European Community Personal Transport: The Need For a More Integrated Approach

Joanne Wade, Environmental Change Unit, University of Oxford

1. SYNOPSIS

A narrow focus for transport policy assessment may lead to sub-optimal choices. A more comprehensive methodology is suggested, to improve information for both government and public.

2. ABSTRACT1

Historically, transport policy has focused on providing unlimited mobility via the use of increasingly sophisticated technology. Where environmental constraints have been recognised, the policy response has concentrated largely on a technological solution to a narrowly defined problem. In many cases this response has resulted in solutions of a temporary nature, and often the concentration on a particular problem has led to a neglect of other important issues. The use of planning, in combination with other policy instruments, has the potential to produce more comprehensive, sustainable solutions to the present day failings of personal transport, delivering a system which provides accessibility rather than mobility, and a better quality of life for the population as a whole. This paper defines a methodology for policy assessment which encourages a wider view of the situation, and which promotes a more integrated approach to transport policy, including technology, fiscal mechanisms and planning in appropriate combinations. The criteria for policy assessment include: impact on emissions of a range of pollutants; economic efficiency; and improvements in social equity. Examples of policies currently being suggested for the reduction of transport sector carbon-dioxide emissions are assessed using the methodology. This assessment demonstrates the more comprehensive and sustainable nature of the benefits delivered by urban planning.

3. INTRODUCTION: THE TRANSPORT POLICY-MAKING CONTEXT

The basic objectives of the European Commission's Common Transport Policy are those of the EEC Treaty and The Maastricht agreement (Commission of the European Communities, 1992), and include balanced and sustainable economic development, high levels of employment and social protection, and increases in the standard of living and quality of life. The concept of sustainability, taken here to mean the meeting of the needs of present generations without compromising the ability of future generations to meet theirs, must be considered in all policy areas.

The European Community is a signatory to the Framework Convention on Climate Change (United Nations, 1992), and therefore is committed to the return of CO_2 emissions to 1990 levels by 2000. The transport sector is expected to play a significant role in the achievement of this target. The Community is also committed to the reduction of long-range transboundary air pollutant emissions, as defined by the 1979 UNECE Convention (UNECE, 1979) and its subsequent protocols.

Historically, transport policy aimed at reducing environmental impacts has concentrated on technological solutions to specific problems, such as the removal of lead from petrol and the fitting of three way catalytic converters to petrol engine exhaust systems. There is increasingly a move away from this type of measure towards the greater use of the market, via the incorporation of externalities into the costs payable by the transport user. However, a continuing need for standards for emissions, noise and energy efficiency at Community levels is suggested (Commission of the European Communities, 1993).

The main body of this paper will concentrate on the assessment of some of the policies put forward within this context for the control of the environmental impacts of passenger transport. The exclusion of freight transport is in no way intended to suggest that passenger modes deserve more attention: rather, the policy instruments involved are very different for each sector, and a sufficient assessment of both is not possible in one paper.

4. THE LIMITATIONS OF POLICY ASSESSMENT WITH A NARROW FOCUS

As summarised above, the aims of transport policy are many and varied. This suggests that the achievement of an optimal policy requires a wide-ranging assessment of the options. The use of a narrow focus in policy analysis can lead to both potential problems and some of the possible beneficial effects being overlooked.

For example, the diesel car has often been promoted as a means to increase the efficiency of the car fleet. An increase in the proportion of diesels may well help the achievement of this aim, but will also lead to an increase in the emissions of particulates from passenger cars: recent concern for the health effects of emissions (particularly in urban areas) has resulted in a questioning of the wisdom of promoting diesel (see for example QUARG, 1993 and House of Commons, 1994)

As the above example shows, within environmental objectives, all the issues need to be considered together if an optimal solution is to be reached. Applying this same principle in a wider context suggests that the consideration of environmental problems in isolation from the social and economic objectives of transport policy may lead to the worsening of problems in these areas. Similarly, the dominance of either economic or social policy to the exclusion of the others would also risk adverse consequences.

The rest of this paper defines an assessment methodology which attempts to incorporate all these categories of objective and thereby demonstrate how certain policies are more effective over a wide range of impacts. The methodology is applied to a range of transport/environment policy options currently being implemented or discussed.

