SUSTAINABLE TRANSPORT AND PUBLIC POLICY

David Banister
University College, London, UK

Keywords: sustainable transport, policy intervention, barriers to implementation, CO_2 emissions, technological innovation, economic policy, planning policy, changing attitudes

Contents

Summary

This article discusses the notion of sustainable transport, an elusive goal that seems to have dominated much of the recent debate on transport policy. In an absolute sense all transport is unsustainable as it consumes resources. Walking and cycling come nearest to being sustainable, as they consume very little nonrenewable energy. As one moves down the transport hierarchy, more resources are used both in terms of energy consumption, and in the production of externalities such as pollution, accidents, noise, and congestion.

It is generally accepted that all forms of public transport are more sustainable than private transport, but even here there is much debate over the relative efficiencies.

Public policy can and should have a role in achieving sustainable transport. To a great extent the options available to move policy towards greater sustainability are well known, yet real progress has been disappointingly slow. Most effort has been directed at reducing the need to travel through a range of technological, economic, and planning interventions. Substantial barriers to implementation have been raised, and policy makers seem to rely increasingly on technological solutions to achieve sustainable transport.

1. Introduction

Sustainable transport is an elusive goal that seems to have dominated much of the recent debate on transport policy. In an absolute sense all transport is unsustainable as it consumes resources. Walking and cycling come nearest to being sustainable, as they consume very little nonrenewable energy, but even here other types of resources are used, principally space. As one moves down the transport hierarchy, more resources are used both in terms of energy consumption, and in the production of externalities. Externalities in the transport context cover the emissions of pollution, accidents, noise, and congestion. In addition, there is water and soil pollution, the waste from the production and disposal of vehicles, the use of public space for roads and parking, the severance effects, destruction of ecosystems, and visual annoyance.

All forms of motorized transport use nonrenewable energy and create substantial externalities. It is generally accepted that all forms of public transport are more sustainable than private transport, but even here there is much debate over the relative efficiencies, as these are dependent on the assumptions made on occupancy levels, whether the vehicles are actually operating at given levels of efficiency, the speed of the vehicle, and the types of externalities (particularly pollutants) being monitored (see Table 1). There are no simple relationships or answers, but certain general principles are apparent.

Mode	**Seats/ spaces**	**MJ/ vehicle km**	**MJ/ seat km**	**MJ/ passenger km**	
Air Boeing 727	167	243	1.45	2.42	
Rail Electric and diesel	377	168	0.45	1.65	
Metro London Underground	555	141	0.25	1.69	
Tram Light Rail	265	79.8	0.30	0.91	1.20
Bus	48	14.7	0.34	0.92	1.53
Lorry				2.94	
Taxi	4	3.3	0.83	2.94	
Car	4	3.7	0.92	2.10	
Motorcycle	2	1.9	0.95	1.73	
Cycling	1	0.06	0.06	0.06	
Walk	1	0.16	0.16	0.16	

Notes: The modal primary energy consumption figures are measured in Mega Joules (MJ) and they include energy use in maintenance. Average figures for cars and motorcycles/mopeds weighted according to national (GB) fleet sizes (Department of Transport, 1993). Occupancy figures are as follows Air = 60%, Rail 28%, Metro 15%, Light Rail = 33% and 25%, and Bus = 33% and 20%. Car occupancy figures are a weighted average of 1.76 (work = 1.2 and nonwork = 1.85). Occupancy for motorcycle is 1.11 and for taxi is 1.12. Where there are two figures in the final column, this gives energy consumption for each of the occupancy rates given above. The figure for air is a low estimate as Scholl et al. give a 3.33 MJ/passenger km estimate.

Source: Based on Banister et al. (1997), Hughes (1993), Stead (2000), CEC (1992), Scholl, Schipper and Kiang (1994).

Table 1. Primary energy consumption figures by mode for the UK

In terms of sustainable transport, both walking and cycling come out top. High-occupancy public transport (including rail, bus, tram, and metro) follows, but in some cases only just ahead of clean, small, efficient cars. The third group includes high-speed rail and many other types of car. Taxis and lorries form a fourth group, with air transport on its own in a fifth group. Air transport is particularly problematic as it both uses large quantities of fuel and the distances traveled are long. It is also a key growth market, and options for more sustainable air travel seem to be distant. Most public policy action on sustainable transport has been directed at the car rather than other forms of transport.

