TRANSPORT FUTURES, CLIMATE CHANGE AND THE CITY

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ABSTRACT

This paper considers the different baselines, projections and opportunities for transport CO2 emissions in five very different contexts: London and Oxfordshire (UK), Delhi (India), Jinan (China) and Auckland (New Zealand). The likely possibilities for reducing transport CO2 emissions are examined and future scenarios are developed, relative to an assumed equitable 0.5 tCO2 per capita target in transport emissions, for each case study by 2050 (Hickman et al., 2011). The realism of the scenarios is examined in terms of the current use and symbolic value of motorisation, and the role of the car in everyday life.

The results indicate that future sustainable travel patterns are possible in very different contexts, including the car dependent industrialised cities and rapidly emerging cities in Asia. However there needs to be a very effective policy stance and level of implementation, including infrastructural measures, urban structure, vehicle technologies and behavioural measures. Governance structures become very important as the level of application required is unprecedented.

Keywords: transport, carbon dioxide, urban structure, vehicle technologies, governance

INTRODUCTION

Over the last 50 years there has been much interest in cities – in their planning, design, degradation and regeneration – and in the last ten years, in particular, much discussion around sustainability, reducing greenhouse gas (GHG) and carbon dioxide (CO2) emissions. Within this, there are aspirations towards sustainable travel. Progress however appears intractably difficult to make in the transport sector as the private car, largely fuelled by petrol or diesel, remains the dominant mode of use and choice. Almost all cities are experiencing

increasing emissions in transport, the city structure is often adversely impacted by planning for the private car, and many people complain of the 'daily grind' of the commute as the worst part of their daily lives.

This paper considers the different baselines, projections and opportunities for five different contexts: from London and Oxfordshire (UK), Delhi (India), Jinan (China) and Auckland (new Zealand). The likely possibilities for reducing transport CO2 emissions are examined relative to the aspirations of the IPCC (2007) and Stern (2009). Future scenarios are developed, relative to an assumed equitable 0.5 tCO2 per capita in transport CO2 emissions, for each case study by 2050 (Hickman et al., 2011).

The political deliverability of low carbon transport futures is considered in governance and governmentality terms, recognising that the current poor deliverability of many measures remains a major obstacle to progress (Foucault, 1991; Freund and Martin, 1993; Dunn and Perl, 2010). The growing body of scenario analysis and modelling of impacts by policy tool or package of tools is useful, but in the end the analysis is only of limited value, if political deliverability is not possible. The paper draws on material from a forthcoming book on transport and climate change (Hickman and Banister, 2013).

Pathways to the Future

Scenarios are developed for future travel behaviour in the selected case studies and Figures 1 and 2 bring together the results in absolute and per capita terms. For each city, comparable values are given for city related transport CO2 emissions and for per capita levels. These represent historic emissions (1990), the current baseline (one of 2004, 2005, 2006, 2010), future BAU (2030 or 2041), the three different future scenarios (2030 or 2041), and an equity target where the same aspiration for per capita emissions are used. The following comments can be made:

Overall (Absolute) Emissions

- CO2 emissions in 1990 and 2005 show the high levels of London (at around 10 MtCO2), as a large industrialised city with relatively high levels of car ownership and use. The other case study contexts are fairly low in emissions, either due to small populations (Oxfordshire, and to a lesser extent Auckland) or low levels of car ownership and use (Delhi and Jinan).

- As time progresses to 2030, the BAU scenarios show CO2 emissions changing markedly. London increases marginally (nearly 12 MtCO2), but Delhi grows rapidly (over 26 MtCO2) and Jinan (over 16 MtCO2). Auckland approaches 8 MtCO2 and Oxfordshire nearly 3 MtCO2.
- The future scenarios reduce emissions significantly relative to BAU, particularly under Scenario 4, where low emission vehicles are delivered at the mass scale and behavioural change is strong.

