

Images of Future Transport in Europe

A study on sustainable mobility

(Policyscenarier för hållbar rörlighet på europainivå)

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Background and aim of study

The POSSUM project - Policy Scenarios for Sustainable Mobility - is a study funded by the European Commission under the Transport RTD Programme of the 4th Framework Programme.

The main task of the POSSUM consortium¹ is to construct scenarios for achieving the objectives of *sustainable mobility* and to assist the Commission in future decisions about the Common Transport Policy (CTP) and the development of the Trans-European Networks (TEN). Thus, based on the EU CTP² the POSSUM project focuses on the objectives of economic efficiency, regional development and environmental protection. A major element in the concept of sustainable development is preserving the environment and its capability to deliver ecological services to man. Thus sustainability in the POSSUM work has a focus on environmental protection.

The end result of the POSSUM project will be a set of scenarios that meet the targets of regional development, efficiency and environmental protection. In this way, European transport policies will be assessed for the first time as to their consistency and feasibility by means of a qualitative scenario approach based on backcasting.

This paper depicts *Images of the future*, that fulfil targets assumed to be in line with CTP.³ The Next step in the work process is to develop scenario paths and policy instruments. This deals with the changes required to reach the different images of the future, and what policy instruments can be utilised to direct the development towards sustainability.

¹ The POSSUM Consortium has members from University College London, The Free University of Amsterdam, The National Technical University of Athens, The Environmental Strategies Research Group in Stockholm, EURES - Institute for Regional Studies in Europe in Freiburg, VTT - Technical Research Centre of Finland in Helsinki, The Warsaw University of Technology, and the Ministry of the Russian Federation in Moscow.

² See CEEC (1992a), The future development of the common transport policy: a global approach to the construction of a community framework for sustainable mobility. COM (92)494 final, Office for Official Publications of the European Communities, Luxembourg..

³ POSSUM (1997) Development of Transport Policy Scenarios - the Images of the Future, Deliverable 2, submitted to EC DGVII Strategic Research, Brussels, December.

Methodology

A modified backcasting approach is used, which means that we identify *external developments*, that constitute different contexts for transport policy making. For each of these external developments we employ a backcasting approach, designing *Images of the future* that would meet the POSSUM targets.⁴ The "solutions" will differ depending on the external conditions in the specific cases.

In a planning context where the actors involved may greatly affect the development, a reasonable strategy would be to attempt to shape the future according to what is preferred, instead of just adapting to what may emerge.⁵ Of course, opinions regarding what is the preferred development may differ and also change over time, making continuous adaptations of policies necessary. However, backcasting studies will be of interest in this case, due to its problem solving character.

Scenario methodologies that do not concentrate on the desirable scenarios, may be labelled *explorative*. Such methodologies are reasonable when essential parts of the system under study cannot be controlled by policy measures.⁶ The scenario analysis may then help in the development of a strategy of flexibility and adaptability, i.e. how to cope with uncertainty and surprise.

Turning to the transport sector, it is obvious that transport policies may have a great impact on the development of transport in the long run, but it is also true that driving forces and conditions beyond the control of transport policy makers will have an impact as well, and will also influence the conditions for policy making. This is the question of *external vs. internal factors*, which is highly relevant in the context of transport policy analysis.

Because of the existence of salient external factors, we have chosen to modify the pure backcasting model a bit, adding an element of explorative scenario methodology. This means that we have chosen a set of different external developments (the explorative element), and for each of these a "solution" to the problems of the transport sector has been sought (the backcasting element). The solutions all meet a set of targets regarding environmental protection, efficiency and regional development.

The time horizon for the analysis is 2020. This means that all goals should be fulfilled at that time. However, the goals should be seen as tentative and intermediary ones. In the very long run, more far reaching goals will probably have to be met, especially regarding CO2 emissions.⁷ An important question in this context is how to avoid a lock-in to solutions that, although fulfilling the targets for 2020, are less feasible in the very long run.

