1 Summary

In the report it is established that methanol and ethanol of bio-based origin, Methyltertiarybutylether (MBTE) and Ethyltertiarybutylether (ETBE) of bio-based origin (alcohol part), Rapemetylester (RME) and bio-gas, influence the climate to a lesser extent than does diesel oil and petrol. They also often have less or comparable influence on the environment and health when compared with the best classes of diesel oil and petrol fuels. Natural gas and motor gas exert a lesser influence on the environment and on health, but as fossil fuels they have only a marginal advantage in terms of affecting climate. Fossil methanol, ethanol, MBTE and ETBE have no advantages in relation to climate, and are furthermore comparable with the best classes of diesel oil and petrol fuels.

It is suggested in the report that a system for the environmental classification of alternative fuels be created and be introduced into a new law on fuels. When making decisions as to environmental classification, factors such as influence on the climate, regional and local effects, renewablilty and the effect on the working environment, and the potential effect on soil and water in the case of accidental discharge or disaster, would all be considered.

It is further suggested for the Fuel law that the environmental classification of petrol and diesel oil respectively should be adopted from the law concerning chemical products, and from the law concerning taxes on energy.

However, it is suggested that all tax questions as regards fuels should remain within the law concerning the taxation of energy.

It is suggested that the environmental classification system be designed in such a way that three classes be formed, where two classes (A and B) are reserved for fuels which, based on the above grounds for assessment, are far better (bio-gas) or better (bio-based methanol, ethanol, MTBE, ETBE, and RME, as well as natural gas and motor gas) compared with the best classes of diesel oil and petrol fuels. One class is reserved for the fuels which are comparable (fossil methanol, ethanol, MTBE and ETBE) with the best classes of diesel oil and petrol.

It is suggested that regular CO2 taxation be applied to alternative fossil fuels. For the bio-based alternative fuels, it is suggested that CO2 taxation should not be applied.

It is estimated that the replacement of diesel oil and petrol with alternative fuels is a pre-condition for the fulfilment of the environmental goals set by

parliament. To enable alternative fuels to establish themselves on the fuel market, their price must be able to compete with that of diesel fuel and petrol on the consumer market. In order for this to happen, bio-based alternative fuels must necessarily, at least initially, be exempted from both CO2 and energy taxation. In the case of natural gas and motor gas, it is suggested that CO2 taxation be maintained, and that energy taxation be reduced by 60 - 70% based on the present day total level. In this assessment, the cost of primary produce, production and distribution have all been taken into consideration. However, the extra cost of the vehicle in question has not been considered. Additional compensation for these extra costs will have to be solved in another way and at another time as and when necessary. This is an important question, not least for gas-driven heavy vehicles which have extremely high extra costs.

The decrease in taxation should, for the time being, be carried out by means of awarding pilot project dispensations from regular taxation, according to article 8.2d in the EU directive on mineral oil (bio-based alternative fuels with the exception of bio-gas), or otherwise by means of an application for exemption from this specific directive with reference to article 8.4. of the directive (bio-gas, natural gas and motor gas).

For mixtures of up to 5% RME or 15% ethanol in diesel oil, as well as methanol, ethanol, MTBE and ETBE in petrol up to the highest permitted oxygen content, it is suggested that taxation be applied based on the properties of the mixture components, and not on the mixture as a whole.

It is suggested that the taxation aspects of this issue also be dealt with through the application of pilot project dispensations.

It is established in the report that the basis for the assessment of the influence of fuel on climate, the environment and public health at the present time is partially lacking, and that there exists no established method for the evaluation and assessment of fuel. It is therefore suggested that continuous work be carried out in regard to these questions. It is further pointed out that there is a need for time and resources to be allotted for these often very extensive issues.

Finally, the report indicates the importance of Sweden working towards permanent tax reduction on alternative fuels, within the framework of the EU, and suggests that Sweden, in the long term, switch to a common environmental classification system for alternative and conventional fuels. In this system, the total effect on climate, environment and public health, etc., should be evaluated in the case of each fuel, forming the basis for placement within the system. Tax reduction should thereafter be based on the socio-economic costs incurred by each fuel as a result of its emissions, etc., and its resultant effect on the climate, environment and public health. According to the proposal, the matter should be assigned to the authorities in question, or to a specially-established committee.

2 Conclusions

According to the directives for the Inquiry, my primary task is to shed light on the environmental and public health aspects of alternative and mixed fuels in vehicle usage.