There are three important reasons that transport should reduce its dependence on nonrenewable oil sources and become more sustainable:

1. *Energy security*. Although there are significant long-term possibilities for substitution, transport is almost entirely oil dependent. There are potential security threats to many highly motorized economies, as well as those at the start of their mobility transition, which are dependent on imports. The energy security and climate change challenge is to use oil more productively and to develop alternative fuels.
2. *Environmental protection.* Transport's share of global and local pollutants continues to grow. Political barriers to reduce emissions are also high (particularly in air transport), but measures need to be taken to ensure transport makes a significant contribution to the achievement of international (Kyoto) obligations through national and local actions.
3. *Economic competitiveness and globalization.* Economies are critically dependent on transport, and transport has been a key facilitator of the globalization process. A large proportion of private and public expenditure is on transport, and transport contributes substantially to national product.

In this paper, the focus is on the role that public policy can and should have in achieving sustainable transport. To a great extent the options available to move policy towards greater sustainability are well known, yet real progress has been disappointingly slow. The argument developed here is that most effort has been directed at reducing the need to travel through a range of technological, economic, and planning interventions. Substantial barriers to implementation have been raised, and policy makers seem to rely increasingly on technological solutions to achieve sustainable transport.

In this paper, the options are presented, together with the barriers and the means by which they can be overcome. But even where successful implementation has taken place, there is a substantial difference between policy intentions and policy outcomes. Even where identifiable change has taken place, the scale is modest. In the concluding section, it is argued that real change can only be achieved through changing the priorities and actions of individuals, and through debates on the types of cities and urban areas in which people want to live. When attitudes and visions coincide, then it is possible to determine the appropriate contribution of transport to that vision.

2. Global Perspectives on Public Policy

Worldwide, there has been a significant change in priorities with the general acceptance of the need to reduce emissions of CO_2 and the five other greenhouse gases (nitrous oxide (N_2O), methane (CH_4), chlorofluorocarbons (CFC11 and CFC12), and hydro chlorofluorocarbons (HCFC22)). The Intergovernmental Panel on Climate Change

(IPCC) has estimated that significant reductions are needed in each of these greenhouse gases if stabilization targets are to be reached: 60% for CO_2, 20% for CH_4, 50% for HCFC22, and over 75% for N_2O, CFC11, and CFC12.

This was first recognized at the 1992 Rio Summit where voluntary stabilization targets were agreed, but more importantly in the 1997 Kyoto Protocol where the 38 developed countries agreed (subject to ratification) to set a series of mandatory targets. These range from a reduction of 8% in CO_2 emissions in the European Union (EU) and Switzerland to a 7% reduction in the United States, and a 6% reduction in Canada and Japan, but with increases in other countries (Iceland +10%, Australia +8% and Norway +1%). The overall reduction was 5.2% between 1990 and 2010. Such a breakthrough in global public policy is encouraging, as the targets set are both realistic and mandatory. Some countries (e.g., the UK and the Netherlands) are setting even more challenging targets of up to a 20% reduction, but still a long way short of the levels demanded by the IPCC.

There is an acceptance that even though the science of global warming and greenhouse gas emissions is not well known, there is sufficient evidence available to adopt the precautionary principle and take policy action. Transport is a major contributor to global warming, principally through the emissions of CO_2 from all carbon-based fuels. In most developed economies, transport accounts for about 25% of the total CO_2 emissions, and it is the only major sector where the absolute amount continues to increase. It is a direct result of the growth in income levels and affluence, the dispersal of urban activities, and the growing dependence on the car (and lorry), and more recently air transport. Over the last 20 years, car ownership levels and travel have doubled in many developed countries, and this increase is expected to continue over the next 20 years by a further 70%.