⁴ Regarding the backcasting approach see Robinson, J (1982), Energy backcasting: a proposed method for policy analysis, *Energy Policy*, December 1982; Robinson J (1990), Futures under glass: a recipe for people who hate to predict, *Futures*, October 1990; Dreborg KH (1996), Essence of Backcasting, *Futures* 28(9), pp 813-828.

⁵ Dreborg, K.H. (1997), *Gaming and Backcasting: Two Approaches in the Face of Uncertainty*², Royal Institute of Technology, Stockholm, page 6.

⁶ Op cit. ,page 6

⁷ See IPCC (1996), Technical Summary in *Climate Change 1995. The science of climate change*. WG1. Cambridge.

Building blocks of the Images

In the following sections we present the main building blocks of the Images of future transport.

Goal structure and Targets

The overriding goal of transport policy is to facilitate accessibility, while at the same time fulfilling such goals as sustainability, efficiency, equity (e.g. regional) and safety. The need for transport is dependent on structural aspects of society, that change only slowly. Land use patterns will e.g. affect how much transport is needed. The need for mobility is much greater in scattered American cities than in dense European cities of comparative size. Another example: The spread of IT may in the long run reduce the need to travel.

When looking some 20 - 25 years ahead (as in POSSUM), one cannot take such structural features of society for granted, that largely determine the short term development of transport demand. Instead we will explore the significance of changes in values and attitudes, land use patterns and the spread of IT. This means that a goal of accessibility does not necessarily imply that transport has to grow at the same pace as GDP or some other measure of welfare. If it is possible to decrease the transport intensity of GDP e.g. - the idea of *decoupling*⁸ - this would facilitate a reconciliation of the different goals of transport policy.

An important element in any backcasting study is the definition of targets to be met by the scenarios (images). POSSUM has focused on the goals of environmental protection, regional development and efficiency. The targets are defined as

25 % reduction of CO2 emissions, 80 % reduction of NOx emissions, no degradation of special protected areas, no or only minor net increase in infrastructure surface, improved relative accessibility of peripheral regions and full cost coverage of transport under market conditions.

Main strategy elements

The Images of the future developed by the POSSUM Consortium are based on two main categories of change that we think are needed to achieve the targets by the year 2020:

1. a reduction of energy use per person kilometre travelled and ton kilometre of freight by means of technological improvements, new fuels, improved load factors and modal shifts. We call this set of changes *Technological Improvement*.
2. a decrease in transport intensity of GDP (i.e. personkm. and tonkm. per unit of GDP) -*Decoupling* for short.

⁸ See e.g. Peake, S. & Hope, C. (1994), Sustainable mobility in context; Three scenarios for the UK, *Transport policy*, 1(3), 1994, pages 195-207.

It should be noted that with the above definitions, better fuels and modal shifts from private cars to public means of transport are included in technological improvement.⁹ However, in Diagram 2 - Relative contributions to goal attainment - at the end of this paper, we show new fuels and modal shift as separate entities.

Improved technology will generally not require that we change our travel behaviour, and may therefore be the preferred solution to many people. The potential of improved vehicle technology and alternative fuels have been analysed and assessed. Although there is a considerable potential to reduce emissions per personkm. and tonkm. according to our estimates, this will not be enough to reach the environmental targets of POSSUM, despite cautious estimates of transport volume increases. What is needed is a trendbreak regarding the growth of transport, which in turn will require a deliberate decoupling policy. Consequently all images rely on both strategies, but in different proportions, depending on the external conditions. Three mixed strategies are defined:

- One solution is a fast dissemination of cleaner technologies and fuels combined with a moderate degree of decoupling (Technology+++/Decoupling+).
- Another solution is a moderate pace of technological improvements combined with a considerable degree of decoupling (Technology+/Decoupling+++).
- A third solution would be to have *both* fast technological improvements *and* a considerable degree of decoupling. However, a Technology+++/Decoupling+++ case would seem to be rather unlikely, because the costs of achieving such far reaching transformations in both dimensions would probably be too high. Therefore, we have chosen as a third case a Technology++/Decoupling++ solution.