Furthermore, I am to draw up a proposal as to the formulation of quality requirements which should be imposed on alternative fuels, and to consider the way in which alternative and mixed fuels should be dealt with in relation to an environmental classification system for motor fuels.

2.1 Considerations

The Need for Measures

If Sweden is to live up to national goals and international agreements within the environmental sector, then often extensive measures are needed in almost all aspects of society. In regard to the transportation sector, it is stated in prop. 1990/91:90, bet. 1990/91 JoU. 30, rskr. 338, that “the transportation sector is to contribute towards the fulfillment of environmental goals”.

Within the work of the an Environmentaly adapted transport system (MaTs), three areas have been indicated where extensive measures are necessary in order to reduce the effects of the transportation sector to an acceptable level. These areas are:

* Effect on the climate - emissions, primarily of CO2.
* Effect on public health - emissions into the air in densely-populated areas.
* Effect due to noise.

Many of the alternative fuels I have studied have, I feel, a major part to play in contributing towards reduced emissions and effects on both environment and public health. The bio-based fuels contribute, primarily, to a decrease in the emission of gases with an influence on the climate, mainly carbon dioxide (CO2). The fossil gases: natural gas and motor gas, contribute primarily to the decrease of emissions of health-affecting pollutants. Bio-gas contributes to

both reduced emissions of CO2 and pollutants which affect the environment and public health.

The Effects on Climate, Environment and Public Health

The alternative fuels studied have, I feel, in many cases lower emissions and also a lesser effect at a regional and local level on the environment and public health respectively, than have the best classes of diesel oil and petrol fuels. In the case of heavy vehicles, the difference is often a relatively large one, while in the case of light vehicles with ottomotor and catalytic converters the difference is only marginal, especially when operating on liquid fuels. As regards the alternative gas fuels, I estimate that they generally have far less effect on the environment and public health than the liquid fuels.

In some cases, the alternative fuels bring about an increase in the emissions of certain pollutants. Examples of this are nitric oxides (NOX) from the use of Rapemethyester (RME) and aldehydes when operating with alcohols. I think, however, that these increased emissions are outweighed by the fact that others decrease. In the case of both RME and the alcohols, there is more often a decrease in the emissions of health-effecting particles and polycyclic aromatic hydrocarbons (PAH).

A common feature of the bio-based alternative fuels is the advantages they possess in regard to their effect on the climate and the question of their renewability.

It is also my opinion that the alternative fuels, with the exception of methanol, have a lesser effect on working environments, and that they all have less effect in the event of accidental discharges or disasters affecting land and water.

Environmental classification

It is my considered opinion that environmental classification represents a means by which consumers can be informed and guided towards products which have a lesser effect on the environment and on public health, etc., than other comparable products.

In the systems for the environmental classification of diesel oil and petrol, the various qualities of each fuel are compared with each other. Since the studied alternatives are of a simple composition, there is no need for an internal environmental classification system. The environmental classification should, instead, be based on a comparison of emissions and influences on the climate,

environment and public health with the corresponding effects as a result of using diesel oil and petrol. It is my firm opinion however, that in the long term a system must be developed where all fuels can be positioned on a scale ranging from the least to the greatest accumulative effect, based upon the substance's total effect on climate, the environment, public health, etc., regardless of whether it be a conventional or alternative fuel. In the event of there being such a system, it is also easier to introduce various economic steering methods which relate to the socio-economic costs of the fuels. I will return to the question of economic steering methods later on. The initiation and development of such a system would probably be lengthy and would necessarily require that it be such that different forms of effects could be weighed against each other. For example, there must needs be an assessment of whether the climate issue is of greater importance than public health, and whether the risk of cancer is more important than the increased prevalence of allergies, and so on. The development of a proposal for such a system should be referred to the appropriate authorities in co-operation with representatives from the different areas and organisations, or else to a committee specially appointed to deal with these questions.

The classification system now proposed is, as I see it, a compromise. I have chosen to propose it because it can be put into effect relatively speedily, and because it is based upon a comparison of the environmental and public health aspects of diesel oil and petrol. To have to wait for a complete new system of environmental classification for all fuels would, I feel, block the possibility of a large scale introduction of alternative fuels onto the Swedish market for a good many years to come.