Countries	Energy use in transport		Carbon dioxide million metric
	Exa Joules	Percent	tonnes
USA	20.3	37.1	1523
Russia	3.5	6.4	263
Japan	3.2	5.9	240
Germany	2.5	4.6	188
Nine countries	13.3	24.3	1001
Seven countries	4.0	7.3	302
The rest	7.9	14.4	593
Total	54.7		4103

Notes: EJ = Exa Joules. A Joule is a measure of energy (kg m^2 s^{-2}) and Exa is 10^{18}
Carbon Dioxide is estimated, by converting directly from energy use – 75 million metric tonnes of carbon dioxide per Exa Joule.
The Nine Countries (1.0 – 1.9 EJ) are the UK, France, Canada, China, Italy, Brazil, Mexico, India and Spain.
The Seven Countries (0.4 – 1.0 EJ) are Australia, Ukraine, South Korea, Thailand, South Africa, Netherlands and Indonesia.
The Rest (<0.4 EJ) cover more than 100 countries
The total including marine bunker fuel increase from 55 EJ to 65EJ
Sources: Michaelis et al. (1996) and IEA (1993).

Table 2. Transport energy use (EJ) and CO_2 emissions (1990)

However, the transport-related energy consumption patterns and levels of CO_2 emissions are not evenly distributed across the world. Just 20 countries consume about 86% of the total transport energy use (see Table 2). The vast majority of that energy use (80%) is for road transport, with air travel accounting for a further 13%, rail 4.4%, and inland water transport 2.6%. The fastest-growing sectors are road (+2.4% per annum) and air (+6% per annum). Two thirds of transport energy consumption is in just 13 countries, with the United States alone accounting for 37% of all consumption.

There are a series of important questions here if the global dimension of sustainable transport is to be achieved, with strong implications for public policy:

- The developed countries should be taking a strong lead in reducing their levels of energy consumption and emissions levels through challenging targets, so that other countries at lower levels of development or in transition can increase their levels of consumption and emissions, at least in the short term.
- The use of tradable permits is likely to have a central role in the achievement of all targets. Investment could take place in developing countries where the opportunities for major savings in energy consumption are possible. The question then becomes who actually claims the savings: the country where the investment took place, or the country that made the investment.
- The responsibility for effective action lies initially in a few major countries—the United States, Canada, Japan, Russia, and the EU. Unless these countries make a serious contribution through domestic policy programs and investments in clean technologies, no progress will be made towards the achievement of the Kyoto targets.
- At the present time, there is no technological solution to reducing the emissions of CO_2. All carbon-based fuels produce CO_2, so reductions can only take place through traveling less; through improved efficiency of travel (more efficient engines, better design, or higher occupancy/load levels); through the use of renewable fuels (solar power or fuel cells); through switching to nonmotorized transport modes; and through the substitution of transport activities with other services (e.g., telecommuting and teleshopping). Other emissions, such as carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen oxides (NO_x), nitrous oxide (N_2O), hydrocarbons (HC), particulates (PM_{10}), and methane (CH_4), can all be controlled through catalytic converters and other add-on technologies.

The most serious unresolved question for public policy lies in the debate over whether the means to achieve the 1997 Kyoto targets are more important than the ends. If it is agreed that the overall reduction of 5.2% in CO_2 emissions is the main target, then it is possible. But it will not be achieved by reductions in emissions levels in the 38 developed countries. It will only be achieved through giving the United States unlimited rights to trade internationally in carbon credits. The United States will buy its way out of its domestic obligations through planting forests, buying credits from countries that have exceeded their savings targets, and through investments in third countries in clean technology. In the United States, CO_2 emissions have increased by 12% (1990–2000) and there has been no progress towards the reduction target of 7% agreed at Kyoto. Emissions would now have to be 30% below the projected level by 2010 to achieve the

Kyoto target, and that is impossible (Frank Loy, the US Under Secretary for Global Affairs, July 2000).

This issue was the main topic for discussion at the 2000 Hague Climate Change convention meeting. Europe wanted to limit the ability of the United States to buy carbon credits from third countries (e.g., Russia) to 50% of its required savings, otherwise the United States would have “escaped” making any direct contribution to CO_2 target reductions. If there were no limits on carbon trading, it would have significantly increased its share from 37% to about 45% of the total global CO_2 emissions in the transport sector. Even within the United States, there are now clear signals that the people want action, with industry now supporting change. No agreement was reached at The Hague, and governments are trying to resolve the impasse of carbon trading and the Kyoto ratification at Bonn in 2001, but with little expectation of progress, particularly as the US president, George W. Bush, has said that he will not ratify the Kyoto agreement.

