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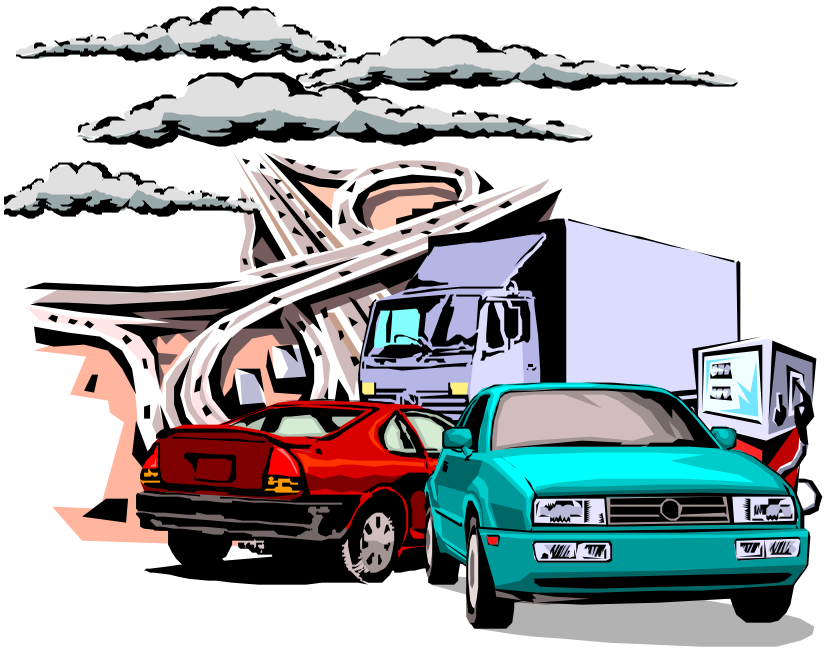

Controlling Traffic Pollution and the Auto Oil Programme

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The Five Key Recommendations

1. European wide technical standards need to be complemented by strong local measures that are developed and facilitated at the European level. The review of the Common Transport Policy will need to strengthen this facilitation role.
2. Future assessments will need to incorporate to a greater extent than has been the case the role national fiscal measures can play in line with the integration report of the Transport council to the Helsinki summit and the Commission's White Paper on infrastructure charging.
3. Cost effectiveness needs to improve to ensure greater comparability of costs from differing measures, their significance to the sector that bears them, the reductions from estimated costs that innovation will bring, as well as accounting for the uncertainty of the size of the predicted targets. It is inappropriate to use cost effectiveness as an approach without clarity of the overall environmental objective.
4. A valuation of the benefits of achieving the agreed targets is needed both to allow for consideration of early attainment of targets and to also usefully place the cost burden to achieve the target in perspective.
5. Multi-stakeholder processes can advise the policy process and aid development of sound policy measures and can also aid their adoption. There is a constant learning process by all stakeholders in this approach that should be built upon for future programmes such as CAFE. Such programmes more effectively engage the strong participation of all stakeholders when there is a strong mandate for legislative action to follow up the programme.

1. Introduction and Background

This publication is intended to fulfil two functions. Firstly to be informative of one of the most significant programmes of the European Commission - the Auto Oil Programme. The second is to outline what conclusions can be drawn from the programme, and what future efforts can be undertaken to reduce the impact traffic has on air pollution. Recommendations are given for the future of European air pollution and transport policy - as well as the necessary complementary national and local policies.

The publication is intended to be as accessible as possible so that those without a technical background gain an understanding of the programme and the recommendations. Additionally, to cater for those who have a good knowledge of the subject, there are numerous footnotes.

Air pollution from traffic is widely accepted to be one of the largest challenges facing us as we move into the next millennium. Both policy makers and large sections of the public are increasingly aware of the need to take action to limit the impact traffic has on the air we breathe. Unfortunately this growing desire to take action is usually restricted to actions that reduce traffic pollution without changing the pattern of transport that has caused the problem.

This desire for improvement without a behavioural change manifests itself most clearly in demands from both public and politicians for a technical solution to the problem. The philosophy has been if we can't live with a dangerous dirty car - we must invent a safe clean one ! However technical approaches to cleaning traffic are not limited to the technology in a vehicle. Improving the quality of the fuel that vehicles use is another type of technological improvement that can also reduce traffic pollution.

At the start of the 1990s the technological approach to reducing traffic pollution taken by regulators in the EU related only to vehicles, fuels had been excluded. The vehicle manufacturers argued that because they had made great progress since traffic emissions were first regulated in 1970, future technical limits to traffic pollution should include fuel quality improvements. There was at this time a debate between the Auto and Oil industries on the relative merits of the two technical approaches to reducing traffic pollution. The Auto industry maintained cleaner fuels would be cheaper and more effective whilst the Oil industry argued with exactly the opposite view.

Deciding on the relative merits of the two industries' arguments was rather difficult for regulators the world over. This was largely because much of the information that could have clarified the debate was held by the two industries. The extent to which the information released by the respective industries was objective and unpartisan could not be determined.

Additionally it was clear that despite great advances in cutting emission levels of new cars since their first control in 1970, the actual levels of traffic pollution over the same period had dramatically increased. The Auto industry argued that this could be explained by the fact that the most important step taken - the introduction of "three way" catalytic converters - had yet to have a large impact on the problem. Many more of the cars on the road would have to have three way catalytic converters before this technological improvement really made an impact. The Auto industry strongly argued that they were being forced into making further costly investments on top of those they had already made before the need to reduce future traffic pollution had been properly assessed. Asking them to bear such costs before assessing the relative costs and effects of efforts to improve fuels instead was irrational.

In 1994 the EU finalised a new emission standard for cars that outlined a new approach to developing future regulation. The European Directive concerned[1] contained an article that specified that in future a much broader approach would be taken than merely improving new vehicle pollution levels[2]. The new approach would estimate the need for further cuts in traffic pollution and would include assessments of the types of fuels used, their quality, programs improving vehicle maintenance, local traffic measures such as supporting public transport, as well as improved cars, vans and lorries. More importantly the guiding rule used in this new approach was that each type of policy was to be assessed on the basis of how much they had an effect and how much they cost; an approach known as cost-effectiveness.

To a large extent this review article in the new Directive gave the European Commission a mandate to continue with a programme it had already begun. The Auto Oil Programme had been devised by the European Commission as a way of resolving the conflict between the Auto and Oil industries, by harnessing the information resources each had at their disposal so as to assess the future regulation of traffic pollution on a rational basis.

The Auto Oil Programme had been launched by a joint initiative of the Energy, Industry and Environment Commissioners[3]. This co-operation between Commissioners was indicative of a programme that not only brought the Commission and industry together but also a wide selection of the branches of the Commission which were unaccustomed to such a close working relationship. Despite this the Auto Oil Programme was criticised for its lack of partnership because it failed to engage Member States, MEPs, Non Governmental Organisations, or relevant industries outside those represented by the Auto industry's ACEA, and the Oil industry's EUROPIA. This criticism is a subject that will reappear as a running theme throughout this overview of the programme. In each of the following sections an outline of what happened in the Auto Oil Programme will be followed by a brief resume of criticisms made by NGOs, member States and MEPs.

In June 1996 the Commission adopted proposals based upon the Auto Oil Programme results.[4] Despite the programme having only assessed the effectiveness of a set of measures to be introduced in 2000, these proposals included two sets of measures, one set for 2000 and the second for 2005. The industry partners felt aggrieved that the Commission had in some way broken a promise in bringing forward two rather than one set of regulations. The Commission, however, had never made a pact with industry that

[1] Directive 94/12/EC

[2] Article 4 of Directive 94/12/EC stated that a future revision of emission standards would take account of:

- the Community's air quality and related objectives,
- cost effectiveness,
- traffic management,
- enhanced public transport,
- new propulsion technologies,
- alternative fuels,
- improvements to traditional engine technology,
- alterations of the test procedure,
- strengthened inspection and maintenance including on board diagnostics,
- conformity of vehicles in circulation,
- measures to cover pollutants not yet regulated, and
- improvements in fuel quality.

[3] The Commissioners Meeting with partners in September 1992 at the "*Auto Emissions 2000 Symposium*" enabled the Commission and the industry to work together on the programme, and for the two industries to sign an agrement in July 1993 that pledged €11 million on a common research programme.

[4] On 17th June 1996 the Commission adopted a Communication on a future strategy to control emissions from road transport, a proposal for revision of the emission standards for passenger cars (70/220/EEC) and a proposal for a fuel quality directive (partly amending Directive 93/12/EC).

diminished its right of initiative. The Auto Oil Programme results were always to be used as a basic starting point for the Commissions proposals rather than a blue-print for them. Indeed, the Commission would have received a great deal more criticism from all decision makers if it had bargained away such powers conferred upon it by the Treaty[5].

The Auto industry felt particularly aggrieved, as a disproportionate contribution was still being demanded from them rather than the oil industry. Furthermore whilst the Auto industry had "indicative" values to achieve for 2005 no such values were included in the Commission proposals for fuel quality.

This is because the Commission did not finalise the Auto Oil Programme with the adoption of these proposals. Rather, it extended the programme both in scope and participation with the aim of confirming the standards that should apply for 2005. The Auto Oil II Programme included all relevant stakeholders rather than just the two industries. The Commission even formalised this approach in its proposals within the articles outlining the review of standards foreseen for 2005[6].

The Auto Oil II programme was launched at a large scale meeting between the Commission, the Member States and all the stakeholders in January 1997. The structure of the programme was rather different in many respects to the first programme. Firstly there was the broadening of participation to include Member State experts, Non Governmental Organisations, Local Authorities, and all relevant industries. Secondly there was a far more structured approach to ensuring that all of the various methods for reducing emissions from traffic were assessed.

The Auto Oil II Programme also enjoyed a stricter and shorter timetable, defined within the Commission proposal, than was the case in the first Programme. This was possible due to the more limited overall objectives of the Auto Oil II Programme, relating as they did to the confirmation of the indicative standards for 2005, and the ability to build upon the work that had already been completed during the first programme.

The adoption of the first Auto Oil Directives[7] in 1998 altered these objectives during the course of the programme. This was because the finalisation of the conciliation agreement between the European Parliament and the Council of Ministers ensured the adoption of

[5] The Treaty of Rome and all of its subsequent revisions have given the Commission the sole responsibility for taking legislative initiative.

[6] COM (96) 248 of 18/06/1996 included revision to Directives 70/156/EEC and 70/220/EEC on vehicle certification and emission standards, as well as a fuel quality proposal in part revising Directive 93/12/EEC. Both of these proposals included "review" articles that stipulated the approach the Commission was taking to the review with Auto Oil II. The approach defined was a comprehensive strategy that was to achieve Community air quality standards and other related objectives at least cost. Article 9 of the fuels proposal and Article 5of the vehicle proposal stated that this overall strategy for reducing emissions should take note of :

- trends in air quality;
- the pollution levels from all sources in Europe as well as the impact that existing decisions would - have on these emissions;
- technological developments;
- alternative fuels such as LPG and bio-fuels;
- improvements to the test procedure;
- technical and non-technical local measures;
- selective and differentiated fiscal measures;
- effects of any measures on CO2 emissions;
- strategies applied by Member States to improve air quality;
- Supply and quality of crude oil.

[7] Directive 98/69/EC on vehicle emission standards and Directive 98/70/EC on fuel quality standards.

mandatory standards for vehicle emissions and partial fuel quality standards for 2005. The tasks that were left for the Auto Oil II Programme therefore related to a review of the measures taken went far enough, and an assessment of the cost effectiveness of any further complementary measures. Nevertheless the second Auto Oil Programme is important for several reasons.

Firstly, in spite of the increased scope of the first Auto Oil Directives, there are still some legislative outcomes of the programme : technical emission standards for motorcycles and the remaining fuel parameters for 2005 in particular. Legislative proposals for these two areas will be informed by the results of the second programme.

Secondly the assessment of the "non-technical" and local measures that was undertaken in the second programme will be utilised by the Commission to promote future action on such measures and to assist in the implementation of the strategy to integrate environmental considerations into transport policy. The work undertaken by the Commission could include strengthening the framework within which local measures can, should, or even need to be applied.

Thirdly the work completed under the second Auto Oil Programme on non-technical measures has also allowed the continuation of a research agenda with the aim of identifying cost effective local measures that will improve air quality in urban environments with the CANTIQUE[8] programme.

Finally the approach adopted in the second Auto Oil Programme is being viewed as a model for future policy development in numerous issue areas. Lessons learned within the scope of this programme therefore have potential ramifications far beyond questions of air pollution from traffic.