5. ASSESSMENT METHODOLOGY

The starting point for this methodology is that environmental and equity goals for the sector must be determined, and only within these should the operation of the market be promoted. This approach is in line with the practical examples of environmental policies to date but runs counter to the thinking of those who wish to rely solely on the functioning of the market with the incorporation of all externalities into the costs of transport[1].

A series of environmental, equity and economic objectives can be identified from a review of the environmental treaties currently in force, the discussions on updating them, and the policy documents published by the European Commission and Member State governments which define the social and economic goals of transport policy (for example see Commission of the European Communities, 1992; Danish Ministry of Transport, 1991; Dehaene, 1991; Ferris, 1991; Grande-Duché de Luxembourg Ministere des Transports, 1990; Netherlands Second Chamber of the States-General, 1990; UK Government, 1992). It is only possible to give a brief summary of these objectives here. Note that the lists below are not intended to be comprehensive, rather they will be used as an indication of the insights offered by comprehensive policy analysis.

The following environmental objectives can be identified:

- compliance with the Framework Convention on Climate Change via the return of CO_2 emissions to 1990 levels by 2000;
- reductions in CO_2 emissions beyond 2000, at a rate of 1% per annum (this is consistent with IPCC estimates of the reductions necessary to stabilise atmospheric CO_2 at 50% above pre-industrial levels);
- stabilisation of the global warming potential (GWP) of emissions by 2000[2];
- reductions in GWP after 2000 at a rate of 1% per annum;
- compliance with the nitrogen, sulphur and volatile organics protocols to the Geneva convention;
- further reductions in nitrogen and VOC emissions as per the European Commission's 5th Environmental Action Programme;
- improvements in urban air quality (this will include reductions in substances not covered by international agreements, such as carbon monoxide and particulates).

Social objectives included in published policy documents include:

- reducing disparities in quality of life between different groups of the population;
- promoting increases in employment in areas of high unemployment;
- promoting the development of the peripheral regions of the Community;
- improving the health of Community citizens;

- providing equal access to other people, to services and to education and leisure facilities for all sectors of the population.

The basic economic objective pursued here is the maximisation of the economic efficiency of the policy instruments implemented. A macroeconomic cost-benefit analysis is not attempted here: the macroeconomic effects of a particular instrument are totally dependent on the context in which it is used and the manner in which it is implemented (e.g. the effects of a revenue-raising instrument such as a fuel tax will depend on the use to which the revenue so raised is put). Economic efficiency can be described as the meeting of the following criteria:

- comprehensiveness (i.e. addressing all sources of all emissions relating to all environmental problems);
- allowing flexibility of response;
- predictability and gradual implementation;
- dynamic efficiency (i.e. the promotion of continuing technological innovation);
- an ability to correct non-externality market failures, in this case enabling the consumer to fully incorporate energy efficiency into vehicle purchase and modal choice decisions.

Policy instruments can be assessed against each of these objectives. For each they can be given a rating, as follows:

--	the instrument works strongly against the objective
-	the instrument works somewhat against the objective
0	the instrument is neutral with respect to the objective
+	the instrument to some extent meets the objective
++	the instrument fully meets the objective

6. ASSESSMENT OF POLICY INSTRUMENTS

The three examples of policy instruments considered are currently all receiving attention within the European Union as possible contributors to the reduction of carbon dioxide emissions from the passenger transport sector.

These instruments are:

(1) A European Union-wide increase in fuel taxes. Here the example used is that currently being implemented in the UK (i.e. 5% per annum in real terms). According to GB Department of Transport estimates (Virley, 1993), this will lead to a 17% increase in real total road fuel prices by the year 2000, over and above baseline projected fuel price increases. Using price elasticities of fuel demand as suggested by Goodwin et al (1992) this increase is translated into a reduction in demand for private car travel. Prices of public transport fares are considered to be unaffected since in many Member States taxes on fuels used by commercial operators are recoverable;

(2) The implementation of fuel efficiency standards for private cars. The standards would require a moderate improvement initially and would be gradually tightened over the period to 2005. They have the effect of increasing the rate of technological improvement such that in 2005 the registration-weighted average new car fuel efficiency is 38% higher than in 1994;

(3) Urban planning aimed at reducing city centre private car traffic. This policy is based on the plan for Amsterdam, as described by Lemmers (1993). As an illustrative example, the public transport improvements and parking restrictions described for Amsterdam are applied to 10% of total European Union urban area. The Amsterdam plan predicts that in the area covered, private car traffic will be reduced by 31% by the year 2005, compared to the predicted level of car traffic at that time. For the purposes of this illustration, it is assumed that this reduction is compensated for by a corresponding increase in urban light rail services.

