be used in the TC-SIM model or similar.

THE PROJECTED GROWTH IN INTERNATIONAL AIR EMISSIONS RUNS COUNTER TO STRATEGIC CO₂ EMISSION REDUCTION TARGETS.

06 ‘Known Unknowns’: International Air Travel and ‘Enabling Mechanisms’

There are at least two difficult [and critical] policy areas that are currently far from being resolved. The first is international air travel, which has until recently been growing at a rate of 6% per annum (doubling every 12 years). There is little political acceptance of the need for reducing the growth in demand, yet emissions from air travel are soon to become a major problem to the achievement of CO₂ reduction targets (Bows and Anderson, 2007).

Two problems are evident. One relates to how international aviation should be accounted for in emission reduction targets. At present they are either excluded (as in most transport planning analysis concerning this topic) or they are considered as contributing a major part of city-based emissions. In London

the calculations are that half the full international aviation CO₂ emissions are allocated to residents (CCAP; GLA, 2007). The problem is either one of omission or one of very large numbers. The potential for growth in this sector over the next 20-40 years is likely to exceed all other transport related emissions.

The second, and more important, problem is that at present there are very few technological opportunities available to reduce emissions for the air sector. Many of the planes flying today will still be in use in 2025 and even 2050 (for example, the new A380). The only way to reduce emissions is therefore to reduce demand - through pricing, regulation and even rationing – and there is little political [or public] appetite for these policy levers.



This leads us onto a second difficult and unresolved policy area: enabling mechanisms. Further incentives or enabling mechanisms may be required to help achieve the headline CO₂ reduction targets as adopted – this paper has demonstrated the difficulties involved in achieving deep reductions in CO₂ emissions. One of the possibilities is carbon rationing.

There are a number of possible ways of implementing a rationing scheme in the transport sector. The most likely are through car manufacturers, fuel suppliers or as personal carbon allocations (PCAs). Each would involve a cap and trade system with an overall level of emissions, probably reducing in volume over time. This enabling mechanism might help achieve high intensity application in the preceding packages.