[8] The CANTIQUE programme - Concerted Action on Non-technical and local measures To Improve Air Quality in Urban Environments - is funded by the European Commission under the forth framework programme for research.

2. Evolution of the Structure of the Programme

The first Auto Oil Programme only bought together the Commission services and the industry associations for the oil industry (EUROPIA and CONCAWE) and the industry association for car manufacturers (ACEA). Although the Commission did receive the rather valid criticism for the narrowness of external co-operation within this programme, it was at least able to have wide ranging and active participation across the Commission services. The Directorate Generals that became involved in the programme included : DG Economics and finance (II), DG Enterprise (III), DG Transport (VII), DG Environment (XI), DG Research (XII), DG Energy (XVII), and DG Taxation (XXI)[9].

Even though other stakeholders, Member States and the European Parliament were not formally engaged in the programme efforts were made to inform them of progress. This took the form of full provision of information on the progress of the programme to the Motor Vehicle Emissions Group (MVEG) - a Commission advisory committee comprised of Member State representatives, industry representatives, as well as consumer and environmental NGOs[10]. Special events were also arranged within the European Parliament in order to brief interested MEPs in developments - although the MEPs showed only limited interest[11].

The programme was split into technical working groups that allowed elements of the programme to be completed in relative isolation. The results of these working groups were then brought together within an overall Auto Oil management committee.

Because of the criticism of the narrow participation in the first Auto Oil Programme and the resulting perception of systematic bias in the results, the second Auto Oil Programme was open for all stakeholders to participate. This enabled participation by Member State experts, wider industry participation (e.g. European Natural Gas Vehicles Association, and the catalytic converter manufacturers association – Auto Emissions Control by Catalysts), representatives of local authorities[12], and environmental NGOs[13].

The structure of the second programme was also revised to enable still wider participation. Rather than informing a wider community of stakeholders of progress of the programme via the MVEG special meetings of a “contact group” were convened that brought together all relevant stakeholders including MEPs.

The structure of the working groups in the second programme was also rather different, there being no overall management committee involving all stakeholders. There was, however, a Commission co-ordination committee that effectively undertook the same function, but that obviously only included staff from the Commission services[14]. Within the

[9] At the time of the first Auto Oil Programme, and for most of the second, these Directorate Generals (DGs) were known by their numbers, and the transport (DG VII) and energy (DG XVII) services were separate entities.

[10] During the period of the first Auto Oil Programme a further advisory committee was convened to advise the Commission on technical questions relating to fuel quality – the Environmental Fuels and Emissions Group (EFEG) - but the meetings of this group were normally held in tandem with the MVEG meetings.

[11] Over a two day period three briefings were held for MEPs in November 1995 in the European Parliament by the Commission at which only five MEPs attended, although several more were represented by their assistants.

[12] The organisation International Council for Local Environmental Initiatives (ICLEI) participated in the working group that addressed non-technical local measures – working group 5.

[13] During the second programme T&E and the European Environmental Bureau have closely followed events, sending experts to all of the technical working groups.

[14] The Commission management co-ordination committee includes members of the commission services from

wider framework of the Auto Oil II Programme, the co-ordination role was in some sense shared between the working groups defining the environmental objectives and the overall cost effectiveness. The seven working groups that comprised the second programme were :

- WG1 air quality and environmental objectives (co-ordinated by DG Environment)
- WG2 vehicle technology (co-ordinated by DG Enterprise)
- WG3 fuel quality (co-ordinated by DG Energy)
- WG4 inspection and maintenance (co-ordinated by DG Transport)
- WG5 non-technical local measures (co-ordinated by DG Transport)
- WG6 fiscal instruments (co-ordinated by DG Taxation)
- WG7 cost effective optimisation (co-ordinated by DG Environment).

all of the units of all the Directorate Generals (DGs) involved in the Programme. In order to share the administrative burden and to ensure no single DG assumed overall control of the Programme the responsibility for organising and hosting these meetings rotated between the participating DGs.

3 Setting the Goals of the Programme

An important goal of the Auto Oil Programme was ensuring that reductions in European traffic pollution were planned using the least costly options[15]. This approach was known as "cost-effectiveness" - ensuring the most effect for the least costs. Whilst cost-effectiveness was an important principle for the Auto Oil Programme, this did not mean that economic rather than environmental considerations were paramount. The goal of the programme was to reduce the contribution made by traffic to air pollution to levels consistent with environmental and human health protection[16]. This meant that an understanding had to be developed of the relationship between pollution emissions, the quality of air, and the level of health effects and the levels that are needed to protect the environment.

Establishing the emission reduction objectives in the Auto Oil Programme was thus a three step programme :

I. Fixing the environmental objective,
II. modelling future air pollution levels,
III. determining how far emissions would have to be reduced to lower air pollution levels to the environmental objective.

3.1 Fixing the Environmental Objectives.

Fortunately at the time of the start of the first Auto Oil Programme the World Health Organisation (WHO) was revising its guidelines for air quality[17] with the assistance of the Environment Directorate of the Commission. The levels of pollution that were used as necessary to protect health were therefore those emerging from these WHO expert groups. The targets that the Auto Oil Programme then had to define were the amounts that traffic pollution emissions had to be reduced in order for future air pollution to be low enough to meet these WHO standards.

By the time of the Auto Oil II Programme, the EU had established legal standards for several of the pollutants of concern in "Daughter" Directives on air quality, and the Commission had adopted proposals for the other pollutants. These firmer standards were therefore used as the environmental objectives of the second programme. The standards used as the environmental objectives in the two programmes are given in Table 1 below.

[15] This is most succinctly outlined in the review Article of the Commission proposal for revised vehicle emission and fuel quality standards COM (96) 248 which states that the review of the Directives shall be "an integral part of a strategy designed to produce effects to meet the requirements of the Community air quality standards and related objectives at least cost." However the Directive on fuel quality that was adopted based on this proposal (98/70/EC) deleted the words "at least cost" although the vehicle emission directive (98/69/EC) did include explicitly the requirement that future proposals be examined for their "technical feasibility and cost-effectiveness including an evaluation of the benefits and availability of enhanced technology".

[16] The review process detailed in the Directive 98/69/EC explicitly recognises this in the review article stating that future proposals will need to assess : "the contribution of possible measures, including those relating to fuels and vehicles, to the attainment of longer term Community objectives on air quality, taking into account technological developments and the results of new air pollution related research including effects of particulate matter on human health".

[17] The WHO guideline values are pollution levels at or below which ill health would not be expected to be caused by the pollution exposure. For substances such as carcinogens and particulates where the WHO could not establish such an "effects threshold" the value is given as an estimate of relative risk for pollution levels. What these values do not cover, therefore, is further health damage caused by the pollution – for example to people suffering from a pre-existing condition.

Table 1 Air Quality Targets in the Auto Oil Programme

Pollutant	Auto Oil I Standards	Auto Oil II Standards
Nitrogen Dioxide (NO_2)	**200 µg/m³ 1 hour average as a 98th percentile (upper value) *** **200 µg/m³ as a maximum value (lower value) ***	**200 µg/m³ 1 hour average 99.8 percentile **** **40 µg/m³ calendar year ****
Carbon Monoxide (CO)	**10mg/m³ 8hour rolling mean ***	**10 mg/m³ 8 hour rolling mean ‡‡**
Benzene	**16 µg/m³ annual mean (upper value** **2.5 µg/m³ annual mean (lower value)**	**5 µg/m³ calendar year ‡‡**
Particulates (PM_{10})	**Not modelled**	**50 µg/m³ 24 hour average ****
Ozone	**180 µg/m³ 1 hour mean ‡** **120 µg/m³ 8 hour rolling mean ‡**	**120 µg/m³ 8 hour mean (within one day) 20 day exedences per year - averaged over three years ‡‡**

***** WHO air quality guideline values
** Adopted Air Quality Daughter Directives
‡ Ozone Directive value
‡‡ Commission Proposals for Air Quality Daughter Directives

3.2 Predicting future Air Pollution Problems (Modelling)

Targets for the amount by which pollution needed to be reduced were established on the basis of predicted future pollution levels. These pollution level estimates were established using the results of two separate pollution modelling exercises. The first assessed levels of local pollution and allowed estimation of the amount by which emissions of pollution needed to be reduced (emission reduction targets) because of **local pollution** problems; and the second what emission reduction targets were needed because of **regional pollution**.

3.2.1. Modelling local pollution in Auto Oil I.

In the first Auto Oil Programme the modelling of local scale pollution was restricted to oxides of nitrogen (NOx), carbon monoxide (CO), and benzene pollution. The modelling was centred on seven urban areas : London, the Hague, Lyon, Cologne, Madrid, Milan, and Athens. The initial stage was to establish for each area[18] a list of the sources of air pollution and the amount of pollution they produce[19]. A number of computer models were then compared on their ability to predict air pollution levels for two days in 1990. In each of the urban areas the models used the list of pollution emission sources together with the years weather details. The computer model that most accurately predicted what the pollution levels were in 1990 was then used to predict future air pollution levels[20].

A new list (emission inventory) of air pollution was devised for the year 2010 comprised of predictions for how much each source on the list would change given a business as usual scenario.

Obviously such a list contains many assumptions about the effects of policies that have been agreed but are not yet implemented, the rate of economic growth in the country and region, and the development of the cities themselves. For example the level of traffic pollution from cars in 2010 would depend not just on the state of the economy in 2010 but economic performance from now to then. These factors will influence the number of cars in 2010, their type, size, and age, as well as the amount they are driven. All these factors will effect how much air pollution traffic will cause in 2010 in each of the cities modelled. The same sorts of considerations also apply to all of the other sources of air pollution in the lists of each city[21].

Nevertheless, given a range of assumptions it was possible for the Auto Oil Programme to use these computer models to produce predictions for pollution levels in the seven cities in 2010. Of course this does not mean that these predictions will be the *actual* pollution levels that will be experienced even if no other measures are taken. What the modelling exercise produces is not "*the answer*", but a much more precise definition of the situation in the future given a set of assumptions. But such an enhanced understanding of the size of the pollution problem does allow an estimation to be made for the amount that pollution needs to be reduced so that the air is clean enough to prevent widespread ill health.

The levels of air pollution that were used as the target levels came from the emerging guidelines being developed by the World Health Organisation. These were stricter than the standards that applied at the time in Member States and the EU but were used because they were expected to form the basis for future legislation[22].

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[18] The areas covered by the modelling was not just the geographical area of the individual cities but a 100 km² area surrounding the central core are of each of the cities.

[19] Compilation of the emission inventories for each of the cities was undertaken with input from the "city contacts" in addition to national data from the CORINAIR inventory. The base line data was for 1990, although complete data sets for 1990 were not available in all modelled cities, and extrapolations were needed to complete the inventories for Athens.

[20] For the modelling of the "primary pollutants" of NOx and VOCs the models had the model components relating to reactivity of these compounds "switched off" to better forecast their concentrations rather than those of the reactive pollutants, such as Ozone or peroxy-acetylnitrate (PAN).

[21] Defining a single future emissions inventory is in many respects a departure from normal practice, where a number of likely scenarios are used. However, given the complexity of the Auto Oil Programme multi-scenario approaches proved impractical and a single energy GDP growth scenario was therefore utilised.

[22] This assumption has proved justified with the elaboration of the "Daughter Directives" to the Framework Directive on Ambient Air Quality Assessment and Management (92/62/EC) following the levels of the revised WHO guidelines more than that of the existing legislation in Member States.

It was found that for some pollutants in most places there would not be a pollution problem at background levels in cities in 2010. The predicted levels of pollution of benzene and carbon monoxide would fall below some of the target levels because of the effect of measures that were already agreed. However, four cities would continue to have pollution levels above the strictest standard for benzene. A large contribution to this predicted reduction in pollution was the effect of the three way catalytic converter. Whilst this had in effect been mandatory for all new cars since the later half of 1992 there is rather a long time lag before all cars on the road will have such high performance[23].

For oxides of nitrogen (NOx) the picture was less optimistic. The Southern cities studied in particular were predicted to continue to have high pollution levels of NOx. It was this pollutant that would determine how much pollution would have to be reduced overall to tackle the problem of local pollution[24].

After the modellers had estimated the levels that air pollution likely in the absence of further measures, the next step was to translate this information into how much each individual pollution source would have to be reduced by for overall pollution to be reduced to acceptable levels. It was this sharing of the burden that was to be based upon cost effectiveness, at least for traffic pollution. Those measures that reduced pollution the most at the lowest cost would be selected as the most cost effective way of reducing future air pollution problems.

