

The Danish Government's Action Plan for Reduction of the CO₂-Emissions of the Transport Sector

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Danish Ministry of Transport

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1. Preface

In 1990, the Danish Government then in office published an energy action plan and a transport action plan with a view to reducing the environmental impact from these two sectors. For the transport area, the action plan was followed up in 1993 by a transport plan, "Trafik 2005."

In 1995 the Danish Government decided that a follow-up was to be made for the energy action plan and the transport plan as far as carbon dioxide emissions are concerned.

The process has been arranged so that first a paper for public debate has been published. Thus the Danish Ministry of Environment and Energy published the paper "The Energy Futures of Denmark" in December 1995. At the same time, the Danish Ministry of Transport published the paper "Transport, Energy and Carbon Dioxide Emissions."

What follows is an account of the Danish Government's action plan for reducing carbon dioxide emissions from the transport area.

In chapter 2 is found an account of the background and premises of the action plan, including targets, expectations concerning the development in carbon dioxide emissions, and the general guidelines in connection with selection of areas for action.

Chapter 3 offers an account of the proposed means and instruments of action.

Chapter 4 gives an account of the consequences of the action plan pertaining to carbon dioxide emissions and other types of emission from the transport sector.

The implementation of the action plan is an ongoing process. Expectations of the development in traffic volumes and the energy consumption, as well as expectations of the effect of the individual means and instruments of action may change. It is therefore important that the action plan is continuously reviewed, so as to maintain the aim of the plan. The Danish Ministry of Transport, in co-operation with the Danish Ministry of Environment and Energy, will ensure that such continuous reviews are carried out.

2. The background and premises of the action plan

2.1 Targets for carbon dioxide emissions

In connection with the combustion of fossil fuels is released among other things carbon dioxide, which is considered the most significant contributor to climatic changes caused by global rises in temperature, the so-called greenhouse effect. The Danish transport sector contributes approximately 20 per cent of the total Danish carbon dioxide emissions from the energy consuming sectors.

The Danish Government's target is to reduce the carbon dioxide emissions from the energy consuming sectors by 20 per cent by the year 2005 as compared to 1988, and to achieve further reductions up to 2030.

The Danish Government is furthermore of the opinion that the reduction of carbon dioxide emissions must as far as possible be based on the most cost efficient initiatives, which is also the main principle when weighing the emphases of effort among the various sectors.

In 1990, the Danish Government then in office drafted a transport action plan, which laid down the present targets of carbon dioxide for the transport area. The target is to stabilize the carbon dioxide emissions by the year 2005 at the 1988 level, and reduce it by 25 per cent up to 2030.

The transport action plan was subsequently followed up by "Transport 2005" in December 1993. This document reviewed the implementation of the energy and environmental targets, and it maintained the targets except for the targets on noise, which were tightened further. In this connection it was emphasized that the fulfilment of the target for carbon dioxide emissions while maintaining the continued offering to people and the business sector of an efficient and flexible transport system is the greatest challenge of the national transport policy in the years to come.

In immediate continuation of "Transport 2005", the Danish Ministry of Transport therefore initiated further clarifying work aiming to point out effective means and instruments for reduction of carbon dioxide emissions in the transport sector. This work is thus the basis of the present action plan. The work will be co-ordinated with corresponding deliberations for the rest of the energy consuming sectors with a view to selecting the most cost efficient initiatives.

On several occasions, the Danish Parliament has confirmed the targets in the transport area pertaining to carbon dioxide emissions, most recently at the adoption of Resolution D36 on 6 February 1996.

It is the Danish Government's attitude that the present targets for reduction of carbon dioxide emissions in the transport sector are to be met. In future, further follow-up is to be carried out at regular intervals in order to ensure among other things a reasonable balance between the efforts in the transport sector on the one hand and the other energy consuming sectors on the other hand. At the same time, the targets for the period up to 2030 must be seen as interim, as these must be determined in the context of future assessments of the latitude allowed by ecological considerations.

2.2 The future environmental impact of the transport sector

In recent years a significant effort has been made to limit the local environmental problems caused by road traffic.

The most visible traffic problem is the impact on the local environment in the shape of road accidents, air pollution and noise. For a number of years local authorities have done great work through conscious traffic planning to concentrate the traffic on the network of main roads, so that local residential areas are relieved. Many large municipalities have drawn up full traffic and environmental action plans. The State has also contributed towards this work through changes of the traffic legislation, financial support for local initiatives, e.g. through the Danish Ministry of Transport traffic funds and construction of by-passes etc.