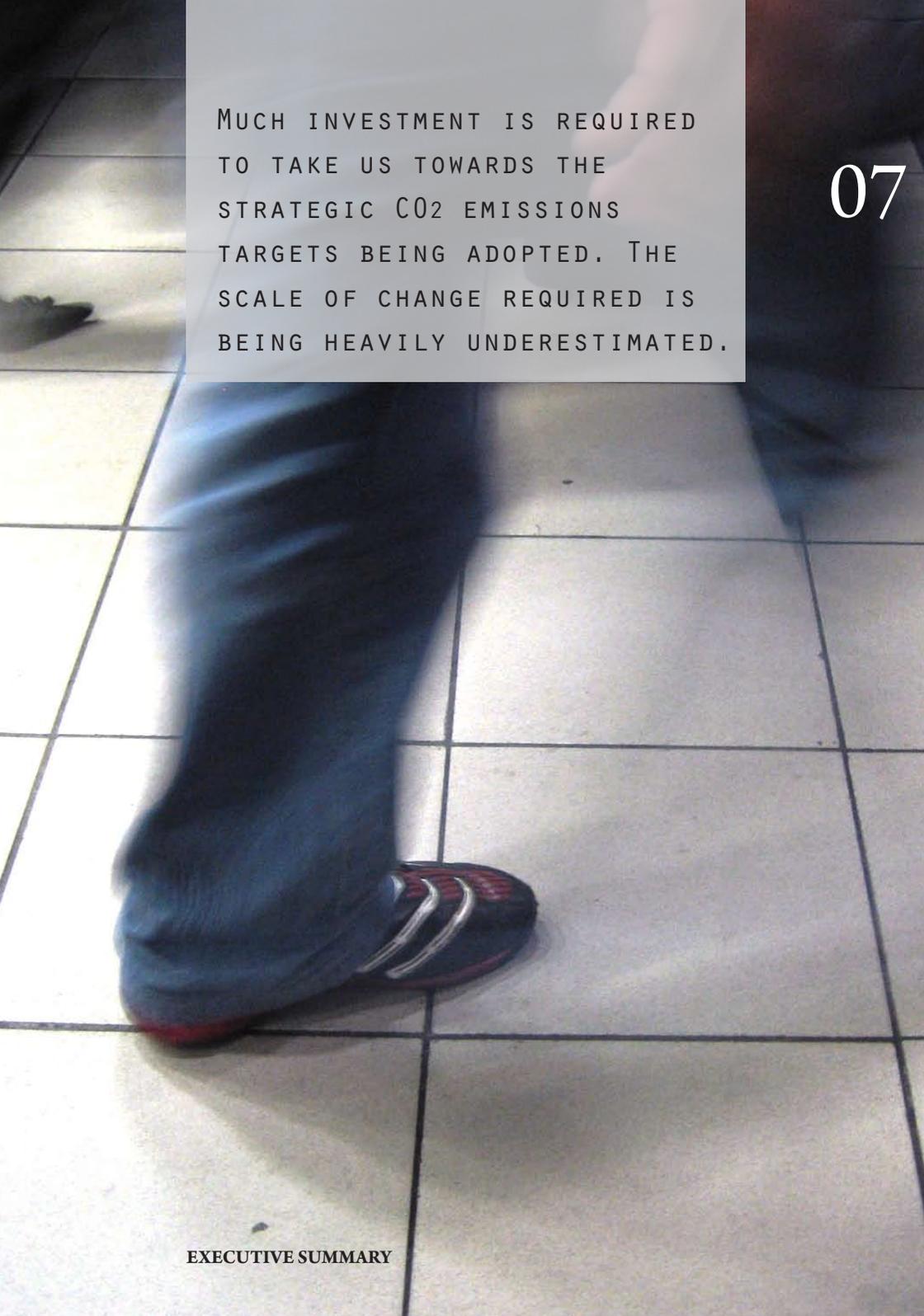
Again, however, there are very large implementation difficulties, particularly with PCAs (Defra, 2008; EAC, 2008). There is, however, some precedence here. The EU Emissions Trading Scheme (EU ETS) is already running, where some major polluting industries are allocated trade emission permits, and can use or trade them according to the levels of CO₂ produced.

The transport sector is likely to be included in this scheme in 2010, with international air emissions also being included (probably in 2012). The idea is to set a cap on the aggregate level of emissions and trade within this level. Trading is likely to be at the business and/or national level. Much uncertainty however remains as to how to implement a trading mechanism for carbon.

THE POTENTIAL FOR GROWTH IN THE AIR SECTOR OVER THE NEXT 20-40 YEARS IS LIKELY TO EXCEED ALL OTHER TRANSPORT RELATED EMISSIONS. THIS IS A HUGE PROBLEM YET TO BE TACKLED IN POLICY TERMS

Very much related is the price of oil. Recent price volatility has an important impact on travel demand (in mid-2008 Brent Crude oil prices were at \$140 per barrel, an increase of nearly 100% over the previous 12 months. They have recently fallen to below \$50 a barrel).

The typical elasticity used for vehicle travel with respect to fuel price is in the order of -0.15 in the short run and -0.3 over the long-run (Graham and Glaister, 2002). We would, for example, expect recent price rises to have fed through to reduced demand for travel – hence may have acted as an effective enabler of reduced carbon dependency in travel.



MUCH INVESTMENT IS REQUIRED TO TAKE US TOWARDS THE STRATEGIC CO₂ EMISSIONS TARGETS BEING ADOPTED. THE SCALE OF CHANGE REQUIRED IS BEING HEAVILY UNDERESTIMATED.