The reduction in air pollution from the levels predicted for the cities in 2010 was equated first to the amount that **all sources** of air pollution needed to decline. For example all sources of NOx pollution in Athens would have to pollute by 55% less in 2010 if the air pollution was to be reduced to acceptable levels.

The programme then used an assumption on how different sectors of the economy would contribute to this reduction in pollution ***before*** the cost effectiveness element was introduced. It was assumed that all other sources of pollution would reduce by the same relative amount as traffic sources. The 55% NOx reduction in Athens, therefore meant that all sources together (power stations, the airport, hospitals, small firms, domestic burners etc.) would have to reduce NOx pollution by 55% as would traffic. Deciding how traffic was to reduce NOx by this amount would be the task of the cost effectiveness element of the programme. Nevertheless, a reduction of 55% in the emissions of NOx in urban areas across Europe was the first target established by the Auto Oil Programme.

The second target that was identified in the first Auto Oil Programme for local pollution was not based on such a comprehensive modelling exercise. Initially it had been intended that the programme would model particulate pollution in urban areas in order to establish, if necessary, emission reduction targets for particulates in the same way as for the other local urban pollutants. However the complexity of the particulate pollution problem and the early state of development of its modelling ensured that this goal was not possible.

[23] The gradual increase in the number of petrol cars on the road that would be equipped with three-way catalytic converters – introduced roughly between 1991 and 1992 depending upon manufacturer and model. When older cars wear out and only cars equipped with catalytic converters remain, then pollution levels will be much lower than present given the same level of traffic and the same proportion of petrol cars compared to diesel.

[24] Part of the reason for this was the much slower "penetration" of the car fleet on the streets of the city by cars equipped with catalytic converters. For example in Athens ACEA estimated that in 2010 50% of the NOx emissions from traffic would come from cars not equipped with catalytic converters.

In order to establish emission reduction targets for particulates a different approach was therefore necessary. Targets had been established by the UK for "acceptable" pollution levels and it was known that the pollution levels at the time were typically far higher. The amount that the current levels of pollution would have to be cut to achieve the UK standard were estimated and this was then used as a proxy emissions reduction target for particulates.

3.2.2 Modelling local pollution in Auto Oil II.

The modelling of local pollution undertaken in the Auto Oil II Programme within Working Group 1 was more extensive than that of the first programme in several respects. Firstly the number of cities assessed was extended from seven to ten. The cities covered were : Athens, Berlin, Cologne, Dublin, Helsinki, London, Lyon, Madrid, Milan, and Utrecht.

Secondly in addition to this "bottom-up" approach a "top-down" approach was employed that assessed a large number of cities using a more simplified modelling approach. Thirdly it was possible in the second programme to model urban pollution of particulates. It was also possible in the second programme to do a limited modelling of some of the more localised air pollution problems within a city - so called "street canyon" modelling. This exercise more than any other is indicative of the problems cities may face in satisfying the legal requirement under European law to reduce air pollution to safer levels[25].

In addition the known measures from the first Auto Oil Directives could be included among the agreed measures of the "base case" so that the predicted level of local pollution in 2010 could be assessed after the agreed improvements to vehicle emissions and fuel quality had been introduced. Furthermore to allow the 2005 step of the first Directives to be assessed fully, the modelling period was extended from 2010 to 2015. It was also possible to use more recent "baseline data" from 1995 rather than 1990.

The lists of air pollution sources (the "inventories") for each of the cities were also updated and improved through extensive contacts with each of the cities[26]. In addition the estimation for the total amount of pollution from large stationary sources in all countries was improved because of the availability of updated information.[27] Overall the predicted pollution emissions - the so called "base case" - was developed to a far greater extent in the second programme than was possible in the first[28]. This was of course partly because

[25] Under the Framework Directive on Ambient Air Quality Management and Assessment (Directive 96/62/EC) and its "Daughter" legislation - so far Directive 99/30/EC (for lead, particles, sulphur dioxide and NOx) and the proposals contained in COM 98/591 (for carbon dioxide and benzene) - Member States will have to ensure air pollution falls below the stipulated levels, even in locations characterised as traffic locations. When pollution levels are higher than these legal requirements Member States must design and enact action plans that will address the air pollution sources that are causing the problems.

[26] This did not prevent some disagreement in relation to some of the estimates of pollution levels for the cities emerging between the programme modellers and the city authorities that co-operated in compiling the emission inventories - most notably with respect to Lyon.

[27] The information was taken from the RAINS model developed by IASA for the negotiation of Protocols to the UN-ECE Convention on Long Range Transboundary Air Pollution. Unfortunately, unlike the approach of the Auto Oil Programme, this model only includes expensive end of pipe technological measures to reduce emissions of pollution from stationary sources.

[28] A contract with the consultancy SENCO enabled the development of a base case that was agreed between all the participants of the second Auto Oil Programme. It included developments of the vehicle fleet over time in terms of the numbers in each country, as well as the type and size distribution. Policy measures such as the first Auto Oil Directives and other measures taken on stationary sources such as large

of the work done in the first programme, but was also due to the availability of newer information and greater effort and resources being deployed.

In many respects the results from the second Auto Oil Programme confirm the findings of the first programme. Athens continues to be the worst of the cities assessed and is predicted to continue to suffer widespread air pollution problems[29]. The share that emissions from traffic contribute to overall emissions was also predicted to decline in the second programme, confirming findings from the first programme.

A rather different picture emerges, however, from the assessment of Lyon. The first programme predicted that emissions reductions below that accomplished by the first Auto Oil Directives would be sufficient for Lyon to comply with the air quality objectives. In the second Programme a few areas within the modelled area were predicted to suffer continued high levels of pollution of NOx.

It is also the case, however, that whilst other cities studied were predicted to comply in general with the background air quality objectives, the "street canyon" studies demonstrated that even in these cities local pollution problems would be expected to continue. Furthermore whilst the share of pollution from traffic was predicted to decline overall, traffic's share of emissions in pollution problem areas was predicted to remain high. Moreover, in those cities that were predicted to comply with the air pollution objectives, such achievement was rather more marginal than it was comprehensive. It is therefore possible to conclude that many traffic related air pollution problems will remain across Europe despite the first Auto Oil Directives[30].

The generalised empirical approach developed by the European Environment Agency supports this conclusion. This approach predicts that significant areas of Europe's urban areas will retain pollution high levels. This approach may not be as robust a modelling approach as the detailed bottom up approach of the ten cities modelled in detail. It does, however complement the other modelling results from the level of street canyons to the entire modelled domain of the ten cities. Furthermore it also confirms that the problem of air pollution in urban areas is not likely to disappear in the next ten years.

The results of the NOx carbon monoxide and benzene modelling for the ten cities in the Auto Oil II Programme are presented in Annex I. The results for particulates for the same cities are presented in Annex II whilst the street canyon results are presented in Annex III. The results of the generalised empirical approach are presented in Annex IV. All of these results are taken from the report presented by the Commission to the Contact Group on 18th November 1999.

combustion plants were also included. This therefore represents a "state of the art" estimate on what emissions of pollution will be in the future, given "business as usual" and full implementation of policy decisions that have already been taken.

[29] The problem of NOx pollution identified as problematic for Athens in the first Auto Oil Programme remains in the assessment of the second programme, even after implementation of the first Auto Oil Directives.

[30] Even in the locations modelled that are predicted to "achieve" low pollution levels, localised higher levels of pollution are predicted to cause problems. The fact that one of these "street canyons" studied is in a city predicted to have low overall pollution levels – Berlin – but will still have very high levels of pollution in the location studied, indicates the extensive nature of this problem. Whilst it is true that these high pollution areas are predicted to improve at a faster rate than the lower background air pollution levels the pollution will still likely exceed the pollution levels required by Directive 99/30/EC.

3.2.3 Modelling Regional Air Pollution

The second type of air pollution modelling undertaken in both Auto Oil Programmes was on regional level pollution by ground level ozone - also known as summer smog. The problem of ozone pollution is much more complicated than the local pollution problems modelled in the first modelling exercise. This is because ozone is not produced or emitted into the air directly, rather it forms as a result of the reactions between different pollutants. These reactions are not simple chains of events, but rather complex interactions involving many different substances affecting the rate the pollution is formed. Furthermore, the rate that ozone pollution develops also depends on the temperature atmospheric conditions and, importantly, on the amount of sunlight. Warm sunny weather promotes much higher ozone levels from the same amount of pollution emitted into the air than under cooler cloudy conditions.

The substances in air pollution which react to form ozone are of two types: oxides of nitrogen and hydrocarbon gases. Oxides of nitrogen are formed during any combustion process due to the high proportion of the atmosphere that is nitrogen. Hydrocarbon gases also come from numerous different sources and are not just man-made. Furthermore the different gases that together make up this group of pollutants each have a different potential to contribute to the formation of ozone pollution. The modelling of the ozone pollution problem across Europe could not directly produce emission reduction targets for ozone pollution. The product of the modelling had to be emission reduction targets for the primary pollutants of NOx and HC but in order to determine these targets several simplifying assumptions had to be made, notably in relation to the effect on ozone levels that would result from reductions in the primary pollutants.

It was assumed that NOx and Volatile Organic Compounds (VOCs) played an equal role in contributing to the formation of ozone. Thus a ton of NOx reductions was environmentally equivalent to a ton of VOC reduced. Whilst this simplifying assumptions is not strictly accurate, it is not completely unreasonable, particularly at the margin (the contribution the two gases will make to the formation of ozone depends upon the relative concentration of each and of ozone, as well as the strength of sunlight and the temperature).

As was the case for local pollutants, the reductions in emissions of ozone precursors were assumed to be proportional for both stationary and mobile sources. Despite all of these obstacles it was possible to determine emission reduction targets for road transport sources of primary ozone pollution. Compliance with the environmental objectives outlined for ozone in the first Auto Oil Programme was calculated to required reduction in regional pollution of NOx and VOCs by 70%.

In the second Auto Oil programme the modelling of ozone pollution was facilitated by the development of a Community Strategy to combat ozone pollution. This meant that the modelling that was undertaken within the context of the Auto Oil II Programme could build upon that undertaken for the ozone strategy and aid its validation[31].

The results demonstrate the extent to which the emission reductions foreseen under the proposed National Emission Ceilings Directive[32], assisting implementation of the ozone

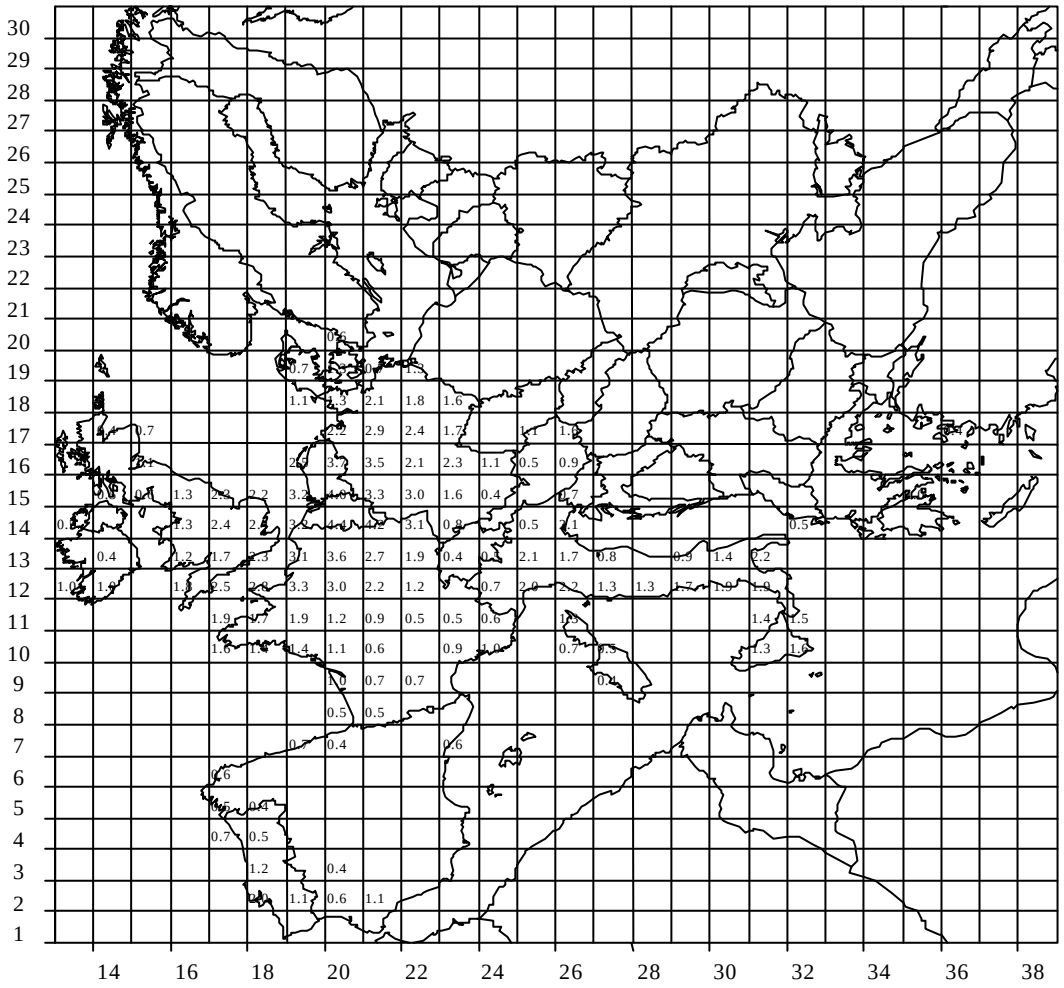
[31] The Ozone Strategy, a Proposal for a Directive establishing National Emission Ceilings and a Proposal for a Daughter Directive to the Framework Directive on Ambient Air Quality Assessment and Management (96/62/EC) was adopted in COM 99/125. This was a comprehensive strategy to complement the acidification strategy and was elaborated to tackle regional pollution that depended on emissions of VOCs, and nitrogen compounds such as ammonia and NOx.