A decoupling policy will have to be targeted towards dematerialisation, the spatial structure of production and residential areas, IT substitution etc.

External developments

In choosing external factors, we have tried to pick those qualities of society that we believe have a profound and widespread influence in the long run on patterns of consumption, production and settlement and thus on transport. In this report a few different developments are identified and used as "the external element" of the images. We think that the *climate for cooperation* at different levels of society, the *attitudes towards the environment* and the balance between *local and international life styles* are such fundamental and salient external factors.

More accidental external occurrences such as e.g. a new oil crisis, may appear in almost any scenario and are, therefore, not included in any specific image. However, a sensitivity test of interest would be to subject all images or policy scenarios to the same occurrence and assess the likely impact on goal attainment etc.

We have chosen the degree of '*cooperation*' as a core feature of the images of the future, because we think it will greatly affect the achievements and relative merits of different transport policies. The concepts of cooperation and polarisation essentially pertain to the way society cope with *market failure* and *public goods*

⁹ This may seem a bit odd for modal shift that has more in common with decoupling, as both require change of behaviour rather than change of technology. This is a consequence of our choice of personkm. and tonkm. as the unit for transport volume. If we instead use vehicle kilometre as the unit, modal shift will go along with decoupling.

and bads. Here agreements and common policies beside the market are often needed. The climate for cooperation will then be of crucial importance. Is there a spirit of cooperation and social responsibility or is the dominant behaviour free-riding? Do people act like citizens or like self interested profit maximisers? This will affect what policies are possible and suitable and what targets can be achieved. There is a rich literature on this problem area in economics, political science, ecology and mathematics (game theory), dealing with the closely related issues of Collective Actions¹⁰, Prisoners Dilemma¹¹ and Tragedy of the Commons¹².

Other external factors used are the strength of *green values* and the balance between *local and international life styles*. As for green values the following cases may be distinguished:

- the case of a strong concern for the environment and future generations among broad groups in society. The preservation of the environment is seen as a necessary condition for the long term wealth of human-kind, or even for it's survival (see *Images 1 and 3*);
- the case of a well informed but pragmatic and more short term view on the environment. The relation to other societal goals is essentially perceived as a trade-off, where the environment does not generally take precedence over the others (see *Image 2*).

The external factors (cooperation, green values and local life-styles) are combined into three external developments:

- a cooperative climate at the local, regional and EU levels, but polarisation at the global level, where EU the US and Japan take different stands on questions such as global warming, and also tend to protect their own markets against competition from outside. The political initiative is mainly of a bottom up character, with strong grass-root movements with green values and local life styles.
- a cooperative climate prevails at the EU level as well as at the global level in the relations between EU the US and Japan, with free trade and a strive for consensus on environmental issues. At the local and regional levels the attitudes towards cooperation are more passive. The political initiative is mainly of a top-down character. An international life style is widely spread.
- a cooperative climate permeates all levels (global to local), and there is a kind of harmony between bottom-up and top-down politics. Green values are widely spread. Local and international life styles are both relatively spread.

Combining the external and the strategy elements into integrated Images

A combination of external developments and transport policies yields nine images according to Table 1

¹⁰ See e.g. Olson, M. (1971), *The Logic of Collective Action: Public Goods and the Theory of Groups*, Harvard University Press, Cambridge, and Hardin, R. (1982), *Collective Action*, John Hopkins University Press, Baltimore.

¹¹ Axelrod, R. (1984), *The Evolution of Cooperation*, Basic Books, New York.

¹² Hardin, G. (1968), *The Tragedy of the Commons*, Science, Vol.162 (1968), pp 1243-8., Ostrom, E. (1990), *Governing the Commons: The Evolution of Institutions for Collective Actions*, Cambridge University Press.