At the global level, there is considerable doubt over whether the targets set at Kyoto can be achieved, particularly in the transport sector. Although transport may not take an equal share in the CO_2 reduction targets, it still has an important role to play. It seems that only if the United States is given unlimited scope to achieve its “domestic” target through investment in “other” countries will the targets be achieved through tradable permits. However, the moral responsibility for each country to make a positive contribution to the target achievement will not have been addressed. There will be even less incentive for the highly mobile affluent car drivers to pressure government to implement sustainable transport policies.

The only alternative to the Kyoto targets seems to be the possibility of contraction and convergence. This is a three-stage process where initially agreement is sought on the upper limits for CO_2 emissions. Once the overall limit has been agreed, there has to be further agreement of the proportion of the gas released that remains in the atmosphere, so that the rate of reduction in emissions to reach the overall target can be estimated. The third stage is the allocation of maximum consumption targets for each nation. This allocation process is still the center of dispute, as a fair level should be an equal allocation to each person. The means to get round this potential impasse would be to have a transition period for the convergence, with the higher consuming countries trading permits with those who were more efficient in their use of fossil fuels. Such an agreement would allow the flow of capital from the rich to the poorer countries, and there would be a strong incentive to reduce reliance on fossil fuels and to maintain efficiency in all energy use. However, making such a proposition is only the first step in the process, which is likely to be long and difficult. As we have already seen in the last ten years (from Rio to Kyoto, via the Hague and Bonn), it is extremely difficult to make global agreements on the environment, and progress towards even converging on an approach has been painfully slow. Perhaps it is at the local level that public policy can have a greater impact on the quest for sustainable transport.

-
-
-

Bibliography

Acutt M. and Dodgson J. (1998). Transport and global warming: modeling the impacts of alternative policies. *Transport Policy and the Environment* (ed. D. Banister), pp. 20–38. London: E. & F.N. Spon.

Banister D. (1998). Barriers to implementation of urban sustainability. *International Journal of Environment and Pollution* **10**(1), 65–83.

Banister D. (2000). *The Future of Transport*. Paper prepared for the Royal Institute of Chartered Surveyors' (RICS) Research Foundation Project on 2020 Visions of the Future, January 2000. London: RICS.

Banister D. and Marshall S. (2000). *Encouraging Transport Alternatives: Good Practice in Reducing Travel*. London: The Stationery Office.

Banister D., Watson S., and Wood C. (1997). Sustainable cities, transport, energy and urban form. *Environment and Planning B* **24**(1), 125–143.

CEC (Commission of the European Communities) (1992). *Sustainable Mobility: Impact of Transport on the Environment*, Rep. COM 92(46). Brussels: CEC.

Department of the Environment, Transport and the Regions (2001). *Transport Statistics: Great Britain 2000.* London: The Stationery Office.

Hathway T. (1997). Successful community participation in local traffic proposals. *Journal of Advanced Transportation* **31**(2), 201–213.

Houghton J., Jenkins G., and Ephraums J. (ed.) (1990). *Climate Change: The IPCC Scientific Assessment.* Cambridge: Cambridge University Press.

Hughes P. (1993). *Personal Transport and the Greenhouse Effect: A Strategy for Sustainability*. London: Earthscan.

IEA (International Energy Agency) (1993). *Energy Balances of OECD Countries 1990–1991*. Paris: OECD.

Louw E. and Maat K. (1999). Mind the gap: pitfalls on measures to control mobility. *Built Environment* **25**(2), 118–128.

Maddison D., Pearce D., Johansson O., Calthrop E., Litman T., and Verhoef E. (1996). *The True Costs of Road Transport.* London: Earthscan, Blueprint 5.

Mägerle J. and Maggi R. (1999). Zurich transport policy: or the importance of being rich. *Built Environment* **25**(2), 129–138.

Meyer A. (2000). *Contraction and Convergence*. London : Green Books.

Michaelis L., Bleviss D., and Orfeuil J.-P. (1996). Mitigation options in the transportation sector. *The Intergovernmental Panel on Climate Change (IPCC) Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change, Scientific and Technical Analyses, Contribution of Working Group II to the Second Assessment Report of the IPCC*, pp. 680–712. Cambridge: Cambridge University Press.