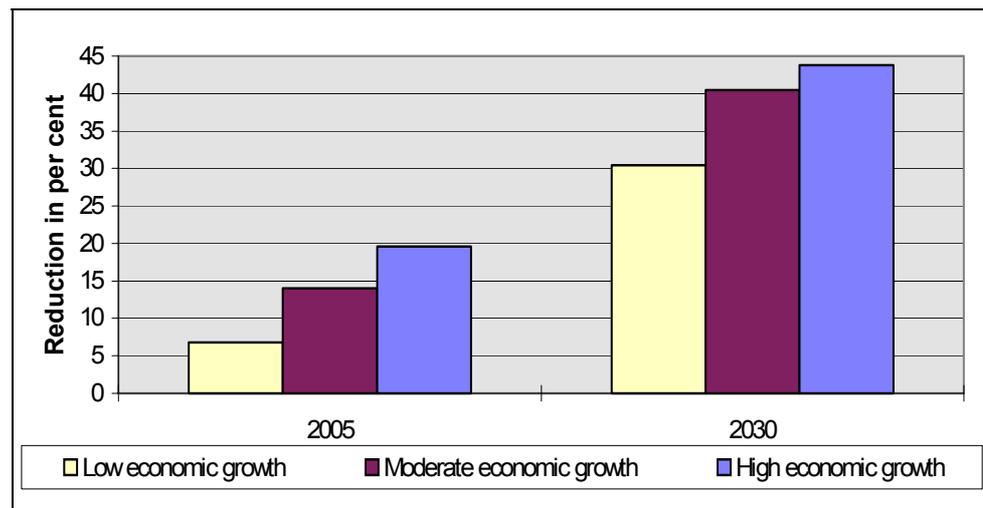
The environmental impact of the transport sector has increasingly been regulated by directives from the EU. Over the last 10 years there has thus been a breakthrough in the road traffic area with regard to fighting pollution. Catalysts and lead-free petrol are a result of this development. Lead emissions have almost disappeared, and many of the other types of emission have fallen. In the course of the coming 10 to 15 years the emissions of a number of pollutants will be cut by half as compared to the 1988 level despite growth of the traffic volume. The quality of the air in our cities is expected to improve. However, there are still several unsolved problems in relation to the local urban environment. Among other things, the emissions from diesel powered vehicles will continue to have a not insignificant impact on the environment. But in most areas the development is progressing in the right direction.

In contrast to this, it has not been possible to slow down the increase of carbon dioxide emissions from the transport sector. In 1995, the carbon dioxide

emission level was thus well above the 1988 level, as a consequence of rapid growth of the traffic volume in the first half of the 1990s.¹⁾

The development in the traffic volume, and hence the development of the carbon dioxide emissions from the transport sector, are assessed to be much dependent on the economic growth. In the Danish Ministry of Transport's paper "Transport, Energy and Carbon Dioxide Emissions", the development is analyzed on the basis of high economic growth scenario (approximately 2.7 per cent per annum up to 2005), and a scenario with low economic growth (approximately 1.4 per cent per annum up to 2005). Subsequently, the Danish Ministry of Finance has drawn up a moderate growth scenario (approximately 2.2 per cent per annum up to 2005), i.e. a growth scenario which lies between the two above mentioned extremes. The consequences on the carbon dioxide emissions by the various growth scenarios appear from figure 2.1.

FIGURE 2.1 *Reductions of carbon dioxide emissions necessary by 2005 and 2030 in order to meet the target, based on various economic growth scenarios*



1) Compared to "Transport, Energy and Carbon dioxide Emissions" there has been an increase of the emission level by approximately 2 per cent in 2005 and 2030 due to adjustment of the calculation premises.

From the figure it appears that the carbon dioxide emissions in 2005 must be reduced by between 7 and 20 per cent if the target of stabilizing the carbon

1) As compared to 1988, surveys made on the background of statistical information on the development in the traffic indicate a rise of 7 per cent, while the energy statistics of the Energy Agency show an increase of 11 per cent in the energy consumption for transport purposes up to 1994. The Danish Ministry of Transport and the Danish Ministry of Environment and Energy will make efforts to create greater correspondence between the statistical statements.

dioxide emission at the 1988 level is to be met. Correspondingly, it is seen that carbon dioxide emissions in 2030 must be reduced by 30 to 40 per cent if a reduction of 25 per cent compared to the 1988 level is to be achieved.

The Danish Government is of the opinion that the basic premise of projections should be the moderate growth scenario. If the growth turns out to be higher, further reductions may be achieved through greater use of primarily economic instruments than what is outlined below.

What has been indicated above also means that carbon dioxide emissions must be reduced by approximately 15 per cent by 2005 in comparison to the benchmark scenario, and that the action plan must point forward towards further long term reductions.