Table 1: Images of the future

Strategy	Technology+++/ Decoupling+	Technology+/ Decoupling+++	Technology++/ Decoupling++
External development			
Local & regional & EU coop.	T1	D1	TD1
Global & EU coop.	T2	D2	TD2
Local - global coop	T3	D3	TD3

However, all combinations do not seem equally plausible. In the first column the general strategy emphasises a fast technological evolution and dissemination, while the degree of decoupling is moderate. This strategy seems to require global cooperation on such issues as regulation of CO₂ emissions - much like in T2 - in order to be effective. T1, on the other hand, lacks international agreements in this area, and is, therefore, not so likely. T3 would be possible, but here the conditions are favourable for both technological improvements *and* decoupling, making a more balanced strategy attractive, as in scenario TD3 in column 3. Consequently, **we have chosen scenario T2 as the most interesting and internally coherent case in column 1.**

In the second column, the emphasis is more on decoupling, while the pace of technological improvement is slower than in the cases in column 1. A radical decoupling demands behavioural changes (mode choice, choice of residential area etc.) which in turn requires grassroots involvement and devotion. This is prevalent in D1, but not so much in D2. Again, when there is cooperation at all levels, a balanced strategy - as in TD3 - would seem to be preferable to scenario D3. Hence, **our choice from column 2 is D1.**

Finally, the cases in column 3 all exhibit a balanced strategy of fast technological development and a considerable degree of decoupling. However, in TD1 the conditions for really fast technological improvements are not so favourable, while in TD2 the popular engagement which seems to be necessary for a far reaching decoupling, is not present. Both conditions are fulfilled in the case **TD3**, though, which consequently **is our choice from column 3.**

To sum up, three images are put forward:

Image 1, EU coordination of active citizens (D1)

Image 2, Global cooperation for sustainable transport (T2)

Image 3, Accord on Sustainability (TD3)

Images of future transport in Europe

In designing the Images we have first assessed the potentials of new technologies for each Image, taking into account the key character of the respective Image (top-down or bottom-up, cooperation or polarisation, dominant values and life styles). The general conditions for far reaching technological improvements are e.g. better in Image 2 than in Image 1. When it comes to decoupling, it is the other way round. Once the technological level of a certain Image is defined, decoupling is largely treated as a residual, in the sense that changes of transport intensity are assumed to fill the gap between the sustainability goals and what is achieved by technological improvements.

What the Images show is, therefore, rather a *need* of decoupling for each Image (provided that GDP growth rates are specified) than an assessment of a realistic potential. As a first step, this is perfectly in line with the backcasting approach. The realistic assessment of actual potentials will be made in other parts of the project. The final result will be achieved by an iterative process, where goals and need for decoupling as well as the estimated potential of decoupling are successively adjusted.

Image 1, EU coordination of active citizens (D1)

People increasingly take responsibility for the common good and attitudes towards collective actions are positive, especially at the *local and regional levels*. There has also been a trend towards more "local life-styles" and green values among the general public. People are pushing the politicians to adopt e.g. stricter environmental regulations and standards, especially at the local level (urban areas). At the *global level*, however, no agreement on harmonising standards is achieved.

People are willing to pay for greener products as well as for locally produced goods. Production has, as a consequence become more local, serving mainly the local markets, but is in many cases based on licenses or know-how of big international firms and networks (glo-cal production). A tax base reform - in line with a dematerialisation strategy - has been performed in the EU countries, shifting taxation from labour to the use of natural resources and energy, with the aim to stimulate conservation of resources.

The shift in values and life styles has led to a higher acceptability for changes in residential and travel patterns, providing an opportunity to bring the growth of transport volumes under control. Therefore *the prime political strategy vis á vis the environmental goal, is to promote a decoupling of transport growth from GDP growth*. Of course, also a *policy for cleaner transport* (pertains to both personal travels and freight) is important.

EU has an important role in coordinating regional and national policies and in harmonising targets and standards in Europe.

The level of total mobility is about the same as in 1995. Long distance-travel, especially leisure travel, has increased, while work and service related travel has decreased. The use of car-rental and car-pooling is widespread and promoted by government measures. This means that niches for specialised vehicles like battery-electric cars have emerged.