[32] COM 99/125.

strategy, really will be necessary. Large areas of the Union are predicted to continue to suffer large exceedences of the objective levels, as demonstrated by Diagram 1.

Diagram 1

The AOT60 modelled for the emissions of the 2010 IIASA REF case, second highest value of five years meteorologies



Taken from the 7th Interim Report on Cost-effective Control of Acidification and Ground-level Ozone, IIASA, 1999.

The figures indicate the AOT60 in ppm hours. This is the accumulated exposure exceeding the threshold value of hourly ozone concentrations over 60 ppm.

3.3 Critique of the Goals Set for the Programme

A number of criticisms were made of the goal setting exercise both by member States and environmental NGOs. Of particular concern in Auto Oil I was the "spatial resolution" of the local air pollution models. In these models the smallest area over which the air pollution was predicted was 2km². Such a large area masks truly localised air pollution problems such as busy streets. This criticism led to the inclusion of further levels of analysis in the second programme with "street canyon" modelling.

However the basic criticism that the air pollution predicted by the modelling exercise is still too large scale to uncover the true extent of continued air pollution problems remains a valid concern. The fact that for many of the cities studied the predicted levels of air pollution will fall only marginally below the objectives, and this on the fairly large aggregate level of 2km², means that these cities can be expected to continue to have problems complying with the Air Quality Daughter Directives. This assertion is strengthened when the results of the "street canyon" modelling exercise are taken into account. The "*Framework Directive on Ambient Air Quality Assessment and Management*"[33] and its daughter Directives require that member states lower their air pollution levels below the standards stipulated, including when measured at busy roadside locations, and not merely on aggregate background concentrations. Indeed the Commission has itself recognised the validity of this in their Preliminary Draft Conclusions from the Auto Oil II Programme which it presented to the "contact group" on 26th November 1999[34].

A related critique of the goal setting part of the first Auto Oil Programme was the standard used to assess benzene pollution. Several standards were used including one that the Commission insisted upon despite opposition from the two industry partners. This more stringent standard of 2.5 µg/m³ was in part taken from the attempts in Germany to set a standard below which benzene pollution had to fall. Whilst this standard was indeed 2.5 µg/m³ in Germany it applied to all locations rather than a general background level. The Commission was therefore criticised for accepting a standard for reduction of benzene pollution that was not strong enough.

This criticism was in diffused in the second Auto Oil Programme since the target used for benzene was the one contained in the Commission Proposal for an air quality daughter directive. However, this criticism still remains valid and ultimately the extent to which this is so, will be decided within the adoption procedures of the daughter Directive.

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[33] Directive 96/62/EC

[34] Commission Discussion Paper 2, *Preliminary Draft Conclusions from the Auto Oil II Programme* (presented to the Auto Oil Contact Group on 26th November 1999) includes within the section on Air Quality the admission that "remaining air quality challenges would appear to be :

- Closing the gap between the AOPII base case emission projections and the proposed national emission ceilings for ozone precursor emissions of NOx and VOCs;
- Meeting the PM_{10} objectives for 2010 in around half of the AOPII cities;
- Tackling remaining but rather limited exceedences of the NO_2 objectives."

Despite this relatively complacent attitude, to NO_2 in particular, it goes on to admit that

- "Concentrations of air pollutants in street canyons will fall further than at background, though in most cases absolute levels will nonetheless remain higher in street canyons; this will mean some **exceedences of the air quality objectives will still occur in cities which comply at the background level**." (Emphasis added) and :
- "Where exceedences occur, road transport will generally continue to be the major contributor; however the balance is shifting and further emphasises the need to have emission inventories that are equally robust for all emission sources."

These criticisms were countered by the Commission with the argument that the Auto Oil Programme was defining Europe wide standards, the severity of which should not be set by the worst pollution black spots in Europe. Rather what was needed to define the goals of the programme was just the background (or ambient) air pollution levels. This argument would have merit if the European framework legislation on air pollution only gave Member States a duty to reduce air pollution over a similar general background "resolution". This, however, is not the case as the Air Quality Directives require compliance in all areas, including busy traffic locations. A further flaw in this defence of the Commission is that if the programme is only to assess air pollution at such a general level in order to set European standards, then only Europe wide measures should be used to reach this target. As we have seen this was not the case in the Auto Oil Programme.

As regards the emission reduction targets for ozone the modelling exercise demonstrated how dramatic the scale of this pollution problem is. Very large reductions in emissions still left a situation where ozone pollution would periodically occur. Rather than set a level of pollution were ozone would very likely not occur, a certain degree of pollution was therefore accepted as inevitable. This was a pragmatic approach, but is neither compatible with the requirement of Directive 94/12/EC to take an approach compatible with the "Community Air Quality and related objectives" or with the Article of the EC Treaty Upon which such Directives are based. This Article[35] requires that action is based on a high standard of protection for human health and the environment. The Commission would counter that to fix the target for Community action on such a high level of emission reduction would not make the resulting proposals "proportionate" another principle which guides policy formulation. Once more this would be a valid defence only if community wide policies were being considered, but as previously stated this was not the case. Defining the overall ambition of the emission reduction targets and those of the final proposal should have been two entirely separate considerations and only in relation to the proposals does any consideration of proportionality have a place.

One of the further problems of using a modelling exercise of local pollution problems to establish targets for pollution reduction across Europe, is knowing to what extent the problems identified are typical of the area modelled or more representative of urban areas across Europe. This criticism of the first Auto Oil Programme was partly alleviated by the addition of the "top-down" modelling of pollution undertaken by the environment agency (the General Empirical Approach) in the Auto Oil II Programme.

However, it remains the case that the detailed knowledge gained of some locations, building from the level of a single "street canyon" to an area of 300km², will only represent that specific area, rather than some aspect of European wide local pollution. Yet it is the "*function*" of the modelled areas to represent some form of an "*ideal*" European urban pollution situation. The fact is that on their own each of these modelled areas can not perform this representative function. Even together the ten areas modelled in detail with the bottom up approach are as representative of the approach as they are of some "ideal".

Similarly the Generalised Empirical Approach falls short of truly representing the "ideal" because it is based on a rather simple approach and data set (although the area covered is of course greater and the number of data points therefore higher). Taken together, however, the two approaches can be instructive on what the pollution situation could be in the future of Europe's urban areas.

Claims that the results in some way "will protect a large percentages of the European urban population" are thus based on rather uncertain assumptions and extrapolations. If

[35] In the Maastricht Treaty this is Article 100a - and in the Amsterdam Treaty this is now Article 95.

further improvements to technical standards are proposed, however, it is unlikely that industry will be able to restrain itself from making such claims following Auto Oil II as they did following Auto Oil I[36].

At present, however, they are complaining about the use to which the General Empirical Approach has been put[37]. It has been used as the basis for a rudimentary evaluation of the benefits of the Auto Oil Directives which are far higher than the estimates of their costs[38]. The industry is therefore aware that the Generalised Empirical Approach could therefore become the starting point of a cost benefit approach that may supplant the cost effective approach utilised hitherto.

The extent to which an analysis of benefits over-time has been in large neglected in the Auto Oil II Programme is a weakness in the setting of the programmes objectives, and a critique that will be covered in more detail in the next chapter of this report on the cost effectiveness approach.

[36] After the first Auto Oil Programme both ACEA and EUROPIA argued that the second step of standards for 2005 were unnecessary. In particular they argued that the six cities modelled that would satisfy the air pollution objectives "represented" 90% of the EU urban population. They derived this figure from the APIS data base of cities which merely ranked 200 cities on the levels of air pollution. APIS, however was never intended to be used to predict the percentage of the urban population that would be protected by some future reduction in the level of air pollution. The industry, in particular EUROPIA, also argued on the basis of the air quality modelling and the APIS data base that the first Auto Oil proposals "overshot" the objectives and were thus not cost effective. The fact that some areas - Athens included - would continue to exceed air quality objectives, that some air pollutants (e.g. PM_{10}, Benzene) do not have a zero effect threshold and that the accuracy of the modelling and its poor relationship to air quality legislation demonstrates the completely spurious notion of any such "overshoot".

[37] Both ACEA and EUROPIA gave critical analyses of the Generalised Empirical Approach and the use to which it had been put at the Contact Group meeting of 26th November 1999.

[38] As outlined in the Commission Document "Discussion Paper 2, Preliminary Draft Conclusions from the Auto-Oil Programme" presented to the Auto Oil Contact group on 26th November 1999.

4. Cost Effectiveness

Whilst the goal of the Auto Oil Programme has always been the achievement of environmental objectives, there has also always been the aim of achieving these environmental objectives at the least cost to the European economy. The methodology that was developed and employed to achieve this aim was cost effectiveness. Once the emission reductions necessary to achieve the environmental objectives were determined in the Programme, a range of different measures were assessed and compared. The aim being to define an optimum final package of measures that would be effective enough to achieve the environmental objective, and cost the least amount possible.

The measures that were included in the cost effectiveness assessment included :
1. technical measures such as improved emission standards for vehicles and improved fuels
2. improved inspection and maintenance of vehicles
3. local measures such as support to public transport, alternative fuels in city authority fleets, selective traffic bans, etc.
4. possible national fiscal measures

Whilst Auto Oil I set out to include all of these measures this proved not to be possible until the more complex modelling developed in the Auto Oil II programme. The optimisation process was therefore restricted in the first Auto Oil Programme to the first two types of measures with an additional estimation of the possible effectiveness of the third group for some circumstances[39].

In order to be able to complete the cost effectiveness part of the Auto Oil Programme, there needed to be estimations of both the potential effects and the costs of all of the measures. These were then combined within the “optimisation” process where the optimum combination of measures was identified.

4.1 Cost Effectiveness - Assessing the Effectiveness

A key element of the first Auto Oil programme was the special programme undertaken by the two industry partners on the relative merits of improving vehicle technology and / or improving fuel quality. There is of course an interaction between the two technological approaches and some vehicle technology developments require changes to the fuel - catalytic converters for example required unleaded petrol. The two industries funded and conducted a special programme with the aim of detailing the benefits that could be expected in terms of reduced emissions from improved vehicles and fuels. This programme was called the European Programme on Emissions, Fuels and Engine Technologies. (EPEFE) . The results of this research programme elaborated the first joint oil and car industry research on the topic.

The EPEFE results included equations that linked changes in the contents of both petrol and diesel fuel to changes to the amount of pollution a vehicle would emit. Similarly with the same fuels EPEFE demonstrated the extent to which vehicle technology could reduce

[39] The air quality modelling demonstrated that for Athens, Milan and Madrid the maximum technology package would not provide the emission reductions required. Conservative estimates were therefore made of the extent to which local measures could contribute thereby lowering the remaining emission reduction target for technical measures. The logic was that whilst the final package of technical measures would not **on their own** satisfy the worst air pollution problems in all areas, they would make a sufficient **contribution** to allow even those areas to tackle their air pollution with “local” measures.

pollution emissions. From the pure technology side there was a high degree of confidence that the research and review that was undertaken in the Auto Oil Programme gave very good indications of the possible reductions of pollution emissions that could be achieved.