The emission of carbon dioxide (CO2) from fuel is presently regulated by a special tax which relates to the carbon content of the fuel. This tax should also be applied to alternative fuels. The bio-based alternative fuels should however be exempted, since their emissions of CO2 do not result in a net addition to the CO2 balance and therefore do not contribute to the effect on the climate. Since I consider the question of climate, and therefore the emissions of CO2, to be of great importance, I have also chosen to allow CO2 emissions to influence the division into environmental classes. My starting point in this instance has been that bio-based fuels which, to as great an extent as possible, are manufactured using bio-based energy, considerably reduce the net addition of CO2 into the atmosphere.

The environmental classification system should, in my opinion, contain three environmental classes. Two classes for alternative fuels with a lesser combined effect on the climate, environment and public health than that of the best classes for diesel oil and petrol, and one class for fuels with an equal effect.

In summary, my assessment of the alternative fuels I have studied is that bio-gas should be positioned in a class that surmounts the best classes of diesel

oil and petrol fuels. This is because of the advantages deriving from regional (environmental), local (public health) and global (climatic) points of view. Bio-based methanol and ethanol, MTBE and ETBE from bio-based alcohol, and RME, should be placed in a class better than that representing the best classes of diesel oil and petrol fuels. The reason for this is that in terms of regional and local effects combined, they are either better than or comparable to the best classes of diesel oil and petrol fuels and because, as they are bio-based, they have a far lesser effect on the climate. Natural gas and motor gas should also be placed in this environmental class. It is certainly true that they are fossil fuels, and have no or only slight advantages as regards climate influence compared with diesel oil or petrol. However, since they are gaseous they have a distinctly lesser effect, primarily on public health but also on the environment, which therefore motivates such positioning. Finally, both fossil methanol and ethanol, as well as MTBE and ETBE from fossil-based alcohol, should be placed in an environmental class equal to the best classes of diesel oil and petrol. They have an effect on both climate and public health that is comparable with the best classes of diesel oil and petrol, which is why they should not be awarded a better placement than them.

The placement into environmental classes as I have proposed is based upon data and assessments currently available. Further development in these area must be continually monitored and, when the need arises, environmental classifications re-evaluated. It can, at such times, be necessary to reposition certain fuels from a better to a worse environmental class, or vice versa. Based on current knowledge within this area, it is my view that the proposed classification system need not be re-evaluated for a period of 8 to 10 years in the case of liquid fuels, and 12 to 15 years in the case of gaseous fuels.

Fuel mixes

I have only been able to study the issue of fuel mixes to a limited extent. This is due to the fact that the effects of alternative fuels in their “purest” form places considerable demands on time and resources. There is also a greater lack of data on fuel mixes than that concerning the effects of fuels in pure form. However, I have felt myself able to derive certain conclusions as regards the low grade mix of RME or ethanol in diesel oil.

There is more extensive available data regarding the low grade mix of alcohols or ethers, so called oxygenates, in petrol. In the prevalent environmental classification system for petrol (MK2) there is a stated

maximum permissible level of oxygen (max 2%) and therefore of the maximum permitted mixture. This limit has been set so to permit mixing without the need for engines to be reset, and without increasing the level of regulated emissions. I have found no reason why these requirements should be changed at the present time. I view low grade mixtures of primarily ethers in petrol as a good alternative to a large-scale introduction of bio-based alternative fuels. This applies not least to the initial phase of an introduction. In addition, the ethers have properties which also improves emissions from the fuel and its effect on the environment and public health.

As regards the low grade mixture of RME in diesel oil, there is data which indicates that emissions remain relatively uneffected, with the exception of a marginal increase of Nox. There is also data, albeit limited, which shows that the mixture of ethanol in diesel oil does not have a negative effect on emissions. I also regard the low grade mixture of RME and ethanol in diesel oil as a good alternative to the introduction of bio-based alternative fuels.

In the case of the mixture being of more than 2 to 3% RME in diesel oil of environmental class 1, or up to 15% ethanol in diesel oil of environmental class 1, the mixture affects the boiling-point interval in such a way that quality requirements for diesel oil in environmental class 1 are no longer met. Instead, the mixture is classified as a diesel oil in environmental class 3. The boiling-point interval is used to define diesel oil. For RME and ethanol, the boiling-point should be of lesser importance, if indeed it has any relevance at all. Available data indicates that the mixture of 5% RME, or 15% ethanol in diesel oil, is possible without emissions being affected to any great extent, in comparison with diesel oil in environmental class 1. I am thus of the opinion that mixtures of up to 5% RME and 15% ethanol in diesel oil, as regards the boiling-point interval, should be assessed based on the individual components in the mixture, and not on the mixture as a whole. As regards ethanol mixtures, I feel that available data and assessments must be supplemented with additional test operations, emission analyses and evaluations before a final position can be assumed in this matter.