2.3 The future of the passenger vehicle traffic

It is the Danish Government's opinion that the action plan should have as its premise that the population and business should still be offered an efficient and flexible transport system. Therefore passenger vehicle traffic will also in future provide most of the passenger and goods transport. In this connection the action plan is to contribute towards making cars more environmentally friendly, and towards limiting the growth of the overall volume of road traffic.

The predominant role of the car on the transport scene is first and foremost based on the great qualities which this transport mode offers as compared to other transport modes.

The car is flexible, comfortable and fast. It offers the possibility for door to door transport, and allows individual choice of route, departure time and travel companions.

The private car at the same time ensures great flexibility for the labour market. Many people depend on their car in order to exercise their trade, and the car is often absolutely necessary in order to work evenings or nights. In the present employment situation it may be necessary to travel far in order to get work, also because it can be difficult for both adults in a household to obtain employment close to the home.

For families with children access to a car is a great advantage, among other things in order to bring and pick up the children, do shopping etc. The everyday life of families with children involves much pressure, and transport time saved means more time for the family.

Spare time traffic makes up an increasing proportion of the total traffic volume, and the way the transport system is built up today, the car is the best

solution to the varied transport needs which a family has in connection with spare time activities.

In rural districts the car is virtually indispensable because of the long distances to work, shopping, friends, family etc.

All in all, the car offers great mobility and time saving, as well as the possibility to arrange things according to one's own needs. Owning a car may thus often be a necessary prerequisite in order to make a workday function acceptably.

2.4 Selection of areas for action

When assessing the various initiatives it is thus important to be aware that the quality of the transport system is of paramount importance for the population's mobility and the movement of goods. Transport is hence not just a question of traveling or being carried between two points. The transport service thus consists of a number of different components, such as e.g. consumption of time (including waiting time), service, accident risk etc.

Carbon dioxide emissions will therefore in many cases be one among several criteria in assessing initiatives of transport policy. In some cases, changes in the level of carbon dioxide emissions will be less important as compared to other circumstances which are important for the evaluation of the initiatives in question.

In many cases a reduction of the carbon dioxide emissions will lead to a reduction of the other environmental nuisances from the transport sector, but sometimes one must weigh between the local and global environmental problems. The use of petrol as opposed to diesel, as well as the spread of catalyst technology, relieves a number of local environmental problems, but at the same time contributes towards increasing the carbon dioxide emissions.

The Danish Government therefore finds it important that a reduction of the carbon dioxide emissions is effected as an integral part of the total transport policy. At the same time, a reduction of the carbon dioxide emissions must not lead to greater local environmental problems or altogether have a negative impact on traffic safety.

The effect of the means and instruments on the carbon dioxide emissions of the transport sector greatly depends on the adoption of coordinated initiatives at the EU level. A reduction of the carbon dioxide emissions in Denmark without corresponding reductions in other countries would mean that the costs of bringing about reductions in Denmark would be higher than in a situation involving coordinated international initiatives. At the same time, it

is only at the international level that initiatives based on negotiations with the car industry can be made.

The Danish Government therefore finds it to be decisive that coordinated initiatives are instigated at the EU level.

3. Proposals for means and instruments of action

3.0 Promotion of viable transport solutions

As part of the action plan it is suggested that the State should take new initiatives in a number of areas, which will be described in what follows.

In this connection, the Danish Government will support the development towards greater energy efficiency and a reduction of the transport need, as well as emphasizing bicycle and public transport etc. by initiating and supporting activities in among others the following areas:

- demonstration projects concerning energy saving behaviour, including projects which explore the possibilities for reducing the transport needs of companies and households.
- disseminating information concerning the energy efficiency of cars
- disseminating information and guidelines concerning energy efficient driving
- development projects for improvement of energy efficiency, including development and research projects concerning alternative fuels and systems, such as e.g. electric cars.
- development projects concerned with public transport
- development projects concerned with bicycle transport
- comprehensive traffic solutions in large cities, i.a. on the basis of transport and environment action plans.
- development projects aiming to promote the environmental optimization of the goods transport.

3.1 Active participation of private individuals and business

A significant element of the action plan is the active and positive participation from citizens and business.

The Danish Government views it as important that the citizens have access to information on the energy consumption of the individual vehicles, and that ideas for ways to save energy on the transport needs of every day life are made broadly available.

Participation must also come from the business community. As a catalyst of this participation a voluntary demonstration test of transport plans is to be initiated in selected companies. In the plans the total transport work will be charted, and measures and means of reducing the transport work will be identified, as will the possibility for transfer of part of the transport work to less polluting transport modes.