Per Capita Emissions

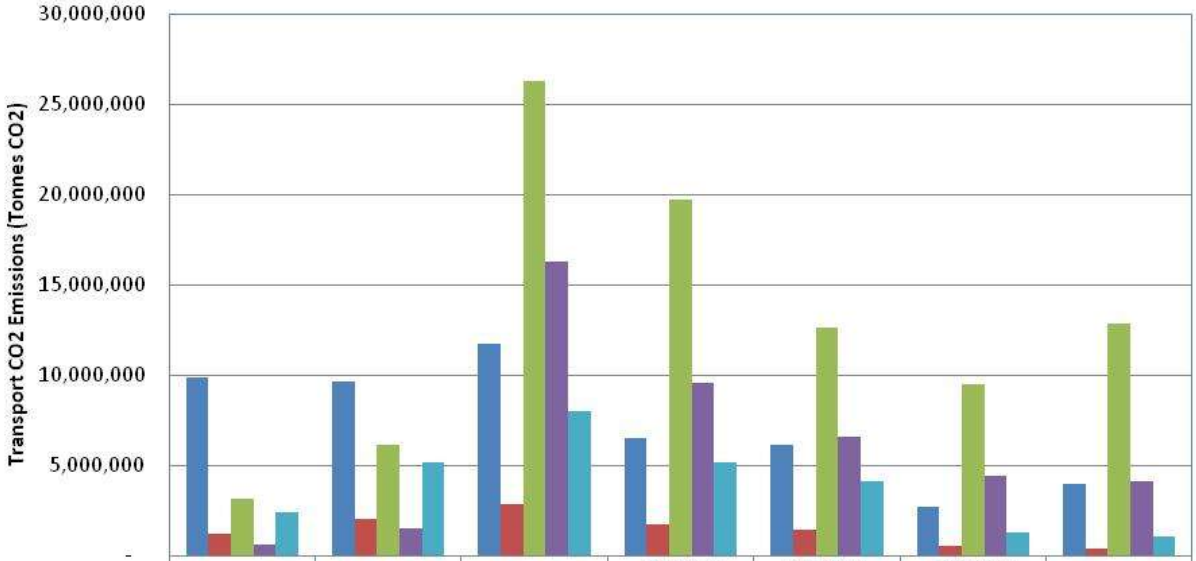
- The per capita data shows a very different story, as the impacts of large populations are removed, and the focus is, to a greater extent, on the level of car ownership and use. Auckland (3.7 tCO2) and Oxfordshire (3.1 tCO2), for example, have very high transport CO2 emissions per capita in 2005, relative to London (1.3 tCO2), Delhi (0.4 tCO2) and Jinan (0.2 tCO2), resulting from current high levels of car dependency.
- The BAU projections to 2030 extrapolate the historic trends, including estimated population growth, motorisation and mode share, but are modified by the current policy approach which tends to include some traffic demand management, in the industrialised countries at least. Auckland (3.8 tCO2) and Oxfordshire (4.1 tCO2) remain high, with some increase in per capita levels, relative to London remaining steady (1.4 tCO2), Delhi increasing nearly to London per capita levels (1.0 tCO2) and Jinan increasing at a rapid rate (2.0 tCO2).
- Again, the future scenarios reduce per capita emissions significantly relative to BAU, particularly under Scenario 4.

The end goal is perhaps a 2050 equity target in transport, where all contexts 'contract and converge' to a common level of emissions of around 0.5 tCO2 per capita, drawing on the framework developed by Meyer (2000), and taken up by the IPCC (2007) and Stern (2009). But as yet it has not been directly applied to the transport field. Such targets may be desirable as end points, but obtaining international agreement on such tough targets is almost impossible, as illustrated in the rather 'soft' CO2 targets achieved in the Kyoto Protocol (1997), which in themselves have not been reached by many of the signatory states. It also ignores the legacy that the developed countries have as the major polluters in the past. For many developing countries, the climate change problem is seen as a Western industrialised country problem (Saxena, 2012). Yet, sadly, CO2 emissions are unlike local air emissions, in that they do not remain local. The impacts of a largely Western-induced climate problem are felt globally, and the consequences will be most apparent in the developing

world. An equitable or equal shares approach to climate change policy making provides one means to address the geopolitical issues of fairness, even though it doesn't address the historic responsibilities for CO2 emissions. Alternatively, there could be two (or three) levels for emission targets, with higher ones for developing countries and lower ones for developed countries in recognition of the legacy, and a possible intermediate one for countries in the transitional stage.