A policy to counteract "urban sprawl" is widely applied in Europe. New residential areas are usually situated along public transport corridors or in city centres. Existing sub-centres are being upgraded to a higher degree of self-reliance. In many of these centres there are well equipped "tele-cottages" intended for use by "tele-commuters", making it possible for people to work in the vicinity of their residences.

More local and "glocal" production in combination with a general dematerialization means less freight transport. The ecological tax-shift has stimulated a more decentralised production system.

Image 2, Global cooperation for sustainable transport (T2)

There is a certain degree of "green consciousness" and an acceptance of policy measures intended to mitigate the environmental problems, i.e. those related to transport. However, these issues are not pushed by a broad opinion among the public. Rather, it is the politicians that are at the forefront, trying to find solutions at the EU and global levels. Politicians are relatively successful in forming opinions and there is an understanding that transport must in principle pay its full costs. But most people are not inclined to accept a major change of travel behaviour.

The international life-style has gained strength, with a high demand for imported goods. Production is increasingly characterised by 'flexible specialisation', and economic development is generally dynamic with a relatively high average GDP growth. Despite a trend towards dematerialisation transport volumes grow due to increasing distances.

The widespread environmental consciousness among leading politicians at the world stage, makes it possible to reach agreements on international standards and norms for cleaner vehicles, reductions of CO₂ emissions and similar levels of taxation of externalities. The accord among world leading politicians impresses the general public, making it possible to gain popular support for such measures. However, people will not accept measures that interfere with their habitual ways of living, such as using private cars and living in sparse residential areas.

Consequently the prime policy regarding the environmental goal in Europe is to *make transport cleaner*. Of course, also policies intended to hamper transport volumes (i.e. *decoupling*) are employed, but mainly by the use of pricing.

As in Image 1 a large number of commuter trips have been replaced by telecommuting. The difference is that here the average distance, due to "urban sprawl", has increased which cancels out much of this benefit.

All purpose cars dominate. Battery-electric cars have only a small niche mainly as "second car". Many cars are hybrid-electric with a gas turbine, DISC-engine or fuel-cell as power generator.

Image 3, Accord on Sustainability (TD3)

A spirit of cooperation permeates all levels of interaction - among individuals, locally, regionally, at the national and EU levels as well as globally. Although many problems are still difficult to handle, there is a respect for other parties interests and a willingness to find win-win solutions.

The high level of interest and initiatives in societal matters by the general public, has led to a strong support for the principle of subsidiarity. At the same time the overarching political structures of Europe are powerful because of the consensus among leading economic powers of the world regarding many global issues, such as the environment. A kind of balance of power has evolved, based on a strong popular involvement in local and regional affairs and a more passive popular support for EU coordination and politics in high level issues. The regions and municipalities of Europe largely choose their own ways in coping with local emissions, congestion etc., while the targets are agreed at higher levels.

There is both a strong support for decoupling and relatively good conditions for technological development. As in Image 1 urban areas are consciously planned to fit pedestrians, cyclists and public transport. Much "enforced travel" is also rendered unnecessary because of "tele-cottages" in decentralised centres and tele-shopping. The technological development is fast as in Image 2 but have a stronger focus on niche vehicles because of prevailing attitudes.

This is the Image with the highest share of fuel cell cars (about 4% of car fleet and 10% of km driven) which uses methanol. This is due to a high share of high-mileage cars (taxis, rental-cars and pool-cars) in combination with a forced technological development.

Leisure travel is somewhat higher in this Image compared to the other two. The combination of both a radical decoupling and fast technological development makes this possible.

Comparison of Images I and II

In this section we try to highlight the profiles of Images I and II. In Diagram 1 we show a possible development of GDP, transport volumes and emissions of CO2 from 1995 to 2030, where 2020 is the target year. In Diagram 2 we show the relative contributions to goal attainment regarding CO2 emissions by new technology, non fossil fuels, modal shift and decoupling.