3.2 Physical planning

Physical planning, which is handled by the counties and municipalities, is, together with other - especially economic - means and instruments, important for influencing the transport needs and through this the energy consumption and carbon dioxide emissions.

The population in rural districts and in small towns have become increasingly dependent upon jobs and services in the large urban areas. At the same time the population has been spreading out geographically. The development so far has led to a rising need for transport, as well as greater differences in the transport needs of the various sizes of urban communities.

The Danish Government will encourage that in future greater emphasis is placed on decentralized efforts towards counteracting continued strong growth of the transport work, while at the same time due consideration is taken of the need for mobility and the Danish Government's labour market policy.

It is the Danish Government's policy that the growth of the total land area for urbanization is to be halted in the coming years. Planning must therefore among other things aim to create a framework for reuse of the growing number of areas ready for renewal, as well as increased density for the less utilized areas which are conveniently situated for bicycle, pedestrian and public transport. Building construction work in the larger conurbations, especially office and commercial services property, must be shifted towards the points which are best served by public transport.

Before authorities effect any changes to the land use which deviate significantly from the previous patterns of urban development, the impact on traffic must be assessed. Fair access to public transport and bicycle transport must be secured through widespread activities to promote these modes. The development of retail sales outlets to be concentrated in ever larger stores and shopping centres, often placed on the edge of towns and primarily based on the use of cars, is an example of changes which have already come up for

reassessment. Thus, a committee has been set up to consider ways in which regional and local planning can secure a network of retailers which stimulates continued investments in local centres, municipal centres and the smaller regional centres, and which promotes the role of the town centres.

The Minister of Environment and Energy will lay down the overall guidelines for regional, municipal and local planning which secures compliance with the stated goals.

In connection with a comprehensive policy for reduction of the transport need, there will be a need for creating, through regional and local planning, a basis for a more decentralized town and centre structure in the large urban communities. This is necessary as part of enabling companies and individuals to reduce their transport expenses, as well as for shortening the time and distance spent on travelling. Correspondingly, there will be a need for supporting this policy through more decentralized provision of services.

There are wide differences in the population's demand for transport. As an example may be cited that in 1992 approximately 20 per cent of the commuters between the home and work or place of education represented approximately half the transport work expended between the home and work or place of education. This group live at a distance of 20 kilometres or more from their workplace.

The use of certain economic instruments, such as e.g. changes of the rules for deduction of transport costs, may therefore, given the present pattern of urbanization, have undesirable distributional consequences, e.g. by being unfavourable for small communities. The parliamentary Transport Committee has requested an account to be made on this issue.

3.3 Increased energy efficiency

It is the Danish Government's attitude that the goals set for reduction of energy consumption must to a great extent be reached through improved energy efficiency. At the same time the Danish Government thinks that improved energy efficiency achieved over the coming years should benefit the environment.

This means that the total transport expenses for a new average passenger car should not be affected by improvements of energy efficiency. On the one hand the variable transport expenses must therefore rise in tandem with the improved energy efficiency of new cars. On the other hand it must be secured, e.g. through a restructuring of taxation, that the increased costs incurred by the car manufacturers through improvement of the energy efficiency do not in themselves lead to higher fixed costs for the operation of the average car.

The EU Commission has published a proposal for a strategy for more energy efficient passenger cars, which takes as its point of departure an average energy efficiency of 20 kilometres per litre, and approximately 22 kilometres per litre for diesel powered cars. According to the EU Commission the target is to be pursued i.a. through agreements with the car industry, the use of economic means and instruments, information on the cars' energy consumption, and research and development. The EU in this connection points out that this is an ambitious target for what may be achieved by 2005, but that significant steps in the right direction can nonetheless be taken.

The Danish Government agrees with the above mentioned targets. As a consequence of the fact that Denmark's far higher taxation of cars in comparison with other EU countries has already meant a relatively high energy efficiency for new cars, the basic situation in Denmark is relatively favourable.

The targets should be pursued through means of:

- an agreement between the EU and the car manufacturers / importers, as proposed by the EU Commission, on a reduction of the carbon dioxide emissions from new cars on the basis of clearly defined standards. The Danish Government will endeavour to conclude the agreement by 1998, at the latest. This agreement must be considered a first step. The demands must be tightened progressively, and the use of norms as such must be evaluated in due course.
- endeavouring to differentiate the vehicle excise taxes so as to create motivation for consumers to purchase more energy efficient cars
- initiating an information campaign on the energy efficiency of new cars, and in this connection consideration of a tagging arrangement.

Furthermore, there will be endeavours to reduce the energy consumption, and thereby the carbon dioxide emissions, including measures to promote energy efficient driving and regular monitoring to ascertain that the taxes and duties have the desired environmental effects.