Despite very different geographical and development contexts, similar types of scenarios can be built for each of the different situations, even though the policy options must be adapted to the particular local situation. The types of futures (clean mobility, limited change, and sustainable transport) all have the same generic roots, and they are often constructed on similar dimensions (e.g. market-based or more interventionist, planning-based policies, and different levels of technological innovation). The differences concern the specifics of the policy measures (or packages) being implemented in each location, the levels of application (investment and wider initiative), and the timeline (pathways) over which the changes take place. In addition there are the differences in the priorities allocated by the decision makers at various levels of government, the key roles that the different actors play in influencing the policies, and the awareness, role and influence of the public. All of these variables have a clear impact on the levels of CO2 reduction. Some of these issues are tackled within the scenario process through participation and debate over the policy options, and perhaps even through the multi-criteria analysis carried out to give priorities and weightings to the decision-making. But a major part also relates to the role that transport has in everyday life, the political process, and the understanding of the limitations under which decision-makers operate. Good intentions and strong commitment to radical change do not necessarily lead to strong action and the achievement of large scale change necessary for sustainable transport.

Figure 1: Comparative Transport Scenarios (CO2 Emissions, Absolute)

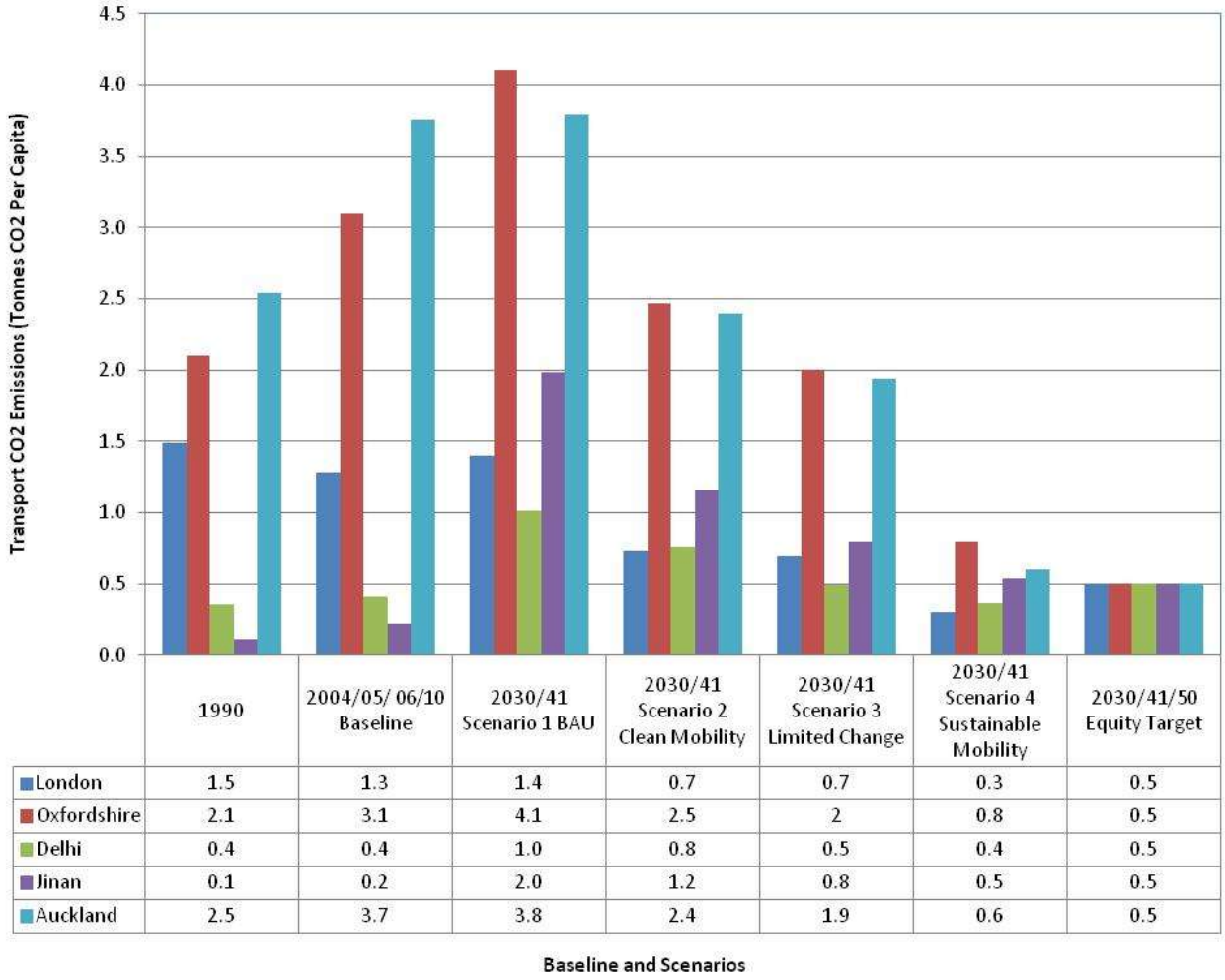


	1990	2004/05/06/10 Baseline	2030/41 Scenario 1 BAU	2030/41 Scenario 2 Clean Mobility	2030/41 Scenario 3 Limited Change	2030/41 Scenario 4 Sustainable Mobility	2030/41/50 Equity Target
London	9,900,000	9,647,900	11,700,000	6,480,565	6,120,306	2,689,809	4,000,000
Oxfordshire	1,200,000	2,015,000	2,876,150	1,732,705	1,403,000	561,200	350,750
Delhi	3,121,712	6,146,651	26,298,177	19,711,040	12,629,030	9,459,180	12,886,766
Jinan	648,267	1,485,025	16,308,110	9,554,246	6,589,135	4,447,666	4,118,210
Auckland	2,400,000	5,140,000	8,030,000	5,188,680	4,106,599	1,314,496	1,061,085

Baseline and Scenarios

Note: different base years are used in the case studies dependent on what data was required and used in the original research studies. For example, the baseline is 2004, 2005, 2006 or 2010 and the future scenarios are developed for either 2030 or 2041 (Hickman and Banister, 2013).

Figure 2: Contraction and Convergence in Transport (CO2 Emissions, Per Capita)

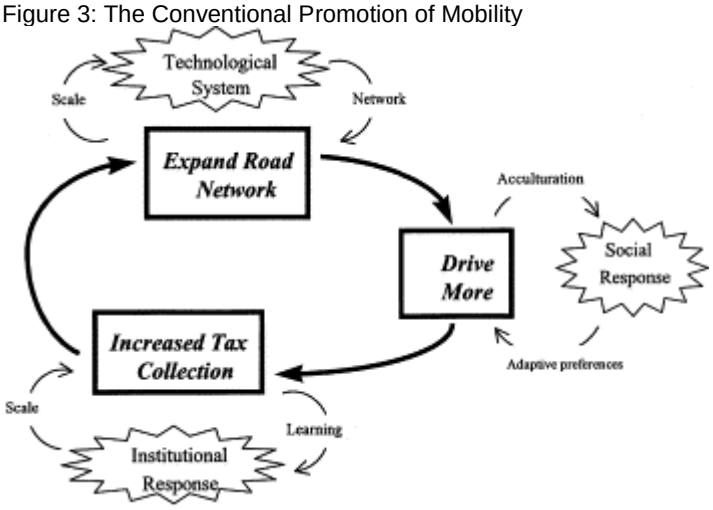


	1990	2004/05/ 06/10 Baseline	2030/41 Scenario 1 BAU	2030/41 Scenario 2 Clean Mobility	2030/41 Scenario 3 Limited Change	2030/41 Scenario 4 Sustainable Mobility	2030/41/50 Equity Target
London	1.5	1.3	1.4	0.7	0.7	0.3	0.5
Oxfordshire	2.1	3.1	4.1	2.5	2	0.8	0.5
Delhi	0.4	0.4	1.0	0.8	0.5	0.4	0.5
Jinan	0.1	0.2	2.0	1.2	0.8	0.5	0.5
Auckland	2.5	3.7	3.8	2.4	1.9	0.6	0.5