The EPEFE results therefore allowed combinations of improvements to vehicles and fuels to be assembled into "packages" that could be assessed in terms of reductions in pollution emissions. The costs of producing these "packages" could then be estimated. The packages applied to:

- fuel, both petrol and diesel
- passenger cars
- light commercial vehicles (vans)
- heavy duty engines used in trucks and buses.

The results of the EPEFE programme, however, were questioned by the industry themselves in the Auto Oil II Programme. The partner that sought to question the EPEFE results the most was the auto industry with ACEA calling for a complete overhaul of the equations that related to the emissions of NOx.

There was less confidence on the degree to which pollution emissions could be reduced as a result of better controls over vehicle maintenance. European Inspection regimes already ensured that pollution levels formed part of the road worthiness inspections.[40] But the extent to which this test could be enhanced, alongside the resulting costs and benefits in terms of reduced pollution emissions was uncertain. The estimations made for both the costs and the benefits of these measures were based upon a data set that was very much less exhaustive than the technical measures.

A further complicating factor in these estimations arose from the fact that enhanced inspection and maintenance estimations were comprised of several elements. Some of these would have been more properly considered as specifications for vehicle technology, so-called on-board-diagnostic (OBD) equipment. This improvement to vehicle specifications would inform the driver via a dashboard light of failures to the vehicle's emission control equipment. OBD would thus help vehicle owners to maintain their vehicle's emission control equipment throughout the life of the vehicle.

A second element of the package improving inspection and maintenance was an increase in the durability of the emissions control equipment of vehicles. Once again this element of the inspection and maintenance package is a technical improvement to the vehicle that will ensure lower levels of pollution from the vehicle when it is used on the road.

A further element of the package was an improved road worthiness inspection test. The requirements that would apply by the year 2000 across the EU for such road worthiness test includes a simple emissions control test[41]. Estimates for the costs and benefits (in terms of reduced emissions) from improvements to this component of the road worthiness test were therefore assessed.

A fourth element of the inspection and maintenance package of measures was a so-called "recall scheme". Vehicle manufacturers have been subject to periodic tests to ensure that their construction and assembly systems produce vehicles that are of a similar quality to that which originally passed the type approval test. A further test was devised that would extend this check on production vehicle quality through the life of the vehicle. Small batches of vehicles being used and maintained by owners in accordance with the

[40] Under Directive 92/55

[41] Directive 92/55/EC came fully into force in 1998.

manufacturers instructions would be tested thoroughly. If these tests demonstrated faults in the vehicles that could be attributed to the manufacturer, then the production run of that vehicle would be recalled in order for the fault to be rectified in all vehicles.

The inspection and maintenance package was therefore comprised of several elements all of which contribute to better performance and lower pollution from cars throughout their useful life. Those that have to contribute include manufacturers, owners and even the government regulators.

In addition to these technical measures other types of more "non-technical" measures were originally intended to feature in the cost effectiveness assessment. Local initiatives such as public transport improvements, local traffic bans or restrictions, cleaner gas buses etc. were to be included. Unfortunately, establishing the reduction in pollution emissions that would result from such measures proved difficult. Equally difficult was any assessment for the costs of such measures. Despite great progress being made establishing methodologies that would to some degree overcome these difficulties, incompatibility with the other more technical elements of the assessment prevented full inclusion in the cost-effectiveness assessment. Local measures were obviously important but a comparison with technical measures could not be made in any meaningful way. In order to continue to recognise the importance of non-technical local initiatives they were assumed to play a role in the most polluted cities, although a conservative estimate of their effectiveness was used[42].

4.1.1 Critique of the Effectiveness Assessment

When the EPEFE programme was completed the results were criticised by a small number of experts as unrepresentative and incomplete. These criticisms were however rejected by both of the industry partners, who highlighted the large overall data set and the rigour with which the results were obtained. Despite these reassurances the criticisms of the EPEFE results continued. One criticism that was frequently made was that the structure of the vehicles selected favoured car manufacturers at the expense of heavy duty engine makers. Some industry engineers working for companies that made both cars and heavy vehicles even felt that their car division had "out-manoeuvred" their own truck and bus divisions.[43]

Such criticisms have gained credence over time as the EPEFE results are now challenged, at least in part, by ACEA itself. The car manufacturers have belatedly realised that the structure of the EPEFE programme tests gave results less favourable to them than to the oil industry. This is not to say that these results are inaccurate, but rather that they give a less than complete picture. The re-examination of the EPEFE equations requested by ACEA during the Auto Oil II programme has therefore served to reinforce the credibility of previous critiques of the EPEFE results.

Of course one of the principal aims of the Auto Oil programme was to utilise industry expertise to enhance the understanding of the interaction between improved fuels and improved vehicle technology. The EPEFE programme should have greatly contributed to the greater understanding of this complex area. Unfortunately because the programme was restricted to the car and oil industries the programme failed to clarify this issue if only because the lack of transparency gave an appearance of collusion. As we have seen it is

[42] See footnote 39 on the approach taken in the most polluted cities assessed in the first programme.

[43] Personal Communication 1996. The engineers concerned wished to preserve both their own and their company's identity, but highlighted to NGOs what they considered to be flawed research in the EPEFE programme.

now the case that ACEA wishes to revisit certain elements of the EPEFE results and so collusion would certainly be an inappropriate description of any weaknesses in the EPEFE results.

The rigour with which the effectiveness of the other measures were assessed, however, was far lower than the EPEFE programme, regardless of its flaws. Very small data sets were available to assess the reduction in pollution emissions that follow from better inspection and maintenance. Furthermore the scale for potential reductions in pollution resulting from extending and / or improving the current road worthiness test were derived by horse trading between the three Auto Oil partners, rather than by any rational scientific assessment process. Despite Commission reluctance, in the final cost effectiveness assessment improved inspection tests were assumed to reduce pollution by 15% despite there being no scientific basis for such a high figure. With the benefit of hindsight this appears to be a serious over-estimation as measures that have subsequently been advanced to improve the inspection test have been estimated to reduce pollution emissions by far less[44].

4.2 Cost Effectiveness - Assessing the Costs

Establishing the costs for any measure or set of measures to reduce pollution from traffic is always problematic. Industry is generally cautious in giving information on costs that in the final analysis could give competitors important information about relative future competitive positions. Costs for new processes and even new plant are difficult to establish because budgeted costs differ from final expenditures. Sometimes these costs are higher than budgets, but frequently they are lower. Competitive companies in the market place will always seek innovative methods of reducing their costs. As projects progress innovative solutions to complex problems which lower overall costs are found.

The Auto Oil Programme attempted to circumvent these problems by undertaking a review of costs for “packages” of technology that would together deliver a defined reduction in emissions. This exercise was undertaken by consultants appointed by the Commission and the information they received from individual manufacturers remained confidential. For the packages that applied to vehicle technology the review was undertaken by Touche Ross Deloitte. They compiled questionnaires which individual vehicle manufacturers completed detailing the expected costs associated with percentage emission reductions from new cars. The results from all the vehicle manufacturers were then aggregated so that a for each “package” of emission reductions costs were known for three size ranges of car, for vans and for heavy duty engines used by buses and trucks.

For the fuel “packages” the consultancy firm of Arthur D Little undertook the cost assessment. For the fuel “packages” the questionnaires were sent not to the refiners themselves, but to those who supply the refining industry. The effects on emissions of altering the composition of the fuel was taken from the EPEFE equations and the costs for altering the amount of each constituent - or parameter - in the fuel were calculated. This process produced costs curves for the relationship between additional costs and changing fuel characteristics.

The costs for improvements to the effectiveness of inspection and maintenance was undertaken by Touche Ross Deloitte. These costs were harder to define as there are

[44] Commission Directive 99/52/EC has extended the testing of emissions, but not to the degree foreseen in the first Auto Oil Programme and is only estimated to reduce pollution emissions by approximately 2%.

several elements to the overall package. Experiences from the USA as well as surveys from different Member States provided the input to arrive at cost estimates. The same data sources were also used to assess the amount these measures would reduce pollution emission by.

4.2.1 Critique of the Assessment of Costs

Of course a cynical view would be that industry inflates its estimations for the costs of regulation in an attempt to prevent this regulation. There will inevitably be an element of truth in this, but the extent to which cost estimates are in excess of final costs is not exclusively the result of deliberate industry attempts at policy manipulation. Factors that influence the assessment of costs include the reductions that stem from, technological advances, the reductions stemming from large scale production compared to the advance prototypes, and reductions in cost that stem from process innovations[45].

Indeed these cost reductions are an example of the efficiency of the free market system compared to a planned economy. They arise where innovation and enterprise bring forward efficiency. A correction factor could have been applied to costs that would have accounted for these predictable cost reductions over time. The fact is that these cost reductions appear to be rather predictable in that a similar range is often quoted for them - a factor of three. Whether this would have been the correct figure could have also been examined by the Auto Oil Programme so that any figure generated could have been supported by all involved. This figure, it must be stressed, would not be correcting for deliberate cost inflation by industry. Rather it would be a correction factor for innovation that the free market predictably provides.

Such a correction factor for costs would not have been needed if the same correction factor could have been applied to all of the measures to reduce pollution that were assessed. If all the measures had been technical costs to industry then this would have been the case. As the cost effectiveness approach is a comparative exercise if all the costs are raised or decreased by the same proportional amounts then the comparative effect is zero. The only effect that inflated cost estimations have is in terms of a “scare factor” for decision makers later in the policy process.

4.3. Cost Effectiveness - The weak link : local measures

As outlined earlier it was originally intended that the first Auto Oil Programme would include local initiatives in the package of measures to reduce pollution. Indeed a model was developed by DG II for this purpose - EU-CARS[46]. However as the programme developed it became clear that the structure of the information produced by EU-CARS was not compatible with the requirements of the model used in the optimisation process. Local measures could therefore not be assessed within the formal cost effectiveness model.

This did not mean that local measures were completely ignored in the first Auto Oil Programme. It quickly became apparent that in the worst pollution areas even the strongest technical measures would fail to meet the environmental objectives on their own. In these cases an estimate was made of the potential of local measures to reduce

[45] *Costs and Strategies presented by Industry during the Negotiation of Environmental Agreements*, 1999, Stockholm Environment Institute, York.

[46] EUCARS was originally developed by DG II (Gert-Jan Koopman, Cecil Denise, and Hienz Jensen).

pollution. But there was no estimate of the associated costs of such measures, nor the likelihood of their full implementation. A certain portion of the required effects of the overall package of measures were therefore assumed to be achieved with no costs. This assumption was thought necessary because the final package of European measures identified as cost effective should, with the addition of local measures, enable every location in Europe to achieve the European environmental objectives.

In the second Auto Oil Programme two of the working groups confined themselves to questions of non-technical measures. Working group 5 assessed local measures whilst working group 6 assessed fiscal instruments. This approach allowed a far fuller assessment of local measures in Auto Oil II than had been the case in the first programme.

The work of working group 5 was always going to be the most problematic in terms of complying with the objectives of the Programme. The programme was structured so that working group 1 defined the targets (the air quality working group), working group 7 identified the most cost effective set of measures and working groups 2-6 provided the data on the amount by which individual measures could reduce pollution and their associated costs.

Providing data on costs and effects of measures which are valid across Europe but are local in their nature and effect was an unrealistic goal for working group 5. At an early stage in the second programme NGOs questioned the extent to which data on local measures from one area could be representative for urban areas across Europe, either for the effects on emissions of pollution or the amount they cost.

The approach the second programme could have adopted was somewhat similar to the first. That is identification of the minimum extent to which local measures could be expected to reduce pollution alongside an indication of the costs that would be associated with such measures. However a different approach was taken by the working group that provided more quantitative results that were of use to working group 7.

The rigour of these quantitative assessments compared to those from the technical groups is low. If the second programme still had to identify how strong the technical standards needed to be in 2005 (using comparative cost effective assessment with the data from working group 5) then the results of the programme would doubtless have been strongly questioned. However, the conciliation process between the European Parliament and the Commission had already established the 2005 technical standards in the first Auto Oil Directives. Moreover the second Auto Oil Programme progressed a fair distance in identifying cost effective non-technical measures that reduce pollution from traffic in urban areas.

The final report of working group 5 may be said to represent the current level of knowledge of the extent to which local measures can reduce air pollution and how much such measures can cost.

This is in stark contrast to the assessment of national fiscal measures that has been undertaken in working group 6. Because of the potentially explosive nature of the tax question within a European context the utility of such measures has received much lower levels of assessment than the others.