In the field of goods transport the engines have already largely been optimized, and the potential for further increase of the energy efficiency is therefore smaller than in the passenger transport area. Furthermore there have not so far been initiatives at the EU level to increase the energy efficiency of individual vehicles of goods transport.

The Danish Government will monitor the development carefully, and work actively to establish agreements concerning improved energy efficiency of vehicles of goods transport, including vans.

The Danish Government i.a. intends to promote international research and development on environmentally friendly vehicles, and make contributions

to ensure that sufficient knowledge and general overview of the area is maintained in Denmark.

In the long term alternative sources of power for propulsion and systems, such as e.g. electric cars, given some prerequisites, can yield significant contributions towards reduction of the carbon dioxide emissions, for which reason it is important that also in this field sufficient research and development is carried out.

The Danish Government will consider whether in connection with the periodical vehicle inspection there is a need for special systems of inspection of the exhaust emissions and energy consumption of cars currently in use.

3.4 Public passenger transport

It is the Danish Government's opinion that both local and regional public transport, as well as national public transport, can be significant instruments in the organisation of a viable transport policy. The most environmentally friendly part of public transport ought therefore to be strengthened in the competition with the other transport modes. The State efforts in this area will still receive very high priority through the State involvement in rail transport operations and support for development initiatives in local and regional public transport.

All parties involved, i.e. municipalities, counties and the State ought therefore to work actively secure that improvements of the quality of public transport are coupled with continued improvements of efficiency, so that the past trend of having fares rise significantly faster than the fuel prices is disrupted.

The Danish Government is of the opinion that the cooperation and coordination among the public transport corporations must be strengthened with a view to achieving increased customer focus.

The cooperation between rail, bus and taxi transport must be strengthened. For the bus and train area the aim is to establish shared ticket and information systems in the rest of the country, as is the case in the Greater Copenhagen area, and that the traffic schedules are coordinated to a far greater extent than today. At the same time there is a need for a special effort to improve terminals in order to facilitate changes between the transport modes.

In recent years there have been many tests of alternative means of public transport. The experiences show that it is possible to make public transport considerably more customer orientated, and that it must be adapted to the specific size of the given urban community. It is now time for putting the experiences to work through corresponding systems which can then be realized in practice in the relevant urban communities. In this connection there

should also be initiatives to promote passenger car sharing, i.e. having more people drive together in the same passenger vehicle.

Across the administrative boundaries shared planning tools, automatic toll systems, telematic systems etc. ought to be developed.

For some years past, present and future, great investments in public transport are being made in the Greater Copenhagen area, and at the same time analytical work has been started concerning possible future expansion.

The opening of the fixed railway link across the Great Belt in 1997 will improve the terms of rail traffic significantly. The Danish Government has furthermore initiated analytical work concerning the future expansion and straightening of the national railway network. Initiatives in this area will benefit both regional and national transport. In connection with this work, the Danish Government is also investigating the possibilities for strengthening the competitive position of rail transport in relation especially to air transport by deploying high speed trains in Denmark.

A strengthening of public transport as described above will contribute towards a reduction of the energy consumption of the transport sector.

In order to strengthen the energy aspect in connection with the planning of the offered public transport the Danish Government wishes to introduce an energy levy for coaches and railways. In order not to weaken the competitive position of public transport the Danish Government will compensate fully for the tax burden placed on the public transport corporations as a whole, so as to promote energy efficient public transport. As a first step, the Danish Government will initiate work with a view to being able to present assessments of various different tax models at the end of 1996, including models for channeling the funds back into the public transport companies.

3.5 Bicycle transport

It is the Danish Government's aim that bicycle transport is to take over a greater share of the transport work. This is particularly to be achieved by transferring short trips from the use of cars to the use of bicycles, but also by promoting bicycle transport for the long term in combination with public transport. At the same time it is a significant aim that the safety for bicyclists is improved.

Viewed in relation to carbon dioxide emissions, especially transfer of short trips from cars to bicycles is expedient, as the energy consumption of cars is especially high in the cold start phase.

In the Danish Government's transport policy paper, "Transport 2005", it is stated that the Danish Government will endeavour to transfer 4 per cent of

the transport work effected by motor vehicle to the bicycle and walking by the year 2005. As the transport work effected by passenger cars for very short trips is smaller than assumed at that time, a fulfilment of the aim presupposes that also slightly longer trips are transferred to the pedestrian and bicycle transport modes.

The Road Directorate and the Transport Council have recently concluded a research project on the potential of the bicycle in city traffic. The results of the project indicate that there is potential for transferring quite a number of car trips. It is recommended that several different proposed solutions and initiatives are deployed at the same time, so that e.g. physical arrangement for bicycles are followed up by e.g. speed restrictions for car traffic and campaigns and other information on the advantages of the bicycle.