Note that the assessment is very specific to the policies as defined above. Small changes in the definition could significantly alter the assessment against one or more of the objectives. For example, a taxation policy could be defined which, by setting the tax increases at a high enough level, fully met the environmental objective of returning CO_2 emissions to 1990 levels by 2000 but acted to a greater extent against the equity criterion of reducing quality of life disparities. However, the aim here is to assess policies which are actually being proposed or implemented, and hence provide an insight into the present status of the system with respect to the defined objectives.

6.1 Assessment against environmental objectives

In the first stage of the analysis the emissions from the passenger transport sector assuming business-as-usual trends were modelled, using the Earth Resources Research Transport Atmospheric Emissions Model as described in Fergusson et al, 19893. These trends are essentially a reflection of the effects of the introduction of the TWC, and the associated emissions limits for passenger cars. Although the policy options being assessed are largely directed at private cars, the land passenger transport sector as a whole is modelled.

Base levels of transport demand and projections of future growth were taken from European and UK statistical publications including Transport Statistics Great Britain, Eurostat and UNECE transport statistics, and UK government, DGVII and DGXVII projections of traffic demand growth. Energy use and emissions factors for road vehicles were taken from work by Eggleston et al (1991). For rail vehicles figures obtained by the author for a previous study (Tomkins and Wade, 1989) and those used in Fergusson et al were employed.

The global warming potentials (GWPs) of the resultant annual emissions were calculated using the method defined in Wade et al, 1994. The effects of the above policy instruments on demand and vehicle technology were then translated into model inputs, and the resulting new projections of emissions and GWP modelled and calculated. Tables 1 and 2 show the results of the policy scenario modelling.

Table 1. *Trends in emissions and global warming potential, all land-based modes, pre-2000*

% change in emissions / GWP		Fuel Tax	Efficiency Standards	Urban Planning
- CO_2	(1990 - 2000)	7,39	9,95	15,32
- CO	(1985 - 2000)	-45,96	-42,38	-42,52
- SO_2	(1985 - 2000)	-11,43	-11,43	-10,61
- NOx	(1990 - 2000)	-54,89	-52,06	-52,13
- VOC	(1990 - 1999)	-48,04	-46,21	-46,31
- Pm	(1985 - 2000)	-12,02	-7,84	-8,02
- 100 year GWP	(1990 - 2000)	0,11	3,15	7,40

Table 2. *Trends in emissions and global warming potential, all land-based modes, 2000 - 2025*

% per ann. change in emissions / GWP	Fuel Tax	Efficiency Standards	Urban Planning
- CO_2	0,38	-0,45	0,52
- CO	-2,90	-2,87	-2,87
- SO_2	0,23	-0,08	0,57
- NOx	-2,79	-2,81	-2,81
- VOC	-3,10	-3,12	-3,11
- Pm	-2,76	-2,74	-2,74
- 100 year GWP	0,17	-0,54	0,31

Table 1 shows the percentage change in emissions and GWP for the three policy scenarios for a range of time periods up to the year 2000. The time period over which the change has been calculated for each emission or GWP category corresponds to the period over which the relevant environmental objectives have been defined. Table 2 shows the average percentage per annum changes in emissions and GWP for the years 2000 to 2025. These values allow assessment against the objectives set or suggested for periods after 2000. In both tables a positive change represents an increase in annual emissions or GWP, and a negative change represents a decrease.

The results of this modelling can be compared to the environmental objectives defined above. The results of this comparison are shown in Table 3.