Trial methods

In order to compare the alternative fuels with diesel oil and petrol, and also with each other, a method is needed which can be based upon representative emission data, etc. During the course of this assignment, it has become clear that it is not always possible to compare different fuels in an equitable way using data currently available. Neither does there exist an accepted method by which comparisons can be made. I have therefore had work carried out in such a way as to improve current data, and have also embarked on the development

of a method for comparing the influence of different fuels on climate, public health and the environment, etc.

The work on these issues which I have previously presented, evaluation matrix for fuels, trial methods and emissions while operating using alternative fuels could, in my opinion, together with data and experience on these issues from the Swedish Environmental Protection Board, the Swedish Transport and Communications Research Board (KFB) and the Swedish Motor test centre, be developed into a working method for the evaluation of different fuels. However, this presupposes that time and resources are allocated for such a task. Against a background of road traffic's relatively major influence on climate, the environment and public health, I consider it important that this be the case. Until such time as this task can be initiated, a suitable authority, such as the KFB, should be appointed to continually update the matrices with new data as soon as, and when, it becomes available.

In the space of a few years, the method I have described above should also be adapted and developed to allow for mixtures of fuel. In which case, almost all existing or new mixtures can be evaluated from a climatic, environmental and public health point of view, once the relevant tests have been applied and the necessary data obtained. Based on this assessment, the mixture in question can then be allocated to the appropriate environmental class. It is necessary, however, that the mixtures to be evaluated and assessed have been clearly defined, e.g. according to Swedish standard and quality requirements, linked to the environmental classification system.

Economic means of control

The introduction of a system of environmental classification of alternative fuels is a means of steering towards the environmental goals decided on by parliament. In order to further improve the steering effect, classification can be linked to economic means of control.

Carbon dioxide taxation

As previously mentioned, there currently exists an economic means of control for emissions of CO2 and its effect on the climate, namely the CO2 tax. The CO2 tax is related to the carbon content of fuels and other propellants. I think it reasonable that the CO2 tax can be the means of control for decreasing CO2 emissions even in regard to the combustion of alternative fuels. However, the bio-based fuel's CO2 emissions are part of the total CO2 balance, and do not constitute a net addition on it. They should therefore be exempt from CO2 taxation. The present day level of the CO2 tax has, in my opinion, failed to

have the steering effect one would wish, and it cannot be considered to correspond with the external costs which CO2 emissions give rise to. The level of the CO2 tax should therefore be reconsidered. If the suggested increase in the CO2-tax (10 öre per litre and year between 1998 and 2020), as recommended by the Communications Committee (KomKom) in its sub-report entitled New Course in Traffic Politics (SOU1996:26), is carried out, then the steering effect will become greatly improved.

From the compilation of produced fuels that I have had assembled, it is evident that a life-cycle perspective should be drawn up for fuels in regard to CO2 emissions from bio-based fuels. For other emissions, and for CO2 emissions from fossil fuels, the combustion phase in vehicle engines represent the dominating part (80 to 90%) of the regulated, and to a certain extent the non-regulated, emissions.

In order that the bio-based fuels not contribute to the net addition of CO2 and hence influence the climate from a life-cycle perspective, they have to be produced to a large extent by using bio-based energy.

I am of the opinion that the issue should be solved primarily by raising CO2 taxation to a level which will have a sufficient steering effect, i.e. when it becomes economically advantageous to choose bio-based energy rather than fossil energy in the production of bio-based fuels. While waiting for this to happen, I feel that Sweden should introduce a voluntary environmental labelling system for bio-based fuels. The system should only concentrate on the CO2 issue. Other means of influencing the application of energy in the production stage have proved to be complicated, and most likely require a joint initiation from within the EU. A voluntary system of environmental labelling can also be applied by importers of bio-based fuels. The risk of producers and importers of bio-based fuels in Sweden failing to manufacture their products in an environmentally correct and tenable way can be regarded as being very slight.