(Hickman and Banister, 2013)

Drawing on the wider literature from the social sciences helps us to understand the importance of cultural practices within lifestyles and travel behaviours (Banister et al., 2011; Schwanen et al., 2011). Much of the conventional analysis and thinking in transport has been path dependent, seeking to facilitate the growth in mobility, which has over time resulted in carbon intensive travel patterns. Policy has often been self-fulfilling, as epitomised in the 'predict and provide' approach in motorisation. Transport analysis needs to be understood within this framework, of promoting car-based transport (at least in recent history), with the socio-technical systems reinforcing themselves through positive feedback loops and increasing returns (Figure 3). The socio-technical regime 'organises' the practices, the routines, competences and materialities of travel behaviours, all of which create the varied patterns of movements and continuously reproduce the system. Individual interventions, for example through network investments or urban development, only usually lead to small changes and modifications in aggregate travel. The 'socio-technical transition' (the system of change) hence includes a number of dimensions, including user practices, institutions, financial rules and regulations, infrastructures, vehicle and artefact, industry structure, and cultural and symbolic meanings (Geels, 2002; Geels and Schot, 2007).

Figure 3: The Conventional Promotion of Mobility



(Unruh, 2000)

In seeking to deliver changed travel behaviours, it is of course important to understand, and respond to, the symbolic value of motorisation. Baudrillard's 'Four Logics of Objects' is useful here insofar as allowing an understanding of the systemic nature of features within society, the world as "produced – mastered, manipulated, inventoried, controlled: a world in short that has to be constructed" (Baudrillard, 1968). This can be extended into the system of mobility, particularly the reasons for the purchase and use of the car. The argument is that people's relation to consumption has a hierarchical 'status value' in a system of 'symbolic exchange'. Hence there is a functional value (of 'getting from A to B'), an exchange value (the transaction value), the value of symbolic exchange (symbolic of another subject, such as the offer of 'freedom', or of the transition to adulthood), and a sign value (the consumptive difference relative to others). Signification and meaning are only understandable in terms of how particular objects or signs interrelate. This 'social institution' determines behaviour as well as the action of the individual. Consumption hence is linked to social status. The act of consumption is not simply a purchase, but the means for an individual or group to define his or her place in an order. There is little point in considering the simple use value of the object; because the object only has relative meaning. This relates well to transport and travel, particularly at the modal level and in the choice, purchase and use of cars (Steg, 2005; Anable and Gatersleben, 2005), and is also important when a transition in behaviour is considered. Very often these systemic issues are overlooked.

The concept of social practices can also be a useful unit for understanding travel behaviour, viewed as 'ordered across space and time', and even as the 'basic domain of study of the social sciences' (Giddens, 1984). Urry (2007; 2000) conceptualises mobility as a central and defining feature of society; and Shove (2010) similarly views practices as the integration of images and meanings, skills, materials and objects. As an example, the decline and growth of cycling in UK urban areas is seen as reflecting the emergence, disappearance, transformation and combination of these defining elements. Shove also asks us the think beyond the conventional psychological approaches to behaviour change, such as the theory of planned behaviour (Ajzen, 1991), where the focus is on the role of individual attitude, behaviour and choice (the 'ABC'). Values and attitudes are believed to drive behaviour, and individuals choose to adopt, perhaps with some limitations imposed by contextual elements. This is viewed critically in terms of the 'value-action gap': people who espouse green values

do not always act in accordance with them, including travelling long distances by air for leisure and business (Blake, 1999; Holden and Linnerud, 2011).

Challenging the current hegemony of the car hence involves significant societal transformation, requiring a deeper understanding of why and how people choose and are required to travel, by particular modes and to particular destinations, within wider patterns of consumption and living. There are considerable costs embedded in the current transport system, and to replace them with a more sustainable transport network would be a costly investment including, for example, new infrastructure for electric technologies and cheaper cycle routes (Bertolini, 2007).