***Table 3.** Assessment against environmental criteria*

	Fuel Tax	Efficiency Standards	Urban Planning
CO_2 stabilisation/reductions	-/--	-/--	--
GWP stabilisation/reductions	0	0	-
Geneva convention			
- SO_2	-	-	-
- NOx	++	++	++
- VOC	++	++	++
5th Action Programme			
- NOx		+	+
- VOC	++	++	++
Urban air quality	+	+	++

The assessment of the policies against the remaining criteria is not a matter for quantitative modelling, as in many cases there are no data available to allow this. Therefore the tabulations in the following sections are the result of a review of the available literature and statistics for each of the issues involved.

6.2 ASSESSMENT AGAINST EQUITY OBJECTIVES

Table 4 shows the assessment of the three policy options against the equity objectives defined above.

***Table 4.** Assessment against equity criteria*

	Fuel Tax	Efficiency Standards	Urban Planning
Reducing quality of life disparities	-	0	+
Increasing employment	0	-	+
Development of peripheral regions	-	0	0
Improving health	0	0	++
Providing access for all	--	0	+

Note that the purely technical measures which have been introduced to date (the base scenario) were found to have little or no impact on social objectives, other than a possible temporary improvement in the health of those exposed to high levels of traffic fumes. There is much debate about the possibly regressive nature of a fuel tax. However, in general there are likely to be adverse effects on groups of the population who rely heavily on the private car, and therefore these may not affect the very poorest groups within society. Efficiency standards are, like emissions standards, unlikely to have a great impact on social objectives. There may be some adverse impact on European car manufacturers if they are less well equipped to meet the standards than external competitors, and if CAFE style standards were used there may be some degree of cross-subsidy from large car purchasers to those buying smaller models. Urban planning can improve both the health and the general quality of life for urban inhabitants, improve access to urban facilities for those without cars, and possibly increase employment in the public transport industries.

6.3 Assessment against economic objectives

Table 5 shows the assessment of the policies against economic objectives.

Table 5. *Assessment against economic criteria*

	Fuel Tax	Efficiency Standards	Urban Planning
Comprehensiveness	+	--	0
Flexibility of Response	++	--	-
Predictability	++	+	++
Dynamic Efficiency	++	0/-	0
Removing non-externality market failures	0	0/+	0

Regulations, either of emissions or fuel efficiency, generally do not meet economic objectives except that they are highly predictable. Urban planning is fairly neutral in terms of economic efficiency: it is comprehensive in that it tackles many environmental problems but not in that it addresses the private car only as the source of emissions; it has no impact on dynamic efficiency or on the removal of non-externality market failures; it does not provide full flexibility or response for those affected but does have an element of predictability. Fuel taxes are designed with economic efficiency in mind and therefore perform well against this category of objective. However, they are not fully comprehensive if only applied to the private car, and do not encourage the removal of non-externality market failures.

7. DISCUSSION

This paper is intended as a first attempt to define a more comprehensive methodology for the assessment of transport policies, and to demonstrate the benefits of using such a method. The lists of criteria used are by no means exhaustive: for example a full list of environmental criteria would have to also include water pollution, noise, and so on. All the criteria listed result from a literature survey of the main issues involved. It is inevitable that this process will have been influenced by the social context within which the author has worked, and others preparing a similar list might choose to incorporate quite different criteria. However, if such a list was prepared co-operatively by a relatively large and geographically dispersed group, the chance of political or social bias should be minimised. It would be possible to produce a far more detailed list of criteria than the one above: a decision on the eventual breadth of the analysis would have to be based on a balance between the additional effort required and the perceived added value of the expanded analysis.

The assessment of the policies against the criteria is far from straightforward, and individuals are likely to differ in the assessments they produce. The expansion of the lists of criteria to include a greater level of detail, and of precision, may reduce this difficulty. Consensus assessments by groups could also be employed, to avoid the limitations of personal biases.

The public, and hence likely political, acceptability of the options has not been compared above. This is an important criterion for policy success and hence a next step in the development of this method would be the definition of a set of criteria to reflect this aspect.

The assessment above does not include the costs of implementing the policies. The acceptability of a particular option will depend on the level of public and private funds which will have to be devoted to it, and therefore for the method to be of practical use to the policy maker, the assessment would have to be extended to include this. However, this additional analysis could be done separately once policies with high overall effectiveness had been identified. It is rather outside the scope of an analysis such as the one presented here, since the acceptability of a particular level of expenditure will be dependent on the framework within which the policy is to be implemented and the other spending priorities against which it is competing.