The Energy tax

The economic means of control for diesel oil and petrol have been designed in such a way as to compensate for the additional costs incurred when producing the better classes of fuel rather than the inferior ones. In the long term, I feel that it would be better to burden each fuel with the socio-economic costs created as a result of its emissions. This demands, however, that one partly has a tax large enough to cover the most inferior fuel’s environmental costs, and partly that one has decided how large a part of the fuel tax is to be assigned to these costs. Furthermore, it is necessary to quantify the socio-economic costs of the fuels in terms of their effect on climate, the environment and public health. No such quantification can reasonably be made at the present time. A proposal

for such a new form of fuel taxation should be developed by a suitable authority or by a committee specially appointed to look into the matter. It is important that all fuels in current use be investigated and that a proposal for taxation be generally applicable, and not aimed at only one or more fuels or fuel groups. As far as possible, the task should be co-ordinated with corresponding work on a new environmental classification system for all fuels.

If several of the national goals set up by parliament are to be achieved, as well as certain international commitments, then there must, in my opinion, be a major, long-term introduction of alternative fuels. In order that this might happen, it is necessary that they can compete with diesel oil and petrol at consumer level. The alternative fuels I have studied are at present often considerably more expensive to manufacture than diesel oil and petrol. In order for them to be able to compete at consumer level it is therefore necessary that manufacturers be compensated for their additional costs.

My assessment suggests that it is necessary for bio-based fuels in environmental class A and B to initially be wholly exempt from both CO2 and energy tax. The fossil gases should be burdened with full CO2-tax, while the energy tax should be reduced by 60 to 70%. In the case of liquid fossil alternative fuels there is, against the background of the environmental classification I have suggested, no reason for a decrease in the fuel tax.

Even when mixing RME and bio-based ethanol in diesel oil, as well as bio-based ethanol, methanol, ETBE and MTBE in petrol, tax exemption should be valid. For the ethers, this is in regard to that part deriving from bio-based alcohol. Here however, certain problems arise with regard to the mixture as a whole, which I will return to later.

The size of the reduction in energy tax is related to the additional costs for production and distribution compared with that for diesel oil and petrol. It is important that the development of costs for the alternative fuels be monitored continuously and, when the need arises, that the level of reduction be adjusted in order to ensure that it really does correspond to actual additional costs. Based on present day knowledge in the area, it is my opinion that the reduction in energy tax as suggested above should be appropriate for the next two to three years, after which time the size of tax reduction should be reviewed at intervals of approximately every two years.

Furthermore, I am of the opinion that the difference presently existing between alternative and conventional fuels as regards the cost of production and distribution will almost completely disappear in the long term. It is my understanding that this will occur at some time within the next 20-25 years.

Differentiated fuel taxes

As members of the EU Sweden cannot unilaterally differentiate its fuel taxes, beyond what has already been established. This issue is regulated by, among others, the so-called Mineral Oil directive. I feel that Sweden should, within the EU, work towards bringing about a decision on a special bio-fuel directive, which would give us the right to differentiate tax for bio-based fuels, as well as to go below the present minimum levels for fuel tax. Alternatively, similar clauses should be included in the Mineral Oil directive.

If we wish to introduce differentiated taxes for bio-based alternative fuels, this can be done by means of dispensations with set time-limits, in reference to article 8.2d of the Mineral Oil directive, the so-called pilot project exceptions. Alternatively, Sweden can, in certain specific cases, also be granted an exemption with the support of article 8.4. However, this requires a unanimous decision on behalf of the council. There already is such an exemption for bio-gas which gives Sweden the right to exempt it from fuel tax. If we want to change this without applying tax at the same level as for fossil methane (natural gas), then a new article 8.4 exemption is required.

It is my considered opinion that Sweden should make use of pilot project exceptions in order to reduce both CO2 tax and energy tax on bio-based alternative fuels. For the time being, the existing article 8.4 exception can be used in the case of bio-gas. As regards natural gas and bio-gas, Sweden can unilaterally change the level of energy taxation as long as it does not fall below the EU minimum level for these taxes. However, only one taxation level can then be applied. That is, if Sweden wants to introduce quality requirements (Fuel laws) for natural gas and motor gas in such a way that there are two tax levels, one for those who fulfil the quality requirements and one for those who do not, then an 8.4 exception is needed.