4.3.1. Cost Effectiveness - Critique of local measures

The second Auto Oil Programme did not progress on the tougher problem of developing methodologies that could adequately **compare** the costs of technology with the costs of policies and measures. At present, using the costs to society for non technical measures on the one hand whilst using the costs to manufacturers on the other, will lead to an overvaluation of how expensive improved technology is to society.

The definition of costs for technical measures used was the total of the investment and additional operating costs for any package. This takes no account of other factors that ordinarily influence investment decisions that are closely linked to the value of those investments to both the enterprise undertaking them and to society as a whole. For example the absolute costs of dramatically enhancing the inspection and maintenance programme using a much more sophisticated emissions test element of the annual inspection test would be low - compared to improved fuels for example. The reduction in pollution that such tests would bring about would be very cost effective within the context of the Auto Oil methodology.

However comparing such absolute figures without reference to who bears them masks how painful such costs are to society. Oil refining is an expensive, capital intensive industry that potentially can bring with it considerable returns on such heavy investment. In contrast the thousands of small back street garages responsible for undertaking the current road worthiness test would face investment costs that may even be greater than the capital value of their business if they were required to invest in the equipment necessary for an improved inspection test. Large figures for additional investment need to be placed within a context of how meaningful such costs are to those who bear them if the cost effective methodology is to serve its purpose - to inform decision makers of the policy options that achieve the objectives but that cause the least economic pain to society.

Realisation of these problems for assessing the costs of non-technical measures was precisely why investment and operating costs in **isolation** did not form the cost valuation for these measures in the second programme. The real social costs for local measures were estimated so that the cost to society as a whole could be established. This approach also needs to be translated into the valuation of the costs of technical measures otherwise the comparative cost effectiveness exercise is unbalanced.

A further problem with treating costs in isolation for the technical measures is the extent to which the comparative cost effectiveness assessment merely boils down to a proxy measure of how capital intensive or labour intensive an industry is. Oil refining is very capital intensive and so it was rather unsurprising that the first Auto Oil programme (where the cost comparisons only included the car and oil industries and inspection and maintenance) concluded that much cleaner fuels were not cost effective. The first programme also concluded that cleaner vehicles that are moderately capital and labour intensive were moderately cost effective. However the first Auto Oil programme further concluded that inspection and maintenance programmes that are very labour intensive and not capital intensive were extremely cost effective.

A constant problem for the methodology of cost effectiveness has been the issue of the value of time. Because the approach of the cost effectiveness methodology was to put the achievement of an environmental objective beyond considerations of cost, no value was given to the benefits that flow from achieving these environmental objectives. This does not make the value of these benefits - or the costs of failing to achieve them - any less real. But as achieving the environmental goals are a prerequisite to the cost effectiveness approach taken, no valuation is given to achieving them.

Unfortunately what this approach does not allow is inclusion into the cost effective assessments of the value to society of reaching the environmental objective sooner or with greater certainty. An improvement to the methodology would therefore include a valuation of the benefits **over time** compared to the costs of achieving this. Valuing the benefits of achieving the environmental objective would also put in some context the costs society is expending in achieving it.

Cost effectiveness also needs to account for uncertainty in a far more thorough way than has been the case in the Auto Oil Programme. Whilst the modelling is of the highest calibre that is possible currently, like all modelling exercises it is only as accurate as the assumptions that underpin it. The fact that only one scenario for the future development of the emissions of pollution was included in both of the programmes is a serious weakness. To allow for the uncertainty of the level of pollution emissions a safety factor could have been included to ensure that the estimated size of the pollution problem would not be underestimated. For if there is an underestimation of the amount that pollution would have to be reduced, then there is a danger that the cost effectiveness methodology fails to deliver the agreed environmental objective.

4.4 Gaps remaining after Auto Oil II

A disappointment from the second programme has been the number of technical issues that remain after completion of the programme. In part this has been due to the short time scale allotted to the second programme – just eighteen months.

It is also the case, however, that this short time horizon has enabled some interests to ensure that certain technical questions were not addressed. Particular problematic in this regard has been the over legalistic approach of the two exclusively technology based Working Groups to their remit. This has meant that some of the most promising technical measures that remain have not been analysed in depth.

For example although motorcycle technology has now been scrutinised to assess the contribution new motorcycles can make to reducing emissions of pollution, mopeds have been ignored. This is despite the knowledge from the programme that cities in the southern Member States with some of the worst pollution problems have also large numbers of mopeds on their streets.

On the fuel side it has been the contention of many, the car manufacturers included, that virtually sulphur free petrol and diesel may be necessary as an “enabling “ fuel for new technology. This cleaner fuel, however, has not been included in any analysis ostensibly because the Parliament and Council set the sulphur levels within their conciliation agreement of the first Auto Oil Directives. However, the Auto Oil Programmes have always *advised* the Commission – not written their proposals and the Commission still retains the right of initiative. If the analysis had shown that low sulphur fuels were cost effective or needed, there could have been new Commission proposals. Not including them in the analysis, however, had the effect of reducing this Commission right of initiative as Working Group 3 effectively prejudged whether the issue was relevant rather than the College of Commissioners.

5. Other Assessments and Processes

During the period that the Auto Oil Programme has been undertaken several other policy processes have addressed the problem of reducing pollution from traffic. Indeed the period has been marked by a growing realisation by transport decision makers of the scale of the problem and the urgency with which it needs to be addressed.

The debate over how best to address transports problems has ranged over a variety of different policy options. To a greater or lesser extent these have been covered within the Auto Oil Programme, but the emphasis placed on the options has often been rather different in other fora.

A major focus for many of these debates has been on market based instruments to tackle transports problems. This contrasts with the focus on technical regulations of the Auto Oil Programme. Of course the Auto Oil Programme has attempted to bring economic considerations into the process by assessing the most cost effective package of measures including technical regulations. But this is rather different from the usual approach taken to applying economics principles to tackle transport's environmental problems. Rather than agreeing to reaching environmental objectives via the least cost options, the more prevalent approach is to evaluate the costs of **not** achieving the objective, and attempt to justify policies on the basis of the value of these costs.

Indeed there is now widespread agreement by transport policy makers for the need to make transport prices reflect all the costs to society of transport, including the costs of pollution. This need for "internalisation of external costs" has been recognised as a basis for new transport policy in several policy related processes and fora.

Firstly European Ministers of Transport have now come together three times in pan European Transport Conferences. The last of these in Helsinki in 1997 saw agreement on a set of principles that would guide the development of a new sustainable transport system in Europe[47]. These principles particularly elaborated the need for transport to internalise its external costs.

The transport ministers could agree such a set of principles because of the comprehensive studies and reports they had commissioned from the secretariat of their European Conference of Ministers of Transport (ECMT) based at the OECD in Paris. Frequently, when the application of the polluter pays principle is mooted for transport many methodological problems are presented. Work undertaken by the ECMT contributed to a better understanding of how and why such obstacles should be overcome[48].

The second international forum in which the internalisation of external costs has been agreed by governments is within the United Nations Economic Commission for Europe (UN-ECE). In Vienna in November 1997 the UN-ECE held a regional conference on transport and environment that bought together ministers of transport and environment from across Europe. The resulting Vienna Declaration[49] and Joint Programme of Action[50]

[47] The Helsinki Declaration was adopted at the Third Pan European Transport Conference 23-25th June 1997.

[48] An extensive catalogue of publications that ECMT have produced on this and other transport topics is available from the web site : http://www.oecd.org/CEM/pub/index.htm. In particular see : "*Transport Economics: Past Trends and Future Prospects*" 1994.

[49] UN-ECE Vienna Declaration, adopted by the Regional Conference, 12-14 November 1997. Reference: ECE/RCTE/CONF./2/FINAL

[50] UN-ECE Joint Programme of Action, adopted by the Regional Conference, 12-14 November 1997. Reference: ECE/RCTE/CONF./3/FINAL

both strongly supported internalisation of external costs as a principal method for tackling the environmental impacts of transport and traffic pollution.

The third forum in which the internalisation principle has been agreed, was one of the follow up events outlined in the Vienna Joint Programme of Action, the third WHO Europe ministerial meeting on environment and health in London in May 1999. At this ministerial meeting in addition to endorsing the internalisation principle in their general declaration[51] the ministers also adopted a Charter on Transport, Environment and Health[52]. Once again the approach that was endorsed to tackle the environmental, and on this occasion the health, impacts of transport was valuing the costs of current damage and internalising this cost in transport prices.

Thus it has only been the Auto Oil Programme that has focused so exclusively on a cost-effectiveness approach to the exclusion of evaluating the costs to society of current impacts. Even the approach adopted within the EU in terms of the Community policy has progressively moved towards adoption of the internalisation principle.

This began in 1995 with the adoption of a Green Paper by the European Commission on Fair and Efficient Pricing in Transport. The green paper sparked a fierce debate with all stakeholders and those in the transport industry. One of the claims of the industry at this time was that large scale external benefits of transport had been overlooked. They claimed that these external benefits counterbalanced the negative effects of transport such as pollution. They argued, therefore, that there were no net external costs to internalise. Such notions were strongly countered by academic economists who highlighted that the effects being referred to were in fact consumer surplus effects and not external to the market .

Indeed the support from the academic economics community of the approach taken by the Commission as well as stakeholder groups, other than those with a vested interest in the status quo, enabled the Commission to adopt a White Paper on Fair Payment for Infrastructure use in 1998[53]. This White Paper outlined a timetable of future action that would enable the eventual internalisation of external costs to all modes of transport. The prices for use of infrastructure for all modes would eventually be based on their social marginal costs - including costs that are currently external to the price such as the costs to society of pollution, accidents and congestion.

Thus, in the period from the mid 1990s the Commission has had two concurrent approaches to decreasing the pollution levels of transport, both of which have an economic foundation but which are radically different. On the one hand the Auto Oil Programme fixed an environmental objective and assessed which measures would achieve that objective at least cost from a top down planning type approach. On the other hand the fair and efficient pricing approach is based on correcting distortions to the market via the price mechanism, and then leaving the operation of the market to decrease the environmental impact of transport including pollution levels.

Both of these approaches, the top down planning of the Auto Oil Programme and the market correction of Fair and Efficient pricing, redefine the “rules of the game” for the European transport market. Economic theory tells us that the most efficient of these is the

[51] WHO London Declaration on Environment and Health, adopted May 1999.

[52] The Charter on Transport, Environment and Health was the only sectoral charter adopted alongside the Declaration, although a protocol on drinking water quality was also opened for signature.

[53] “*Fair Payment for Infrastructure use: a phased approach to a common transport infrastructure charging framework in the EU*” , European Commission White paper 22nd July 1998.

second, harnessing the efficiency of the free market to define the most cost effective policies after price corrections, rather than somehow attempting to prejudge this.

The approach that has been the most politically acceptable, however, has been the planning approach of the Auto Oil Programme. Directives have now been adopted for vehicle emission standards, fuel quality standards and improved inspection and maintenance tests. Meanwhile there has as yet not even been a Commission proposal on pricing, and the complete process, outlined in the White Paper, is not expected to see Commission adoption of a final proposal before 2005.

The reason for this situation, where the most economically efficient approach is the least politically acceptable is, of course, related to the perception by Member State governments that a greater delegation of sovereignty is associated with European pricing / taxation issues, compared to the harmonisation of technical standards.

The extent to which various approaches to European Transport decision making are viewed as a delegation of national sovereignty is therefore an important consideration in assessing the Auto Oil Progamme. Evidently the greater political acceptability of the top down harmonisation of standards enables progress on concrete measures that will reduce pollution from traffic. This principle even applies to the various measures identified within the Auto Oil Programme as cost effective. Those that the Member States view as their own responsibility - pricing, non-technical local measures etc. - are yet to be coherently or comprehensively implemented as Member States block progress at a European level with arguments of “subsidiarity”.

A further European process that has developed transport policy has been developments following changes to the EU Treaty. The new Amsterdam Treaty includes a new commitment to integrate environment into all areas of Community decision making. In December 1997, before the Treaty came into force, the Swedish government asked what the Community was doing to implement this new commitment[54]. The EU heads of government requested the Commission to analyse this question and the Commission therefore adopted a Communication on the topic of integration in April 1998.

On June 16th 1998 at their next European Council in Cardiff, the EU government heads supported the approach outlined in the Commission Communication, and invited their junior colleagues from Energy, Agriculture and Transport ministries to draw up plans on how to apply the integration principle to their own European Council work[55]. These strategy plans drawn up by these “three formations of the Council” were to presented to the EU Governments heads at their next meeting in December 1998. From this point on the integration process was frequently referred to as the “Cardiff” process.