A related issue is that of timescales: both of the implementation of policies and of their effectiveness. Acceptability will partly depend on the speed with which a policy has to be implemented - any major change will be received more favourably if it can be achieved slowly and gradually. Also a policy will more fully meet the aims of sustainability if the impact it produces contains some element of a long-lasting change in the system. If, as has been implicitly assumed in this paper, the transport sector is expected to contribute to the meeting of all environmental aims in proportion to its level of emissions, policies will have to be introduced which produce a large effect over a relatively short timescale. However, if other sectors are to be relied upon to produce short-term changes (e.g. the increase in the use of gas as a fuel for electricity generation in the UK in relation to the meeting of CO2 reduction commitments), and the transport sector is given more time since the adjustments needed may be perceived as more difficult, then there may be greater willingness to look for policies which take more time to produce results, but which have a more lasting effect.

The presentation of the modelling results in the same form as the assessment against other criteria, i.e. using symbols rather than a numeric assessment of the degree to which the objectives are met, is deliberate. It is possible that the desire to translate all environmental and social impacts into economic values arises from a tendency to regard numbers as somehow more valid than a qualitative assessment of an issue. This can however result in important aspects which cannot (yet) be quantified receiving less attention than they merit. The suggestion here is that the use of a common set of symbols to represent both quantitative and qualitative assessments removes this disparity in treatment, whilst providing a short, easily comparable summary of the analysis results. It would be possible to assign relative weightings to each of the criteria to allow an overall assessment of each policy option to be reached. However, this process would involve many subjective judgements since there is no consensus over which of the objectives are more important. Therefore the results are more useful at this point if given without weightings, allowing the reader to apply his or her own opinion of the relative importance of the different criteria.

This paper compares three policy options which are actually being considered within the EU. Since they would require very different levels of action and expenditure, and would affect different groups of people within the transport sector, it could be argued that the policies are not directly comparable. However, as mentioned earlier, an analysis of this type, which concentrates on policies which are actually being proposed or implemented, can provide a useful insight into the problems which are currently being neglected or indeed worsened. For example, Table 4 can be used to show that, in regions where tax and/or regulation is being relied upon to improve environmental problems, the equity issues associated with passenger transport are not being addressed.

The process of considering the wider implications of a policy is undoubtedly one which is pursued by policy-makers. The explicit summary of the process, as demonstrated above, is perhaps not as common. Therefore a practical suggestion for the use of the method has to be for the policy-makers themselves and those who study and comment on their actions. By considering each criterion separately and being forced to assign an evaluation to it, gaps in available knowledge and possible personal political biases may be revealed.

This identification of issues which are not addressed by current policies is one of the strengths of this type of analysis. Another is the identification of gaps in our knowledge about the transport system itself. An example of this product of the analysis can be found by looking at the issue of global warming potentials. The GWP results from the modelling are as speculative as the analysis against equity objectives, since the GWP values for individual gases are estimates only. Indeed, as the complexity of atmospheric chemistry is more fully appreciated, the certainty attached to the estimates is reduced (see for example, IPCC 1994) . There are two possible reactions: either the use of GWPs can be ignored, or the accuracy with which they are estimated can be improved. For land based transport vehicles, the predominance of the effects of CO2 emissions may suggest that the former option is the most appropriate. However, the inclusion of air transport into the analysis (see below) identifies it as a mode of growing importance in environmental terms. It is possible that the relative importance of gases other than CO2 (eg NOx or water vapour) at high altitude would alter the conclusion in favour of the need for better understanding of GWPs.

8. CONCLUSIONS

There is little to choose between the policy options as defined here when considering environmental objectives: all have some positive contribution to meeting many of the aims, but none is sufficient to stabilise or reduce the sector's CO2 emissions or overall global warming potential. However, the sector may not be expected to meet a proportional share of overall reductions if the achievement of aims is easier in other areas. Therefore the main conclusion from the environmental assessment may be that, since there is little to choose between the policies, the one which best meets other objectives could be favoured.