That which is to be considered a pilot project exception is decided upon by the respective country which puts it into practice. The Communications Committee has, in its sub-report entitled New Course in Traffic Politics (SOU 1996.26), proposed a 15% (energy based) introduction of bio-fuels until the year 2010. Cost estimates for an introduction strategy based on the proposal have been made by SIKA. The estimates have shown that such a scenario would lead to considerable socio-economic costs. If the introduction were to be extended to the year 2020 then there would be a considerable decrease in costs. My assessment as regards the extent of the volume of bio-based fuels which can be realised within the next five to ten years is that it will not exceed what can reasonably be defined as being a pilot project. I assume that the question of the taxation of bio-fuels during that time will be decided on within the framework of the EU. As regards what can be termed to be a pilot project, the way in which other countries have interpreted the concept should also be noted, as well as the fact that the EU (the ALTERNER-programme) has announced its

ambition that 5% of the fuel market should be replaced by bio-fuels by the year 2005.

The pilot project dispensations should, in my opinion, be granted for eight to ten years, and in such a way that the size of the tax reduction be reviewed approximately every two years.

Furthermore, pilot project dispensations should be applied to the taxation of up to 5% RME and up to 15% ethanol, in diesel oil, based on the individual properties of the mixture components (environmental classification) and not the mixture as a whole. Dispensations for the mixture of RME can, in my opinion, be granted for approximately five years, while dispensations for the mixture of ethanol should for the time being be granted for no more than a period of one and a half years.

Pilot dispensations for the mixture of methanol, ethanol, MTBE and ETBE in petrol should be granted for periods of up to five years.

Laws and regulations

The Fuel law

According to directives I have received, part of my assignment is to propose changes in the system of regulations, in order to achieve a greater degree of unity and simplicity. At the present time, the proposal of the Inquiry into the Environmental Act is being considered. According to the report, it is proposed that the rules concerning the environmental classification of petrol, which are at present to be found in an appendix to the law on chemical products (LKP), be transferred to the law concerning car emissions. As I do not consider this to be appropriate, I propose instead that the regulations in LKP, as well as those concerning the environmental classification of diesel oil and other products within the law on the taxation of energy (LSE), be transferred to a new law concerning fuels, the Fuel Law. The Fuel Law will, according to my proposal, become a purely environmental law, compared to what it is at the present time. This law should also include alternative fuels and their environmental classification.

Regulations concerning the taxation of fuels should henceforth also remain within the law regarding the taxation of energy.

Within the Fuel Law alternative fuels are to be defined, and those which have been environmentally classified are to be listed and sorted into one of the three proposed classes, depending primarily on their effect on climate, the environment and public health, but including working environments and the effects they would have in the event of accidental discharges or disasters. The

Fuel law should also include the quality requirements which alternative fuels must comply with in order to obtain an environmental classification.

It is important that both Swedish standards and quality requirements be developed for the alternative fuels I have studied. This should happen promptly. The quality requirements should be based on Swedish standards for the specific fuels. A proposal as regards quality requirements for the fuels studied should be produced by the National Environment Protection Board, in co-operation with the general standardisation group, as well as with relevant government bodies and branch representatives.

The regulation regarding motor petrol and the car emission law

With present day laws it is difficult, if not impossible, to ban fuels which are worse than even the most inferior qualities of petrol and diesel oil. The only limits regulated in law that exist in this respect is the regulation concerning the content of bensene and lead in petrol, as contained within the regulation concerning motor petrol. I find this to be an unsatisfactory condition which should be corrected as soon as possible. The regulations for motor petrol should therefore be changed to become a regulation concerning motor fuels, in which there are fundamental requirements for the regulation of ottomotors and compression motors. The National Environment Protection Board has, on several occasions, presented proposals to the government regarding such a change.

The present day system for the certification of engines and vehicles also makes it impossible to ban the use of a fuel in a certain type of engine or vehicle. Certification is carried out with diesel oil or petrol specified for that particular purpose, depending on the type of engine. It is thereafter up to the user to use the fuel he himself prefers, taking into account the manufacturer's warranties. Neither is it possible to ban the use of specific fuels in older engines or vehicles. This would be desirable in certain cases, among others with regard to the use of alternative fuels. In this way, e.g. alcohols and RME would only be allowed in vehicles specially adapted for these fuels, which in many cases would have an even better effect on overall emissions, as well as wear of the engines, etc.

I am of the considered opinion that the present day system of certification of engines/vehicles should be further developed in such a way that fuels for certification are produced for all fuels defined in the Fuel Law, i.e. both diesel oil and petrol, as well as fossil and bio-based alternative fuels.