However the documents that were adopted by the three Council formations (Agriculture, Energy, and Transport) fell far short of outlines for real strategies. As a result the EU government heads decided in Vienna to intensify and extend the integration process[56]. Firstly the Agriculture, Energy and Transport Councils were “invited” to prepare a more extensive document outlining a strategy that included indicators, further measures and a timetable. These three initial Councils were also extended to include three more formations of the Council; Development, Internal Market and Industry. All of the strategies prepared by these Councils were to be completed by the end of 1999, and presented to the heads of government at the Helsinki European Council.

[54] Council Document 400/97, adopted on 12/12/1997.
[55] Council Document 150/98, adopted on 16/06/1998.
[56] Council Document 300/98, adopted on 12/12/1998.

The integration process was further extended by a further three sectoral areas[57], at the next European Council meeting of government heads in Cologne on June 4th 1999[58]. In addition to the extension of the process to include more issue areas the heads of government also gave all of the sectors guidance in what they thought to be the most important consideration for integration of environmental considerations into all policies : climate change and meeting the Kyoto Commitments.

This guidance allowed the Transport Council to adopt their strategy paper at their meeting on October 6th 1999.[59] This strategy was more comprehensive than any of the other strategies that had been adopted. It gave tasks to the Council, to the Member States themselves and to the Commission. Not only this, but it also included a timetable for the actions. A central role in this strategy was given to the implementation of fair and efficient pricing and the internalisation of external costs. Indeed the Commission was invited to bring forward a proposal on pricing as early as mid 2000.

This approach was welcomed by the EU heads of government at their summit in Helsinki in December 1999. The leaders asked that all of the work of the Council elaborating strategies should be completed by June 2001, and that the "completion of the sectoral strategies should be followed by their immediate implementation"[60].

The integration process therefore clearly has a strong impetus from the very top level of policy making in the EU. It is also clear that as a result much of the efforts of policy making will now focus on attempting to change the fundamental driving forces currently making transport patterns so unsustainable. Any future developments of the Auto Oil Programme within the context of the Clean Air For Europe Programme must therefore take account of the importance of these driving forces in transport policy development.

[57] The Councils are General Affairs, Economic and Financial Questions, and Fisheries. They are to report to the European Council in the year 2000.

[58] Council Document 150/99, adopted on 04/06/1999.

[59] Transport Council Conclusions of 06/10/1999 – Council Document 11282/99

[60] Helsinki Council Conclusions. Council Document 300/99.

6. Conclusions and Recommendations

6.1 Recommendations on the Auto Oil Methodology

The multi-stakeholder process that the Auto Oil Programme evolved into has frequently been mooted as a model for other policy processes to follow. It is true that the programme was far better as a policy process in its second incarnation rather than its first. However this does not mean that the process itself could not be further improved.

One of the greatest problems has been the workload involved in following in close detail the technical work of seven working groups. The number and frequency of meetings dictated by such a structure gives stakeholders a heavy workload and demands a great deal of time and resources. This is not merely problematic for NGOs: industry representatives and Member States have in the past questioned the necessity for such a burdensome structure. Indeed this has been the conclusion of the commission services that have been most closely associated with Auto Oil. Future work in this and related areas is set to become more comprehensive whilst at the same time rather more streamlined than the current situation. In a paper originally presented to the Air Quality Steering group the environment directorate of the Commission has suggested a marriage between all of the related processes that are developing clean air policy, including any future Auto Oil review.

This Clean Air For Europe (CAFE) programme would enable a single approach to modelling for both the environmental parameters such as air pollution levels, and the effects and costs of the measures to address these problems. A single cost effective programme would reduce the administrative burden and deliver policy proposals based on a coherent and consistent programme across all contributing pollution sources.

From the NGO perspective this welcome development needs to also take into account the criticisms of the cost effectiveness approach outlined in this paper. In particular if future policy on air pollution is to be based on cost effectiveness there needs to be inclusion within this approach of :

1. The uncertainty of the predictions of future pollution emission levels, particularly the importance of the underlying assumptions (economic growth levels, traffic fleet structure, effectiveness of existing policies etc.) upon which they depend. This will most easily be achieved by using a “safety factor” that takes account of the uncertainty of such predictions - comparisons of previous Auto Oil predictions with outcomes could be taken as a starting point for this safety margin.
2. The degree to which the innovation of the free market, development and innovation in production process and economies of scale reduce estimated costs for technological improvements needs to be accounted for. Merely taking the estimated costs from industry has consistently proved an inaccurate overestimation and for the sake of the credibility of the cost effectiveness approach this needs to rectified in the future.
3. There needs to be inclusion of the significance of the costs to the sector of society that has to bear them (whether that be the impact on small garage owners of small costs, or the inability of large industrial sectors to pass on larger absolute costs to large numbers of customers in small percentage price rises).
4. The true cost to society of technical measures to reduce pollution need to be calculated, rather than an exclusive focus on investment and operating costs to producers. This approach would enable greater ease of comparative assessments of the various measures to reduce pollution, technical and otherwise. In this regard it is

important to recall that a strong technologically advanced vehicle manufacturing industry is so valuable for European Employment that the first Auto Oil Proposals included a second technological standard, the 2005 step, in an attempt to push the industry's commitment to investment in technology forward.

5. A valuation of the benefits of achieving the environmental objectives would allow a similar valuation to be made for early achievement of the targets and also give a context to the cost burden measures would be estimated to give.

It is also true that the cost effectiveness approach adopted in the Auto Oil Programme is only applicable to other policy areas that have clearly identifiable environmental objectives. In the Auto Oil Programmes this was possible because the ultimate aim was to achieve air pollution levels that were low enough to satisfy firstly WHO guidelines and later EU legislation. It is not always the case that such clear environmental objectives will be both available and readily agreed by all stakeholders. In such cases traditional cost benefit analysis is much more suitable than an inappropriate use of cost effectiveness.

6.2 Overall Conclusions from the Auto Oil Programmes.

A surprising finding from the first programme was summarised by the Touche Ross Deloitte consultant that presented the first stage of the cost effectiveness assessment to the Member States and stakeholders in the MVEG. He highlighted firstly how for three of the cities studied air pollution was predicted to be so high in 2010 that even with best available technology pollution would continue to exceed WHO guideline levels. The good news on the other hand was that this best available technology - for both fuels and vehicles only amounted to a small percentage of total prices before taxation.

Such assessments, however, neglect the fact that these this small percentage increases also approximate to the industry profit margins, and so the impact on industry would be dependent upon the extent to which they could pass these relatively small cost rises on to their customers. Nonetheless the simple message was that best available technology would be necessary given the extent to which pollution was expected to continue, but that its cost to society was relatively small.

After the adoption of the first Auto Oil Directives the packages that represented "best available technology" are now, more or less, mandated from the start of 2005 rather than 2000. The second programme has confirmed the extent to which such a delay in applying best available technology will affect the reduction in pollution to the target levels. Two out of the ten cities assessed will continue to have NOx pollution problems even in 2010 and the others will have areas of the city that only marginally achieve the pollution targets. Moreover these targets are not likely to be achieved in the most problematic localities of most cities, with street canyons and hot spots continuing to cause great difficulties for cities to meet EU legal standards for lowering air pollution. Air pollution problems from traffic are set to continue across Europe despite improvements.

The significance of traffic pollution problems has been increasingly recognised by policy makers across Europe as one of our major challenges. The solutions in future will have to be much broader than marginal improvements to transport technology. Policies aimed at the internalisation of external costs – making the polluter pay – will need to be dovetailed to policies that improve the quality of transport technology such as emission and fuel quality standards.

Both the approach of setting minimum technical standards and of taxation or fiscal incentives to internalise external costs are about creating a different set of “rules” in which the market should operate. The difference between them is the efficiency and effectiveness in achieving the end goal. An almost exclusive dependence so far on technical standards has not delivered the goal of sustainable and efficient transport in Europe.

What the Auto Oil Programmes have demonstrated is the significance of best available technology to combat our air pollution problems from traffic. We did, and indeed do, need the reductions in pollution that best available technology can offer us and we can afford this. But on its own this is not going to be enough. We need to redouble our efforts in achieving changes to how we use motorised transport, not just improve the technology.

The work undertaken in working group 5 of the second programme in this respect is of great importance. It has identified a number of measures that national and local authorities can undertake at low cost to society. Other assessments by EU institutions and Member State governments also support the application of these measures. The challenge is now to translate this apparent consensus into action.

6.3 The Five Key Recommendations

1. European wide technical standards need to be complemented by strong local measures that are developed and facilitated at the European level. The review of the Common Transport Policy will need to strengthen this facilitation role.
2. Future assessments will need to incorporate to a greater extent than has been the case the role national fiscal measures can play in line with the integration report of the Transport council to the Helsinki summit and the Commission’s White Paper on infrastructure charging.
3. Cost effectiveness needs to improve to ensure greater comparability of costs from differing measures, their significance to the sector that bears them, the reductions from estimated costs that innovation will bring, as well as accounting for the uncertainty of the size of the predicted targets. It is inappropriate to use cost effectiveness as an approach without clarity of the overall environmental objective.
4. A valuation of the benefits of achieving the agreed targets is needed both to allow for consideration of early attainment of targets and to also usefully place the cost burden to achieve the target in perspective.
5. Multi-stakeholder processes can advise the policy process and aid development of sound policy measures and can also aid their adoption. There is a constant learning process by all stakeholders in this approach that should be built upon for future programmes such as CAFE. Such programmes more effectively engage the strong participation of all stakeholders when there is a strong mandate for legislative action to follow up the programme.

Annex I

Summary of air quality model results for AOPII cities

Athens[61]

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	●	●	88	66	15	15	100%	98%
NO2 1hr	●	●	252	205	70	70	33%	2%
CO 8hr	●	❍	13mg	5mg	1360	1055	15%	0
Benzene annual	●	●	17	5,2	0.7	0.4	62%	2%
Ozone 8hr	N/A	N/A						

Berlin

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	❍	❍	34	27	13	8	0	0
NO2 1hr	❍	❍	127	107	62	45	0	0
CO 8hr	❍	❍	5mg	2mg	1553	1106	0	0
Benzene annual	●	❍	10	2	1.2	0.3	52%	0
Ozone 8hr	N/A	N/A						

Cologne

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	●	❍	46	36	14	9	90%	0
NO2 1hr	❍	❍	158	132	68	49	0	0
CO 8hr	❍	❍	4mg	2mg	1137	911	0	0
Benzene annual	❍	❍	2	1	0.3	0.2	0	0
Ozone 8hr	N/A	N/A						

[61] ● signifies exceedance of objective; ❍ signifies compliance; average concentration change is for inner domain (to be replaced with city change)

Dublin

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	❍	❍	30	22	9	8	0	0
NO2 1hr	❍	❍	118	94	49	45	0	0
CO 8hr	❍	❍	3mg	2mg	949	823	0	0
Benzene annual	❍	❍	2	1	0.2	0.1	0	0
Ozone 8hr	N/A	N/A						

Helsinki

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	❍	❍	31	27	12	10	0	0
NO2 1hr	❍	❍	119	108	60	53	0	0
CO 8hr	❍	❍	3mg	2mg	1030	961	0	0
Benzene annual	❍	❍	2	1	0.3	0.2	0	0
Ozone 8hr	N/A	N/A						

London

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	●	❍	60	39	27	17	40%	0
NO2 1hr	❍	❍	192	141	109	77	0	0
CO 8hr	❍	❍	6mg	2mg	2062	1136	0	0
Benzene annual	●	❍	6	2	1.6	1.1	7%	0
Ozone 8hr	N/A	N/A						

Lyon

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	●	●	93	46	11	6	54%	9%
NO2 1hr	●	❍	262	158	57	37	20%	0
CO 8hr	●	❍	23mg	7,8mg	1566	1056	24%	0
Benzene annual	●	●	22	5,4	0.7	0.3	50%	2%
Ozone 8hr	N/A	N/A						

Madrid

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	●	❍	45	30	6	4	3%	0
NO2 1hr	❍	❍	155	116	38	28	0	0
CO 8hr	❍	❍	6mg	3mg	1043	860	0	0
Benzene annual	●	❍	6	2	0.4	0.2	4%	0
Ozone 8hr	N/A	N/A						

Milan

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	●	❍	67	38	18	11	16%	0
NO2 1hr	●	❍	208	137	82	57	1%	0
CO 8hr	●	❍	17mg	7,8mg	2386	1462	6%	0
Benzene annual	●	●	19	5,3	1.7	0.9	43%	1%
Ozone 8hr	N/A	N/A						