Mittler D. (1998). *Environmental Space and Barriers to Local Sustainability. Evidence from Edinburgh, Scotland*. Paper presented at: Planning Patterns For Sustainable Development, International Conference, Padua, Italy, September 30–October 3 1998.

Mittler D. (1999). Reducing travel!? A case study of Edinburgh, Scotland. *Built Environment* **25**(2), 106–117.

OECD/ECMT (Organization for Economic Cooperation and Development/European Conference of Ministers of Transport) (1995). *Urban Travel and Sustainable Development*. Paris: OECD.

OECD/IEA (Organization for Economic Cooperation and Development/International Energy Agency) (1997). *Transport, Energy and Climate Change.* OECD/IEA Policy Analysis Series. Paris: OECD/IEA.

ROCOL (2000). *Road Charging Options for London: A Technical Assessment.* Report for the Government Office for London (March). London: The Stationery Office.

Royal Commission on Environmental Pollution (1994). *Cm 2674. Transport and the Environment.* London: HMSO.

Royal Commission on Environmental Pollution (1997). *Cm 3752. Transport and the Environment: Developments Since 1994.* London: HMSO.

Salomon I. and Mokhtarian P.L. (1997). Coping with congestion: understanding the gap between policy assumptions and behavior. *Transportation Research D* **2**(2), 107–123.

Scholl L., Schipper L., and Kiang N. (1994). *CO_2 Emissions from Passenger Transport: A Comparison of International Trends 1973–1990.* Discussion Paper from the Lawrence Berkeley laboratories, California.

Smith T.B. (1973). The policy implementation process. *Policy Sciences* **4**(2), 197–209.

Stead D. (2000). Relationships between transport emissions and travel patterns in Britain. *Transport Policy* **6**(4), 247–258.

Biographical Sketch

David Banister has been Professor of Transport Planning and Director of Research at the Bartlett School of Planning, University College, London, UK, since 1995. From 1994 to 1997 he was Visiting VSB Professor at the Tinbergen Institute in Amsterdam, the Netherlands, and in 2001/2002 he was Visiting Research Fellow at the Warren Centre in the University of Sydney, Australia. In 2000 he was invited to be listed in *Who's Who*.

Recent research has focused in three areas. (i) Reducing the need to travel, including the instrumental role that planning policy can have in achieving sustainable development. Responsible for the development of a range of measures; some based of statistical analysis of secondary data (e.g., the National Travel Survey) and others of spreadsheet models of energy and emissions data. Most recently, this research has resulted in a GIS-based model of transport, energy, and emissions, available to local authorities to test the transport implications of different housing and other location strategies. (ii) Development of good practice guides for transport and planning; originally in the context of PPG13 and more recently in the DANTE project that developed good practice in European cities for the reduction of car-based travel. Part of this work has resulted in the development of the necessary organizational and institutional frameworks within which effective policy can take place, and the barriers to real change. (iii) Policy-scenario building and the development of a new form of modified backcasting methodology where targets, desirable images of the future, and actual policy packages and paths are developed. This methodology has been applied in a variety of applications from the EU level (POSSUM and ICTRANS), through national level planning to the subregion and city. Most of the scenario building has been placed within the context of sustainable development and the necessity to reduce levels of car (and air) dependence.

Professor Banister is the author or editor of 16 research books, including *Transport Planning* (2002), *European Transport Policy and Sustainable Mobility* (2000), *Encouraging Transport Alternatives: Good Practice in Reducing Travel* (2000), *Transport Investment and Economic Development* (2000), *Environment, Land Use and Urban Policy* (1999), *Transport Policy and the Environment* (1998), *Telematics and Transport Behaviour* (1996), *Transport and Urban Development* (1995), and *European Transport and Communications Networks: Policy Evolution and Change* (1995). In addition, he has written more than 50 papers in international refereed journals, and he has published a further 50 papers in journals or as chapters in books. Other outputs include research monographs (31) and reports for researcher sponsors (over 100). He is the editor of *Transport Reviews* and joint editor of *Built Environment*.