07

Conclusions: Backcasting from 2025

There are a very large number of policy pathways towards substantial improvements in carbon efficiency in the transport sector. All represent significant breaks against current trends and are likely to be very difficult to implement. A number of conclusions can be drawn:

1. The current trends mean that the transport sector continues to perform poorly as it does not contribute to cross-sectoral CO₂ reduction targets. The clear message is to work much more effectively across the broader range of policy packages available and at a higher intensity of application relative to current trends.
2. A balanced package of measures, described in this summary as a 'balanced policy package', should take us perhaps halfway towards the adopted 60% CO₂ reduction target. A caveat here is that this assumes a successful level of application across a wide range of policy levers. Heavy investment is required to move beyond this level. Achieving a deeper target reduction – a 20% transport system (an 80% reduction in transport CO₂ emissions) – is a huge challenge.
3. Low emission vehicles and alternative fuel penetration are likely to remain the most important policy levers, as they tackle carbon efficiency in the dominant mode of travel (the private car). The main difficulty here is in achieving any level of success in penetration to the mass market. The motor industry and government need to develop mechanisms to achieve this, including mandatory targets for manufacturers. The 80 gCO₂/km average total car fleet and 800 gCO₂/km or lower average total heavy goods vehicle fleet (fully loaded) should be developed as a mandatory target for an agreed future year, say 2025. A similar target can also be developed for light goods vehicles.

4. There is also much potential in the behavioural measures, including pricing regimes, increased use of public transport, walking and cycling, ecological driving and slower speeds, and more efficient freight transport. Urban planning and smarter choice soft measures, as well as acting in their own right, potentially perform very important roles as supporting measures to other policy packages, enabling higher levels of success in implementation.
5. There is little current understanding concerning synergies between policy levers and packages. Much further analysis is required on this issue, amongst others.

6. We will need to get much more innovative as we see that headline targets are not being achieved. For example, we may need to consider: greater use of zero and low emission vehicle zones, automatic low speed city driving systems, new forms of car use and ownership (building on the recent growth of city car clubs), new forms of public transport to serve suburban areas, substantial increases in walking and cycling (the latter using Vélib'-style city schemes and smart technology to find and use bicycles), virtual mobility massively scaled up to reduce 'unnecessary' physical travel, and a whole host of ideas we have yet to think through.

7. Engagement and involvement of policy makers, businesses and the general population at all levels of decision making is essential. It is not just the question of whether challenging targets can be achieved through the creative combinations of policy packages. It is also the need to get all stakeholders to 'buy into' the ideas of pushing technological change and in changing behaviour so that real progress can be made. Hence the importance attributed to focus groups and workshops in the backcasting approach. The TC-SIM innovation also attempts to raise awareness about the nature and scale of change required.

The likelihood of deep CO₂ reductions in the transport sector is looking very unlikely based on current patterns, although major efforts have been made in certain leading cities (such as London). The public needs to radically change their purchasing patterns and behaviour to be more carbon efficient. The means of knowledge dissemination, communication, participation in decision-making and marketing of policy options and futures all need to be considerably strengthened. Tools such as TC-SIM, applied to different contexts, could play an important role in testing different options with a range of different users.

The backcasting approach offers a way forward to this extremely challenging future policy [and lifestyle] dilemma. The huge challenge now is to map out and discuss a variety of policy pathways to carbon efficiency in the transport sector. And then – the difficult step – to enable and actually *achieve* a level of consumer and behavioural change consistent with strategic aspiration.

WE WILL NEED TO GET MUCH
MORE INNOVATIVE AS WE SEE
THAT HEADLINE TARGETS ARE
NOT BEING ACHIEVED

Acknowledgements

Many thanks to the UrbanBuzz programme www.urbanbuzz.org which funded the VIBAT London study. Source funding from the Higher Education Funding Council for England and the Department for Innovation, Universities and Skills.

Also the wider VIBAT London study team who have helped develop the work – Halcrow, Oxford University Transport Studies Unit, Space Syntax, ZupaStudio.