Similarly, the car emissions law should be extended in order to become an engine emissions law, with the ability to stipulate emission requirements for all kinds of motors. Emission requirements for motors/vehicles as stipulated in the car emissions law should be linked to operations using one or more specified

forms of fuel. Here, there could be different emission levels depending on the fuel in question. In order to drive a motor/vehicle using one or more forms of fuel, the motor/vehicle must be certified for that, or those, specific fuels. It is then required that the manufacturer can show that he fulfils the requirements established within the engine emissions law when operating the fuels (certification fuels) for which he wishes to use the engine/vehicle.

The task of changing and extending the regulations concerning engine petrol and the car emissions law should be charged to a suitable authority or a committee specially appointed for the purpose.

Influence on motors

I am of the opinion that the alternative fuels, primarily methanol but also ethanol, and to a certain extent RME, lead to increased corrosion in motors and distribution systems. This problem can be solved by replacing exposed parts with those made using resistant materials. This has happened in a great many cases. In Brazil, for instance, ethanol has been used to a great extent for 20 years in vehicle operations. There are presently approximately 4 million vehicles which use pure ethanol and approximately 10 million vehicles which use a mixture of 22% ethanol in petrol. In my opinion, this means that corrosion is no longer a major problem in these instances.

I feel that it is important to stress that various fuels should only be used in those vehicles approved by the manuacturer. Otherwise, manufacturer and emission warranties will not be valid. Furthermore, there is a large risk of increased emissions when the vehicle is not entirely adapted to the new fuel. As I have already explained, there are no legal possibilities by which control can be exerted over fuels in this way.

The potential of raw material

In order to determine the extent of the potential of raw material behind the alternative fuels I have evaluated, I have studied a number of reports concerning this issue.

The almost unanimous opinion seems to be that there is great raw material potential. Based on present day estimates, it is not possible to replace all fuel consumption with bio-based fuel, especially not if other energy production is also to be bio-based. Moreover, seen from a medium term, and perhaps even a long term perspective, there is no ambition to achieve such a state either.

It is my opinion that Sweden, seen from a relatively long-term perspective, will be able to replace diesel oil and petrol with bio-based alternative fuels to

the extent that can reasonably come into question, e.g. the 15% level of all fuel use until the year 2010 as suggested by ComCom.

The raw material potential for natural gas is of the same extent as that of crude oil. There is also significant potential for motor gas, which is either extracted or obtained as a by-product in refineries.

DME

Dimethylether is an alternative fuel for diesel engines. Many factors point to it being a good fuel in many ways, not least when it comes to emissions. The basis for assessing emissions from DME and its effect on climate, the environment and public health, is as yet too inadequate in my opinion in order to propose an environmental classification. As soon as complete data is available, DME should also be evaluated and environmentally classified. Furthermore, a decision should be made in this regard concerning a possible tax reduction, as well as how it could be implemented.

Introduction of alternative fuels

If the goals set up by parliament are to be met, it is my opinion that long-term measures must be adopted within the transportation sector. Alternative fuels afford considerable potential for the reduction of CO2 emissions and health-affecting pollutants. I consider it important that Sweden makes it possible for alternative fuels, which are better than diesel oil and petrol in regard to effects on climate, the environment and public health, to compete with these other fuels by bringing about a reduction in the fuel tax. With the possible exception of natural gas, none of the alternative fuels I have studied can by themselves completely replace diesel oil and petrol. However, together they may form a relatively large percentage of total fuel consumption. I therefore consider it important that Sweden does not concentrate on one fuel at a time, but that we instead proceed on a broad front, as far as possible from the point of view of the climate, the environment and public health. I am also of the opinion that the relatively high production costs of alternative fuels at the present time run the risk of being consolidated if there were to be a concentration on any one of the alternatives studied.

It is important that Sweden utilises the experience available in other countries regarding the introduction of alternative fuels. Great importance should, for instance, be placed on making sure that no lack of fuel, or vehicles specially adapted for the fuel, arises after the introduction. The availability of distribution systems and stable, powerful interested parties/principal owners is also important.

However, the most important factor is probably that society gives clear, distinct and long-term signals in regard to the basic underlying economic principles, and that emphasis be placed on these principles being applicable for a long period of time.