TRANSPORT GOVERNANCE AND GOVERNMENTALITY

The framework of governance structures can be important in influencing societal travel behaviours, and obviously they vary hugely by country. Transport governance operates at multiple levels (Marsden and Rye, 2010), at the international, regional, city and local; and involving many different actors, including public authorities, transport operators, industry, the public, and many others. But, beyond this, there are different levels of potential 'application' of governance, in the coverage and nature of chosen policy measures. For example, rather than taking high cost and high risk alternatives, decision makers typically have more actively pursued measures that would address low carbon transport within the same or slightly modified socio technical system (Unruh, 2002). These measures include end of pipe emissions technologies (such as catalytic converters) and continuity measures to maintain the system but in a slightly reconfigured way (for example, hybrid vehicles). There are very few more radical discontinuity measures designed to create a new system (such as different urban forms, much increased levels of walking and cycling, accessible High Speed Rail networks, and teleconferencing facilities).

Foucault (1991) offers some insights as to the multiple definitions, dimensions and possibilities to the role of government, including the role of the government (the legislators, administrators, and arbitrators in the administrative bureaucracy who control a city/state at a given time, and the system of government by which they are organised); governance (what the government does; the act of governing, including the decisions that define expectations, grant power, or verify performance) and governmentality (the art or 'how' of governance; the purposeful effort to guide, steer, control, or manage sectors or facets of society; the way governments try to produce the citizen best suited to fulfill the governments' policies, the organised practices (mentalities, rationalities, and techniques) through which subjects are governed).

The art of government (governmentality) can be viewed in Foucauldian terms as an approach to 'social regulation and control', and it is perhaps this that is least well understood in terms of achieving sustainability in travel (and wider lifestyles). Developing from the sixteenth century in Europe, governmentality is associated with the breakdown of the feudal system and the development of the administrative state in its place, with a key principle developed of 'legitimate rule'. By the eighteenth century, many of the early European states considered their populations as citizens, making up a social body and a society, requiring intervention, management and protection. This framework could be used to help maximise wealth, productivity and even protect vulnerable citizens. Hence a series of statistics and indicators of progress became important, including demographic estimates, marriage and fertility rates, life expectancy and, in time, GDP, income and employment rates. The

contemporary form of governmentality has developed over the last 30 years, increasingly characterised by neo-liberalist beliefs, championing individual freedoms and rights over the 'excessive intervention' of the state (Foucault, 1991; Lupton, 1999). Hence governmentality has been shaped in a particular manner to make it more acceptable to the current move towards neo-liberal views in governments. The individual becomes the 'the entrepreneur of himself or herself' attempting to maximise 'human capital'; seeking to attain a certain state of happiness, purity, wisdom or perfection (Foucault, 1988; Gordon, 1991), or often just survival. 'Risk' has also become a key concept, where control over one's life is perceived as important, and used to explain deviations from the norm, misfortune and hazardous events (Adams, 1995; Lupton, 1999).

The importance for transport is in the remit of transport governance and the delivery of transport investments. This can be seen in the perceived reticence to 'socially engineer' mobility patterns beyond offering different types of 'choice' in mode, and perhaps a little exhortation to travel in a more sustainable manner. Governance is offered 'at a distance', and the individual is viewed as homo economicus, a 'rational choice' actor, weighing up the pros and cons before deciding on the actual activity, location, mode and time of travel. The practice of transport modelling is largely based on these concepts, the dominant four-stage model, as developed in the 1950s, with utility (cost and time) used to represent travel behaviours. Much of this paradigm becomes problematic as we face key societal challenges that demand a strong political lead, such as climate change, or wider intentions to improve well-being and 'happiness'. For example, it is unlikely that the neo-liberal view of promoting individual choice in travel will lead to the required trend-break in transport CO2 emissions. Despite debating long and hard over international climate change negotiations and the development of national targets, this is all made irrelevant if the citizens cannot be encouraged to change their behaviours. The dominant governance approach of 'muddling through' or 'incrementalism' cannot deliver radical policy change, carefully planned strategic steps become ordinarily impossible (Lindblom, 1979). .