The VIBAT London Study Team

Dr Robin Hickman
(Halcrow Group and Oxford University TSU)
Professor David Banister
(Oxford University TSU)
Olu Ashiru
(Takedo International and Halcrow Group)
Sharad Saxena
(Oxford University TSU and intern at Halcrow Group)
Dr Annabel Bradbury
(Halcrow Group)
Alain Chiaradia
(Space Syntax)
Chris Stutz
(Space Syntax)
Jorge Gil
(Space Syntax)
Jasia Ward
(ZupaStudio and Space Syntax)
Gavin Bwaily
(ZupaStudio and Space Syntax)

Thanks also to Transport for London and the Greater London Authority who were generous in supplying data and time acting as project steering group members and commenting on various working paper drafts and versions of TC-SIM.

Thanks to Professor Abigail Bristow, Dr Miles Tight, Dr Jillian Anable and Tim Pharoah for comments during the study.

The views expressed in this executive summary are, of course, from the authors and do not necessarily reflect those of UrbanBuzz, TfL or GLA.

All images from the study authors, Halcrow Group and LowCVP.

Images of the Future graphics from the Foresight Intelligent Infrastructure Futures Project (DTI, 2006), Foster & Partners.

References

- Ashiru, O., Hickman, R. and Banister, D. (2008) TC-SIM Modelling Assumptions. Working Paper. London: Halcrow Group.
- Banister, D., Stead, D., Steen, P., Åkerman, J., Dreborg, K., Nijkamp, P. and Schleicher-Tappeser, R. (2000) European Transport Policy and Sustainable Mobility. London: Spon.
- Bows A, and Anderson K L. (2007) Policy clash: can projected aviation growth be reconciled with the UK Government's 60% carbon reduction policy? Transport Policy, 14 (2), pp 103-110.
- Climate Change Committee (CCC) (2008) Building a Low Carbon Economy. London: TSO.
- Department of the Environment, Food and Rural Affairs (Defra) (2008) Synthesis report on the findings from Defra's pre-feasibility study into personal carbon trading. Published by Defra, April.
- Department for the Environment, Transport and the Regions (DETR) (2000) Climate Change, the UK Programme. London: TSO.
- Department of Trade and Industry (DTI) Foresight/Office of Science and Technology (OST) (2006) Intelligent Infrastructure Futures: The Scenarios – Towards 2055. London: TSO.
- Environmental Audit Committee (EAC) (2008) Personal Carbon Trading, 5th Report of the EAC, HC565, London: TSO.
- Graham, D. and Glaister, S. (2002) Review of Income and Price Elasticities of Demand for Road Traffic. London: Imperial College London.
- Greater London Authority (GLA) (2008) Way to Go. London: GLA.
- Greater London Authority (GLA) (2007) Action Today to Protect Tomorrow: The Mayor's Climate Change Action Plan. London: GLA.
- Greater London Authority (GLA) (2004) The London Plan. GLA.
- Hickman, R. and Banister, D. (2006) Visioning and Backcasting for UK Transport Policy (VIBAT-UK). Study Reports Stages 1, 2 and 3 and Executive Summary. London: Department for Transport. Available on: www.vibat.org
- Hickman, R. and Banister, D. (2007) Looking over the horizon: Transport and reduced CO₂ emissions in the UK by 2030. Transport Policy, 14 (5), pp. 377-387.
- Hickman, R., Ashiru, O., Saxena, S., Bradbury, A. and Banister, D. (2009) Visioning and Backcasting for Transport in London (VIBAT-London) Study Reports Stages 1, 2 and 3, and Modelling Assumptions. Halcrow and Oxford University for the UrbanBuzz Programme. London. Available on: www.vibat.org
- HM Treasury (2006) The Eddington Transport Study [Rod Eddington]. London: TSO.
- HM Treasury (2007) The King Review of Low Carbon Cars [Julia King]. London: TSO.
- Johansson, T. B., Steen, P., Bogren, E. and Fredriksson, R. (1983) Sweden beyond oil: The efficient use of energy, Science 219, pp. 355-361.
- McKinnon, A. (2007) CO₂ emissions from Freight Transport in the UK. Report prepared for the Climate Change Working Group of the Commission for Integrated Transport.
- Organisation for Economic Co-operation and Development (OECD) (2000) EST! Environmentally Sustainable Transport. Futures, Strategies and Best Practice. Synthesis Report. Paris: OECD.
- POSSUM (1997) Development of Transport Policy Scenarios - the Images of the Future, Deliverable 2, submitted to EC DGVII Strategic Research. Brussels: EC.
- Transport for London (TfL) (2006a) Transport 2025: Transport Vision for a Growing World City. London: TfL.
- Transport for London (TfL) (2006b) The Mayor's Transport Strategy. London: TfL/GLA.