The Danish Government has planned and already initiated a number of activities which improve conditions for the bicycles. Thus a number of projects have been initiated around the country to build bypasses and traffic calming, which improves the traffic situation for the light traffic, and every year new bicycle tracks are constructed along the main roads. Furthermore, DSB works continuously on improving the bicycle parking facilities and bringing bicycles along on the trains.

The Danish Government wants to extend the good experiences with carrying out various demonstration projects in cooperation with selected municipalities. In this way authorities reap useful experience with solutions which will be able to find broad applications, i.a. through State efforts to disseminate information. The latest experience gleaned on the potential of the bicycle in city traffic will be exploited in this context.

The Danish Government will also in other ways carry out projects which can contribute towards exploiting the potential of the bicycle. Such projects should include experiments with drawing up corporate action plans, in which bicycle and pedestrian transport is intentionally afforded a role for solving the company's own transport needs, as well as the transport needs of its employees to and from the workplace. There should also be more untraditional experiments, which could contribute knowledge on ways in which bicycle transport is best promoted, and which can increase attention on the possible uses of the bicycle and its good environmental and energy qualities.

3.6 Traffic in large cities

In the large cities public transport, bicycle and pedestrian transport must be favoured. It is the Danish Government's aim that a growing proportion of the traffic to and from the cities, as well as in them, is to be handled by these transport modes so that the car traffic does not grow.

To realize this aim, and in order to achieve the greatest possible energy savings in relation therewith, it is of great importance that the transport policy is focused on the total transport need door to door, and that the overall prioritization of the street area for the various transport modes is viewed as a whole. E.g. terminals are to create good possibilities for combining the various transport modes. The Danish Government intends to support projects which promote such integrated comprehensive solutions.

A large number of municipalities have drawn up local transport and environment plans for the last five years. These ought to be continuously revised. In assessing the possibility of State participation in a specific project emphasis will, where relevant, be placed on whether or not a comprehensive transport and environment plan has been, or is being, worked out.

The Danish Government will cooperate with the largest city municipal authorities to estimate the total transport development in these municipalities. The purpose is to initiate a dialogue on the adequacy of the present means and instruments to achieve the goals.

If the outcome of the dialogue is that new means and instruments, such as road tolls or other payment systems, are indeed necessary the Danish Government will be willing to consider contributing towards creating the necessary framework.

3.7 Goods transport

Also in the goods transport area it is a central political aim that the transport work must be done with lower carbon dioxide emissions than it is the case today. The transporters have fair opportunities to influence the overall logistics and transport service towards being more environment friendly, e.g. through better utilization of the capacity and by choosing the right mixture of transport modes.

The Danish Government will invite representatives of the goods transport industry to a dialogue with a view to improving the environmental aspects of goods transport. One possibility would be to enter a voluntary agreement with the industry on specific targets of energy efficiency. Another possibility could be to cooperate with the industry to secure the development of a measuring system, which could provide the basis of an environment or energy certification system.

The Danish Government will support demonstration projects etc. in which the purpose is to promote environmentally friendly transport. In this connection emphasis is placed on initiatives which can improve both better exploitation of the capacity and more energy efficient driving. This is so both in connection with long hauls and in connection with delivery driving, i.e. short trips. In relation to delivery driving there is a need for development of

concepts for improved city logistics through a coordinated effort by the municipalities, the transport industry and the business community.

Especially the sea and rail areas need product development and higher efficiency, which would improve the competitiveness of these transport modes and hence the availability of environmentally friendly transport capacity.

In connection with future straightening of the Danish railway network, the Danish Government wants to secure that the necessary capacity for increasing the proportion of goods moved by rail over long distances is available. It is especially for this type of transport task that moving goods by rail has environmental advantages over road haulage.

In relation to many transport tasks sea transport has a relatively low energy consumption. Sea transport furthermore moves only to a very limited extent through densely populated areas, which reduces the local impact of its pollution.

On several destinations of short distance traffic sea transport is a very cost competitive transport mode. Even so there is a need for continuous development of the minor sea transport towards markets which offer higher value addition. The Danish Government will later introduce a bill on development of the minor sea transport.

If sea and rail transport are to have a greater share of the market in future there must be cooperation with the road transport sector on developing door-to-door concepts. To support the development of environment friendly combined transport, the existing business promotion instruments may be used.

3.8 Transport costs

It is the Danish Government's opinion that the total social costs, including the environmental costs, which transport causes must be integrated in the pricing of transport. To the extent the costs are not reflected in the price of the transport mode in question they may, as a matter of principle, be incorporated in the form of taxes.