The political deliverability of low carbon transport futures and the current governance structures available hence appear to be a major obstacle to progress. The growing body of scenario analysis and modelling of impacts by policy tool or package of tools is useful, but in the end of limited value, if political deliverability is not possible. Very often transport planners overlook this issue, concentrating on the technical feasibility rather than the political deliverability. The history of road pricing illustrates these problems well. Pricing is (almost) universally supported on technical grounds by transport planners and economists, but has a very poor history of implementation. But more important is the short term view taken by many politicians, as the electoral cycle is at odds (4-5 years) with longer term thinking (scenarios), and radical change towards sustainability is not high on the list of political priorities. It is small wonder that any progress is made at all.

To illustrate this further, the political possibility of delivering particular projects can also be examined in terms of the degree of public authority (legitimate coercion) required to implement them (Hood, 1986; Dunn and Perl, 2010). The level of 'coercion' is viewed as reflecting an element of 'forcing' another party to behave in a non-voluntary manner (through action or inaction). A 'weak state tradition', say in the United States, or perhaps increasingly in the UK and New Zealand, means that policy tools are generally chosen from the least coercive part of the spectrum. Regulation on businesses and individuals results in hostile responses and intense lobbying and 'watering down' of original proposals. Increasing taxes, for example, in the US is almost viewed as 'legalised extortion', and perhaps this is not

confined to the US. Subsidies and voluntary schemes prove much more acceptable to politicians and the public (Dunn and Perl, 2010). A 'stronger state power' means that even the coercive measures can be used. China, for example, can develop vehicle registration schemes and develop high speed rail investments at a scale and speed that is difficult in Europe or elsewhere, perhaps offering greater potential for achieving CO2 reduction aspirations.

CONCLUSIONS

The car has been an incredible invention, and has become central to the working of society and to peoples' lives: "Automobility adapts as it spreads along the paths and roads of each society [...] it seems to provide the solution to the problems of congestion that it itself generates [...] it externalises dangers onto those outside the system as it provides enhanced security for those 'within', and it is central to the individualistic consumerist affective culture of contemporary [society]" (Sheller and Urry, 2004). In all of the case studies this is evident in the current and projective BAU scenarios.

The scenarios developed for London, Oxfordshire, Delhi and Jinan illustrate that different futures are possible, and that the 0.5 tCO2 per capita target can be achieved in different contexts. However, this assumes that a 'Sustainable Mobility' (Scenario 3) type of future is deliverable, that governance is far reaching and effective, and that the (petrol and diesel) car can be disassociated from use in everyday life. These are all ambitious assumptions, and Urry, Giddens, Shove and others remind us that changing travel practices is associated with fundamental change at the societal level. This is the key problematic that now needs to be faced. Dennis and Urry (2009) ask us to envisage life 'after the car', and it is very likely, indeed certain, that a new pathway will being to develop: perhaps the travel of 'the day-after-tomorrow' is starting to unravel. What will travel look like in a world without oil and with limited energy resources? We perhaps don't know how society will respond as yet, but for certain oil is a finite resource and in the not too distant future we will need to travel in ways that require much less oil. The convention of seeking increased GDP per capita in the economy, of facilitating increased mobility, of relentless consumer novelty will have gone; to be replaced perhaps by a new approach, premised on a better and fairer social logic (Jackson, 2009); where cities, travel and the quality of life are developed to make a positive contribution to well-being, livelihoods and capabilities (Sen, 2009).

Mobility is, as ever, central to social relations, and currently this is usually delivered by the petrol or diesel private motor car. This latter social construction however can – and must – change. The worry, of course, is that we cannot make progress beyond the incrementalism. We hope to have begun a serious consideration of the possibilities for changing travel behaviours, but we should perhaps consider a final warning (More, 1516): "there are many features of the Utopian commonwealth that I can more easily wish for in our own societies than hope to see realised."

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