Halcrow Group

Halcrow specialises in the provision of planning, design and management services for infrastructure development worldwide. With interests in transportation, water, maritime and property, the company is undertaking commissions in over 80 countries from a network of more than 90 offices. The group includes one of the leading international transport planning consultancies. We have operated as a market leader in the transport planning industry throughout the last 40 years.

A key strength is our ability to provide quality and innovative transport planning advice, over a range of skill areas, for public and private sector clients. We offer services ranging from policy formulation and strategic planning, including detailed planning and design, through to implementation, operation and performance modelling. Our clients value our ability to provide comprehensive integrated advice, by drawing on in-house skills in other disciplines, including environment, planning, economics and business-solutions, in order to deliver solutions to multi-faceted issues.

Our areas of work include:

- Research and strategy.
- Strategic public policy advice, spanning transport, land-use and the environment, including urban and inter-urban strategy and policy studies.
- Local transport policy advice, encompassing local transport plans, major scheme bids, accessibility planning and public consultation.
- Demand forecasting and appraisal, including variable demand modelling, highway and public transport modelling, economic appraisal.
- Development planning, transport assessments and traffic management.
- Public transport operations.
- Smarter choices and travel planning.
- Traffic engineering and design, including microsimulation and pedestrian planning.
- Intelligent transport solutions.

www.halcrow.com

Oxford University (Transport Studies Unit)

The Transport Studies Unit (TSU) is a research centre based at the Oxford University School of Geography and the Environment (SoGE). The TSU mission is to promote excellence in transport research and teaching, with particular emphasis being placed on understanding the social, economic and environmental impacts of transport over time and space. There are currently four main research foci:

- Demand forecasting and regulatory studies;
- Transport infrastructure, city futures and economic development;
- Transport, accessibility and societal issues;
- Transport, energy and the environment.

The concept of sustainable transport provides a unifying theme to all the research.

www.tsu.ox.ac.uk

Space Syntax

Space Syntax provides a unique, evidence-based approach to the planning, design and operation of buildings and urban areas.

Through over twenty years of research-informed consulting, we have developed a powerful technology that demonstrates the key role of spatial layout in shaping patterns of human behaviour. These patterns include movement on foot, on cycles and in vehicles; way finding and purchasing in retail environments; vulnerability and criminal activity in buildings and urban settings; co-presence and communications in the workplace.

Our technology is underpinned by spatial design principles that have influenced planning and design policy throughout the world. The Space Syntax approach empowers people to make informed decisions about the key issues concerning them. Our mission is to help create environments that are socially and economically sustainable.

- We add value through a unique service offer:
- We create places by producing visionary planning and design ideas, leading and supporting multi-disciplinary teams.
- We shape knowledge by developing technology, undertaking research and publishing findings.
- We inform practice by training and licensing people to use our technology as well as by contributing to the production of new planning and design policy.

www.spacesyntax.com

UrbanBuzz

UrbanBuzz: Building Sustainable Communities is a 2-year programme that aims to develop new ways of delivering genuinely sustainable forms of development and community in London and the wider Southeast region. UrbanBuzz is a University College London (UCL)-led programme whose prime partner is the University of East London (UEL). The programme has funded 28 projects over 2007-08. Funders are the Higher Education Funding Council for England (HEFCE) and Department for Innovation, Universities and Skills (DIUS).

www.urbanbuzz.org





Halcrow Group Ltd
Transport Research Sector

Vineyard House
44 Brook Green
Hammersmith
London
W6 7BY

www.halcrow.com