At the same time it must, however, be realized that the present taxation methods only make possible a certain approximation to the above mentioned principle. One future possibility in the slightly longer term could be a road pricing system, so that payment is made dependent on where the vehicles travel, the time of day and type of vehicle. It will, however, take a number of years before a thoroughly tested road pricing system can be implemented. The Danish Government pays constant attention to the development in this area around the world, and Denmark will endeavour to ensure

the necessary research and development in the area is carried out at the international level.

It is the assessment that it is possible to meet the target of stabilizing the level of carbon dioxide emissions at the 1988 level by 2005 if the price of petrol rises roughly in tandem with the improvements in energy efficiency of new cars. For the price of petrol to follow the energy efficiency gain corresponds to unchanged fuel costs per kilometre for new passenger cars. On the other hand unchanged prices of petrol and energy efficiency gains would mean that the fuel costs per kilometre would fall.

Assuming continued gains in the energy efficiency of new cars the price of petrol must rise if the principle of unchanged fuel costs per kilometre for new cars is to be followed. At the same time it is assumed that the price of diesel will follow the rise in petrol prices.

Much seems to indicate that the fuel prices will to a certain extent rise as assumed. In several prognoses for the oil prices on the global market it is estimated that the price of oil will rise much over a number of years. This will mean that the producers' price of petrol will rise correspondingly.

To the extent the increases are not realized through increases of the producers' prices, other means to influence the variable transport costs will be considered. The rate of possible tax increases will be adjusted to the level of the prices of petrol and diesel in our neighbouring countries, so as to avoid undesirable cross-border trade. In this connection Denmark will work on raising the minimum rates for fuel taxes in accordance with the EU Mineral Oil Directive. The Danish Government will furthermore work actively to create a coordinated policy in the area together with our neighbouring countries.

It is especially the development in Germany which is important for the issues surrounding cross-border trade. It is, however, not unlikely that Germany will follow the principle of raising the fuel taxes. Partly because Germany has a fiscal need for the tax revenues, partly because the environmental impact of road traffic is also an important issue in Germany.

In accordance with the declaration of the meeting of the OECD ministers of environment in February 1996, the Danish Government will seek to establish internationally agreed taxes for the energy consumption of the air transport sector. At the same time the Danish Government will seek to have the EU regulations changed so as to allow taxing of ferries and aircraft.

As mentioned in 3.4 the Danish Government will look into models for taxing the energy consumption of coach and railway transport.

4. The consequences of the action plan

4.1 Reduction of carbon dioxide emissions

4.1.1 Improved energy efficiency

In connection with the projections it is assumed that even without the action plan there will be gains in energy efficiency. It is thus assumed that new petrol powered cars drive an average of 14 kilometres per litre in 1995 and 15 kilometres per litre by 2005.

In this connection it should be noted that there is a certain amount of uncertainty involved in calculating the energy efficiency of new cars. Some assessments seem to indicate that the above estimates for 1995, and thereby for 2005, are overestimated. The estimates of the changes in the carbon dioxide emission level as consequence of the action plan outlined below have been estimated on the basis of percentage changes in the energy efficiency and thereby to a certain extent become independent of the absolute figures.

As it appears from section 3 the Danish Government proposes entering specific agreements at the EU level with the car manufacturers on limiting the carbon dioxide emissions per car. It is assumed that this will result in a reduction by at least 25 per cent compared to the 1990 level. Consequential upon the assumption that the price of petrol will follow the average gain in energy efficiency it is assumed that the rise in energy efficiency at the EU level will be reflected fully in the average energy efficiency of new cars in Denmark. This means that a new petrol powered car is assumed to drive 18 kilometres to the litre by the year 2005 without any further interventions.

An average energy efficiency of new cars of 20 kilometres to the litre is to be achieved by further specific decisions on the use of financial incentives and information campaigns on the fuel efficiency of cars, as described in the action plan. In this connection it must be remarked that an analysis based on international comparisons indicates that it is relatively difficult to change buying habits in connection with car purchases by differentiating the consumer prices on the basis of energy efficiency. Therefore the achievement of the goal may turn out to be very ambitious indeed.

An energy efficiency of 20 kilometres to the litre for new cars means an increase of the energy efficiency by 2005 of approximately 30 per cent (20 km/l in relation to 15 km/l). Only part of this improved energy efficiency will be effective for the total number of cars by 2005. Considering the expectations of a relatively high level of car sales, together with the fact that

new cars drive more than older cars, it is assumed that 30 to 35 per cent of the increase in the number of new cars will be effective in the total number of cars by 2005, which corresponds to a rise in energy efficiency of 11 per cent.