Utrecht

	Exceedence		Highest concentration µg/m³		Average concentration µg/m³		% of city with exceedence	
	1995	2010	1995	2010	1995	2010	1995	2010
NO2 annual	●	●	78	47	24	18	0	0
NO2 1hr	●	❍	232	160	100	81	0	0
CO 8hr	❍	❍	7mg	4mg	1474	1124	0	0
Benzene annual	●	❍	11	3	1.1	0.5	0	0
Ozone 8hr	N/A	N/A						

[*Note: exceedances are in Amsterdam, not Utrecht*]

Air quality effect of removing emissions from road transport and other sources in 2010, µg/m³

City	Average NO_2 concentration over central ten cells	Non-linear element	Effect of eliminating emissions from:			
			Road transport	Area sources	Large area sources	Other area
Athens	62	25	38	62	61	49
Berlin	20	6	15	19	19	12
Cologne	9	2	6	9	8	8
Dublin	24	4	6	24	22	24
Helsinki	26	6	8	26	26	24
London	39	16	27	32	39	36
Lyon	44	5	8	44	43	43
Madrid	28	2	3	28	28	28
Milan	37	12	17	35.	36	34
Utrecht	26	8	14	24	25	22

Annex II

PM_{10} model results

City	Highest concentration µg/m³		Average concentration µg/m³[62]		% of city with exceedence		Notes
	1995	2010	1995	2010	1995	2010	
Berlin	**35**	**22**	**12**	**7**	**100%**	**17%**	Based on TSP Emission and PM10 concentrations from Campaigns
Cologne	**30**	**17**	**6**	**3**	**100%**	**0**	Based on TSP Emission and PM10 concentrations from Campaigns
Helsinki	**16**	**17**	**3**	**2**	**0**	**0**	Based on PM10 Emissions and hourly PM10 concentrations
London	**34**	**23**	**7**	**5**	**40%**	**1%**	Based on PM10 Emissions and hourly PM10 concentrations
Lyon	**84**	**39**	**2**	**1**	**45%**	**18%**	Based on TSP Emissions and hourly PM10 concentrations for 1998
Madrid (*)	**119**	**59**	**5**	**2**	**86%**	**33%**	Based on TSP Emissions and PM10 concentrations from campaigns
Milan (*)	**26**	**12**	**2**	**1**	**2%**	**0**	Based on TSP Emissions and PM10 concentrations from campaigns and 1998
Utrecht	**24**	**11**	**10**	**6**	**16%**	**0**	Based on PM10 Emissions and hourly PM10 concentrations

*Modelling periods unlikely to represent the annual mean concentration

[62] Average concentration figures are for inner domain, not city

Annex III

Changes in air quality reduction from 1997 to 2010 for the episode mean 14-17 Nov 1997, Milan, Viale Murillo

CONCENTRATION REDUCTIONS AT RECEPTOR A and D

Episode Mean Nov 14-17,1997 ■g/m3 (CO mg/m3)	**CALC 1997**	**CALC 2010**	**2010 as % of 1997**
CO Receptor A	7.8	1.9	24.4%
CO Receptor D	6.5	1.6	24.6%
NO Receptor A	378	95	25.1%
NO Receptor D	291	67	23.0%
NO2 Receptor A	96.1	67.4	70.1%
NO2 Receptor D	86.8	63.2	72.8%
TSP Receptor A	67.7	22.2	32.8%
TSP Receptor D	58.3	21.1	36.2%
Benzene Receptor A	37.3	5.8	15.5%
Benzene Receptor D	28.0	5.0	17.9%

Changes in air quality from 1995 to 2010 for the episode mean 21-25 Feb 1995, Berlin-Schildhornstrasse

CONCENTRATION REDUCTIONS AT STATIONS 117 AND 088

Episode Mean Feb 21-25 ■g/m3 (CO mg/m3)	**CALC 1995**	**CALC 2010**	**2010 as % of 1995**
CO 117	2.3	7.8	33.7%
CO 088	1.2	5.1	41.8%
NO 117	144.5	47.1	32.6%
NO 088	57.8	19.3	33.5%
NO2 117	48.1	29.7	61.7%
NO2 088	38.6	25.6	66.6%
TSP 117	42.6	17.2	40.4%
TSP 088	32.5	15.8	48.6%
SO2 117	31.1	14.8	47.6%
SO2 088	24.9	15.5	62.2%
Benzene 117	16.2	2.8	17.3%
Benzene 088	8.3	1.6	19.3%

Comparison Scenario 2010 Berlin Schildhornstrasse Versus Milan Viale Murillo

% of 1995 or 1997 figures	Traffic emissions	Background air Quality	Street canyon air quality
CO 2010			
Berlin-Schildhornstrasse	**25%**	**59.0%**	**37.8%**
Milan-Viale Murillo	**21%**	**25.3%**	**24.5%**
NO2 2010			
Berlin-Schildhornstrasse	**33% (NOX)**	**78.6%**	**64.2%**
Milan-Viale Murillo	**28%(NOX)**	**76.7%**	**71.5%**
Benzene 2010			
Berlin-Schildhornstrasse	**15%**	**24.3%**	**18.3%**
Milan-Viale Murillo	**9%**	**37.2%**	**16.7%**
TSP 2010			
Berlin-Schildhornstrasse	**27%**	**55.3%**	**44.5%**
Milan-Viale Murillo	**18%**	**50.0%**	**34.5%**

N.B. Street canyon air quality calculated as receptor average

Annex IV

Fraction (in %) of total urban population living in non-attainment cities

Pollutant	Averaging period	1995 (a)	2010(b)
SO2	1 hour	*23%*	2%; *3-6%*
SO2	24 hours	*25%*	7%; *9-11%*
NO2	1 hour	*5%*	5%; *0%*
NO2	Calendar year	*65%*	5%; *20%*
PM_{10}	24 hours	*89%*	62%; *73%*
PM_{10}	Calendar year	*87%*	62%; *52%*
CO	8 hours	*14%*	*0.5-1.5%*
O3	Daily 8-h max	48%	6%
Benzene	Calendar year	*50%*	*13%*
Pb	Calendar year	*23%*	*0%*

(a) fraction estimated from UAQAM and OFIS model calculations
(b) fraction estimated from cQ, UAQAM and OFIS model calculators; results obtained by UAQAM are given in italics.

Annex V

NGO Participants in the Working groups of Auto Oil II

Working Group	Participant	Organisation
I Environmental Objectives	Annette Hauer	EEB
	Sarah Blau	EEB
	Frazer Goodwin	T&E
II Vehicle Technologies	Karola Taschner	EEB
III Fuels technology	Karola Taschner	EEB
IV Inspection and Maintenance	Frazer Goodwin	T&E
V Local Measures	Gijs Kuneman	T&E
	Beatrice Schell	T&E
	José Palma	T&E
	Frazer Goodwin	T&E
VI Fiscal instruments	Gijs Kuneman	T&E
VII Cost Effectiveness	Christer Ågren	T&E
	Malcolm Fergusson	T&E
	Frazer Goodwin	T&E

T&E publications

T&E 92/6	Making Fuel Go Further - a critical evaluation of different political instruments for improving the fuel efficiency of new cars and other light vehicles (one copy free)
T&E 92/7	External Costs of Air Pollution - the case of European transport (reduced price 200 BEF)
T&E 93/1	Damage Costs of Air Pollution - A survey of existing estimates (350 BEF)
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T&E 93/5	Taxation and Infrastructure Costs of Heavy Goods Transport (BEF 400)
T&E 93/6	Getting the Prices Right. A European Scheme for Making Transport Pay its True Costs (220 p.) (BEF 625)
T&E 93/7	Getting the Prices Right. A European Scheme for Making Transport Pay its True Costs, short version (30 p., free)
T&E 93/8	External Benefits of Transport? (BEF 350)
T&E 93/12	Pour la vérité des coûts - un modèle Européen pour la couverture par les différents modes de transport de l'intégralité de leur coûts (final report of "Internalising Social Costs of Transport"; short version) (free)
T&E 93/14	Air Pollution by Air Traffic - overview of problems and possible solutions (BEF 400)
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T&E 94/3	The Concept of Sustainable Transport (BEF 350)
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T&E 94/6	Greening Urban Transport - Cycling and pedestrian policy (400 BEF)
T&E 94/6A	Greening Urban Transport - European examples of good cycling and pedestrian policy (annex to 94/6, 400 BEF)
T&E 94/7	Greening Urban Transport - Parking policy (400 BEF)
T&E 94/8	Greening Urban Transport - Public transport (400 BEF)
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T&E 95/4	Taxing Diesel and Petrol - Contemplations on environmental, health and social aspects (free)
T&E 95/7	Parkplatzpolitik. Teilstudie im Rahmen des Projekts "Greening Urban Transport" (400 BEF).
T&E 95/8	To Clear the Air over Europe - a critical examination of the present guidelines and standards for air quality, with proposals for their revisions (350 BEF)
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T&E 96/10	The Greening of Freight Transport in Norway - Background report of the project "The Greening to the project The Greening of Freight Transport" (200 BEF).
T&E 96/11	The Greening of Freight Transport in Germany - Background report of the project "The Greening to the project The Greening of Freight Transport" (around 350 BEF, also available in German).
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T&E 97/2	Reducing Cars' Thirst for Fuel - position paper on reducing CO2 emissions from passenger cars (free)
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T&E 97/4	Updated response to the EU's Auto-Oil Programme (free)
T&E 97/5	Memorandum on Transport and Environment to the Council of Ministers and the UK Presidency (free)
T&E 97/6	Response to the European Commission's Acidification Strategy (joint paper with EEB and Swedish NGO Secretariat on Acid Rain) (free)
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About this paper

This publication outlines the progress of the European Commission's Auto Oil Programme and the legislation it has spawned. The aim of the programme was to devise a comprehensive strategy to reduce pollution levels from traffic so that Member States could meet air quality objectives.

Reducing pollution from traffic requires a combination of : better vehicle technology and improved fuels to lower pollution from new cars, vans and trucks; the improved maintenance of vehicles emissions control equipment and its durability; managing the demand for transport with local measures such as traffic restrictions, subsidised public transport, parking policies etc.; national fiscal instruments such as vehicle purchase tax, petrol duties etc. ; and new technologies such as alternative fuels.

The Auto Oil Programme assessed which combination of these many ways to reduce traffic pollution would have the least cost to the EU economy. The strategy has resulted in a raft of new regulations controlling the pollution levels from new vehicles, improved fuels and better inspection and maintenance programmes. But the strategy has yet to be followed up by Member States and without the actions that fall under their jurisdiction the strategy will fall short of the environmental objectives.

This report assess the approach taken by the Auto Oil, how the actions that have followed it may be built upon, and what gaps now remain in the assessment of the best ways to reduce traffic pollution. It also recommends ways in which the model used by the programme may or may not be suitable for other Community initiatives.

About T&E

The European Federation for Transport and Environment (T&E) is Europe's primary non-governmental organisation campaigning on a Europe-wide level for an environmentally responsible approach to transport. The Federation was founded in 1989 as a European umbrella for organisations working in this field. At present T&E has 32 member organisations covering 19 countries. The members are mostly national organisations, including public transport users' groups, environmental organisations and the European environmental transport associations ('Verkehrsclubs'). These organisations in all have several million individual members. Several transnational organisations are associated members.

T&E closely monitors developments in European transport policy and submits responses on all major papers and proposals from the European Commission. T&E frequently publishes reports on important issues in the field of transport and the environment, and also carries out research projects.

The list of T&E publications in the annex provides a picture of recent T&E activities.

T&E member organisations

Aksjon Naermiljo og Traffikk (Norway)
Associació per la Promoció del Transport Públic (Spain)
Aviation Environment Federation (United Kingdom)
Cesky a Slovenský Dopravní Klub (Czech and Slovak Republics)
Danmarks Naturfredningsforening (Denmark)
Ecologistas en Acción (Spain)
Environmental Transport Association (UK)
Estonian Green Movement (Estonia)
Fédération Nationale des Associations d'Usagers de Transports (France)
GAJA (Slovenia)
Gröna Bilister (Sweden)
Groupement des Usagers des Transports Intercommunaux Bruxellois (Belgium)
Komitee Milieu en Mobiliteit (Belgium)
Liikenneliitto (Finland)
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Pro Bahn (Germany)
Pro Bahn Schweiz (Switzerland)
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Society for Nature Protection and Eco-development (Greece)
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