As the results show, all the types of policy suggested have their merits when considering the other objectives. It is worth noting however, the comparative strength of urban planning in meeting social equity goals, and that of fuel taxes in complying with economic criteria. The definition of the methodology above began with the statement that economic objectives could be considered subordinate to environmental and equity goals. If this interpretation is applied to the results, urban planning becomes the preferred policy as it most closely meets the defined social equity objectives. This interpretation of the results is consistent with the aim of promoting sustainability: most accepted definitions of the concept include the objective of meeting the needs of present generations in addition to safeguarding the ability of future generations to meet their needs, and the argument here is that the social criteria defined above represent the steps needed to ensure that present generations are considered.

The use of the above criteria has highlighted one area of particularly scarce data: the actual requirements for transport which people have. The task of assessing policies against criteria such as 'reducing quality of life disparities' and 'providing access for all' is complicated by an imperfect knowledge of the factors which contribute to quality of life, and the locations to which people want access. For this reason, the equity criteria are perhaps less well defined than the environmental and economic ones. There is much debate about all of the policies which have been assessed, in terms of their acceptability to the electorate (for example, local councillors are often unwilling to introduce urban planning schemes of the type described above due to a fear that they will prove unpopular). Much more information about what people actually need and want from a transport system is needed before this type of debate can be resolved adequately.

The promise shown by planning policies, combined with this lack of information, has prompted a new research project in Oxford. This is based on an in depth social survey of a sample of Oxfordshire residents to attempt to determine the pattern of land-use and transport which would contribute to the maximisation of social welfare in the county. This is one example of how the method described above can lead to the definition of necessary research for policy decisions of tomorrow, in addition to assisting the policy-makers and analysts of today.

A final point about the benefits of a comprehensive analysis concerns the inclusion of air transport when considering the effectiveness of transport policies. The environmental analysis used above deliberately excluded this mode to facilitate a comparison of policies which involve only land-based transport. However, other work carried out by the author (Wade, 1995) has shown that the predicted growth in intra-European passenger air transport requires serious consideration in terms of CO_2 emissions and global warming impacts. For example, in the urban planning policy scenario, emissions of CO_2 from this sector are projected to rise by almost 360% over the period 1985 - 2025, whereas CO_2 emissions from cars over the same period rise by 44%. In this scenario aircraft on intra-European flights are responsible for 16% of passenger transport CO_2 emissions in 1985, but in 2025 this share has risen to 38% (whilst the passenger car's share has fallen from 74% to 55%).

A passenger transport policy analysis which ignores this sector risks producing an overly optimistic assessment of the progress which is being achieved.

9. ACKNOWLEDGEMENTS

This paper was prepared with the financial support of the Commission of the European Communities and Oxfordshire County Council. Much of the research was carried out at Imperial College, London, with the support of the United Kingdom Science and Engineering Research Council. The modelling of atmospheric emissions was carried out using the Earth Resources Research Transport Atmospheric Emissions model, developed by Malcolm Fergusson with the support of the World Wide Fund for Nature. The opinions, findings, conclusions and recommendations expressed herein are solely those of the author, and do not necessarily reflect the views of any of the organisations mentioned above.

10. ENDNOTES

1. There is much debate about the extent to which the full costs of environmental and social impacts can be incorporated into the costs borne by the user of a transport system. The issues are discussed fully elsewhere and hence will not be addressed in this paper. The author acknowledges that the reader may disagree with the framework for the assessment. However, the basic method would remain even if the particular objectives chosen were altered. Thus the statement of the underlying assumptions is considered sufficient here.

2. As part of the general principle that a more comprehensive approach is more likely to lead to a better solution, the calculation of total global warming potential of emissions can be seen as an appropriate step. However, the values for GWP assigned to different gases are at present estimates only, and therefore the results of the analysis must be treated with caution. (The GWP values used here are: CO2 =1; NOx =1,7; CH4 =13,5; NMVOC =6,7; N2O =272; CO =2,5; see Wade et al, 1994 for further details) This point will be discussed further in the final section of the paper.

3. The modelling of emissions reported here was carried out during 1994, and therefore all quantitative results refer to the twelve Member States of the Union at that time, i.e. the new States (Austria, Finland and Sweden) are excluded.

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