As a consequence of the higher fuel efficiency, and the correspondingly lower costs of owning and driving a car, the population will drive more. On the basis of various surveys it is assumed that every time the energy costs drop by 1 per cent the car travel activity rises by 0.4 per cent. The rise in energy efficiency for the total number of cars of 11 per cent thus entails a rise in car travel activity of 4 per cent. When this rise in the car travel activity is put together with the average fuel efficiency gain of 11 per cent, the total energy savings on passenger car transport will therefore be approximately 6 to 7 per cent. As the passenger cars are responsible for approximately

55 per cent of the emissions, this means a total reduction of the total emissions of the transport sector of 3 to 4 per cent. The total long term effect is estimated to be approximately 9 per cent, and the rest of the increase (from 3 - 4 per cent to 9 per cent) is expected to become effective mainly during the period 2005 to 2010.

If it turns out to have been possible only to achieve an average energy efficiency of 19 kilometres to the litre for new cars, the reduction of the carbon dioxide emission level by 2005 becomes 0.5 to 1 per cent lower than calculated above.

4.1.2 Fuel prices up to 2005.

The Energy Agency assumes a rise in the producers' prices for diesel and petrol which leads to an increase of consumer prices of approximately 25 per cent. An increase of fuel prices at the lower edge of the gain in energy efficiency for new cars entails an increase of about DKK 0.50 in relation to 1996 prices besides this increase.

On the basis of various surveys it is assumed that when the energy price rises by 1 per cent the fuel consumption for passenger cars falls by 0.4 per cent, and for vans and lorries it falls by 0.2 per cent. An increase of fuel prices at the lower edge of the fuel efficiency gain for new passenger cars on this background entails a drop in the fuel consumption for passenger cars by approximately 11 per cent, and for van and lorry transport by 6 to 7 per cent. As passenger cars are responsible for approximately 55 per cent of the emissions, and vans and lorries are responsible for approximately 35 per cent, this means a reduction of the total emissions of approximately 8 per cent.

4.1.3 Other areas for special efforts up to 2005

The other areas singled out for special efforts include among others:

- physical planning
- research and development
- promotion of energy efficient behaviour, including energy efficient driving
- promotion of a reduction of the transport need of households and companies
- promotion of bicycle transport
- promotion of energy efficient public transport
- promotion of coastal sea transport
- promotion of optimization of environmentally friendly goods transport

It is estimated that these areas combined can yield reductions of the emissions of up to 4 per cent.

4.1.4 Total effect

The total effect is estimated to be a reduction of the carbon dioxide emission level of about 15 per cent in comparison to the expected emission level by 2005, so that it is stabilized at the 1988 level.

At the same time the action plan provides a good platform for further initiatives in the long term. Especially initiatives to bring down the transport need would be significant, while at the same time putting in long term efforts to improve the energy efficiency.

The action plan assumes continuous undertaking of specific initiatives. As mentioned in section 1 there is still some uncertainty in connection with the individual fields of effort, as is the case with the expectations for the future development. The plan therefore needs continuous follow-up.

4.2 Reduction of other types of emission

In connection with a comprehensive evaluation of the environmental effect of the action plan, it is furthermore of relevance to assess the consequences of the other significant pollutant emissions from the transport sector, in the shape of nitrogen oxides, hydrocarbon and particles.

These emissions are assumed to be dependent on the extent of road transport and not on the level of energy consumption. In implementing the action plan it is assumed that the passenger car transport will rise less than during the reference development sequence, so that the passenger car transport level by

2005 will be approximately 7 per cent lower than the reference development sequence. The corresponding figure for van transport is 7 per cent, and for lorry transport 3 per cent. The calculations exclude consideration of the effects of “Other areas for special efforts up to 2005”, mentioned in section 4.1.3.

On the basis of these premises, the fall in emissions of nitrogen oxides, hydrocarbon and particles is analyzed in table 4.1. As the figures exclude consideration of the initiatives in section 4.1.3, this is a depiction of a minimum estimate of reductions. From the table it is seen that in relation to the reduction of emissions taking place between 1995 and 2005 as a consequence of the tighter emission demands for the individual vehicles, the action plan provides only a minor contribution.

Table 4.1 Emissions (1,000 tons) of nitrogen oxides, hydrocarbon and particles in 1995 and 2005

	1995	2005	
		WtAP ¹⁾	MH ²⁾
Nitrogen oxides	87,8	48,5	46,4
Hydrocarbon	78,5	44,5	41,5
Particles	4,5	2,6	2,5

¹⁾ WtAP = without action plan

²⁾ WAP = with action plan, excluding the initiatives of section 4.1.3.