Diagram 1a

Development of GDP, Transport volumes and emissions, Image 1

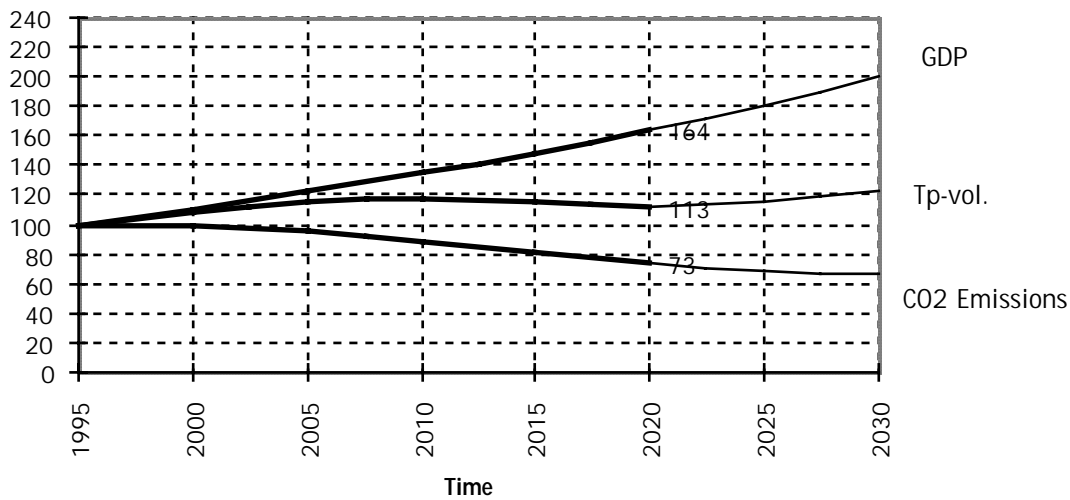


Diagram 1b

Development of GDP, Transport Volumes and Emissions, Image 2

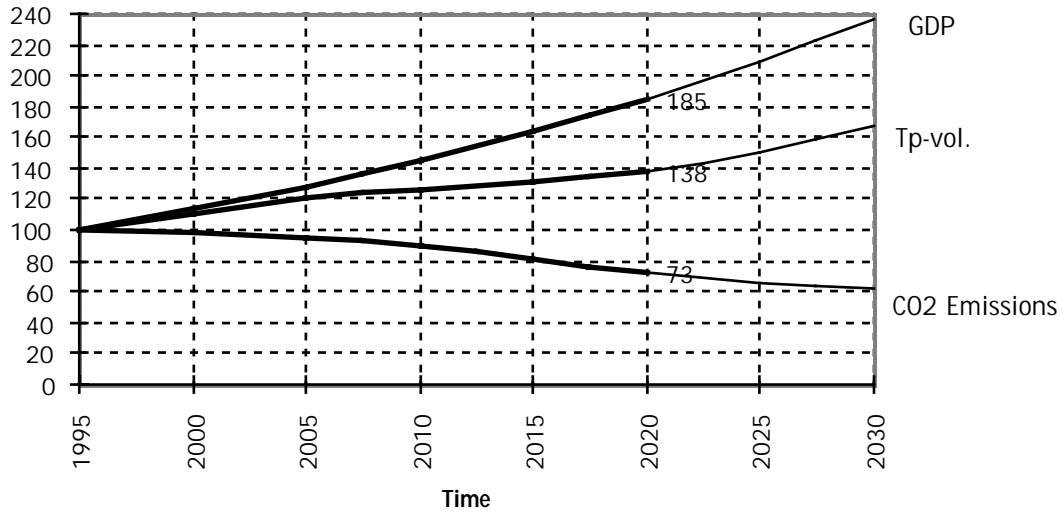


Diagram 2a

**Relative contributions to goal attainment in
Image 1**

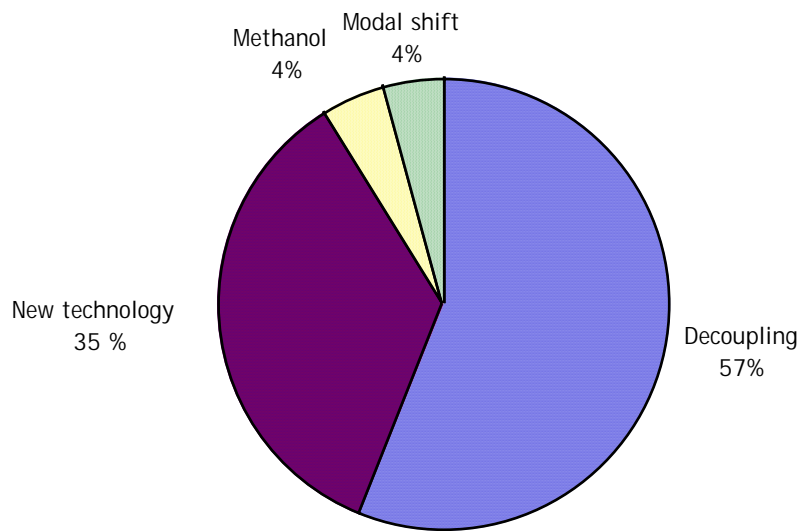
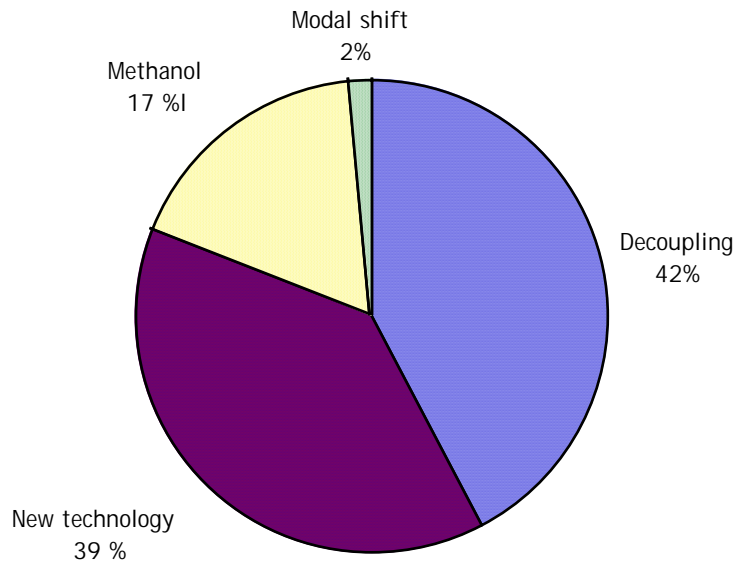


Diagram 2b

**Relative contributions to goal attainment in
Image 2**



Concluding remark

The next step in the POSSUM work is to design policy instruments. The dimension of cooperation-polarisation, chosen in the images, will influence the usefulness of different policy instruments.

A tentative conclusion is that it is possible to reach the POSSUM targets under different external circumstances. However, the CTP has to be adapted to prevailing exogenous factors such as dominant values and climate for global agreements, as indicated in Images 1 and 2. It seems that for the POSSUM targets to be met, there must be a certain degree of "sustainability consciousness" and a sense of responsibility for the common good in society (citizenship). Otherwise the costs of transport policies and the necessary adjustments of travel behaviour will not be accepted. The majority need not be green idealists, but a majority must support (or at least tolerate) political initiatives aiming at a sustained handling of transport's externalities.

The POSSUM targets for environmental protection 2020 are unlikely to be final goals, especially when it comes to CO₂ emissions. In the long run a more ambitious level should apply. Therefore, when discussing and assessing the POSSUM Images, one should consider the prospects of realising very long term goals, depending on the strategy chosen up to 2020. For example, if urban areas are permitted to sprawl, it may be very difficult to reverse the trend if this turns out to be necessary in order to cut down commuting to work and other structurally determined travel.