2.2 Proposal

Based on what I have previously accounted for in the report and the considerations presented above, I suggest that government propose to parliament the creation of a new law regarding fuels. The law is suggested to be a purely environmental law. The existing environmental classes for petrol and diesel oil respectively in the appendix to the law on chemicals, and the law on the taxation of energy, should be transferred to the law on fuels. Differentiation of the fuel tax or similar measures should, in the future, also remain part of the law on energy taxation.

I also propose that a decision be made concerning a system for the environmental classification of alternative fuels, and that it be included in the law governing fuels. The system of environmental classification of alternative fuels should be based on its effect on climate, the environment and public health, etc. seen in comparison with diesel oil and petrol. In the Fuel law, alternative fuels are to be defined. Furthermore, it will list the alternative fuels which have been positioned in the environmental classification system, along with the specific quality requirements for these fuels.

Swedish standard for the alternative fuels should be produced promptly in those cases where standards do not as yet exist.

The National Environment Protection Board should be allocated the task of promptly producing a proposal regarding specific quality requirements for the alternative fuels studied by myself, and this should be done in co-operation with the general standardisation group, government agencies affected, and branch representatives. The quality requirements should be based on Swedish standards or on proposals for Swedish standards.

I suggest that the environmental classification system consist of three classes as shown below, and that the fuels I have studied be positioned in these classes as indicated.

* In **ENVIRONMENTAL CLASS A** are the following fuels whose overall effect on climate, the environment and public health is considerably less than the corresponding influence of diesel oil in environmental class 1, and petrol in environmental class 2.

1. Bio-gas (mainly methane of biological origin)

* In **ENVIRONMENTAL CLASS B** are the following fuelswhose overall effect on climate, the environment and public health is less than the

corresponding influence of diesel oil in environmental class 1, and petrol in environmental class 2.

1. Bio-based methanol

2. Bio-based ethanol

3. Methyltertiarybutylether (MTBE), produced from bio-based methanol

4. Ethyltertiarybutylether (ETBE), produced from bio-based ethanol

5. Rapsmetylester (RME)

6. Natural gas (mainly methane of fossil origin)

7. Motor gas (to a large extent propane of fossil origin)

* In **ENVIRONMENTAL CLASS C** are the following fuels whose overall effect on climate and the environment is similar to the corresponding influence of diesel oil in environmental class 1, and petrol in environmental class 2.

1. Fossil-based methanol

2. Fossil-based ethanol

3. Methyltertiarybutylether produced from fossil-based methanol

4. Ethyltertiarybutylether produced from fossil-based ethanol.

It is my considered opinion, based on data available at the present time, that the positioning of the liquid alternative fuels should be relevant for a period of 8 to 10 years. The positioning of the fuels in the form of gas should be relevant for a further 4 to 5 years, i.e. 12 to 15 years in all.

I further propose that in the case of mixtures with up to 5% RME or 15% ethanol in diesel oil, the environmental classification as regards the final boiling point and the starting boiling point respectively at 95% distillation residue, shall be based on the properties of the individual mixture components and not on the mixture as a whole. In other words, it is e.g. the starting and final boiling point prior to the mix that is relevant to the environmental classification of diesel oil in this respect.

I am of the opinion that in the long term, the environmental classification of fuels should be formed as a common classification system for all fuels. The system is to be based on the fuel's overall effect on climate, the environment and public health, etc. Furthermore, a tax differentiation should be linked to this system, based on the socio-economic costs the emission of the fuel, etc.,

incurs. I propose that the government assigns appropriate government agencies the tasks of investigating this matter and producing proposals for new systems of environmental classification, and the tax differentiation for all fuels. Alternatively, the task can be assigned to a specially appointed committee.

I further propose that a method be developed to assess the way in which pure fuels and mixtures of fuels affect climate, the environment and public health, etc. The work on these issues which I have previously presented, the evaluation matrix for fuels, trial methods and emissions while operating with alternative fuels, should in my opinion be further developed in order to create an accurate and reliable method for the evaluation of fuels, together with the basic data and expertise at the National Environment Protection Board, the Working Committee on Communication Research and the Motor test centre. The task, with the aforementioned content, should be assigned to one of the above-mentioned bodies.

If the environmental goals established by the government are to be met, then at times far-reaching measures are needed within the road traffic sector. If the goals as regards decreased emissions of CO2 and other decreased emissions which affect public health are to be met, then I feel that alternative fuel will have to replace diesel oil and petrol to a great extent. In order for this to happen it is necessary that these fuels can compete as regards price with diesel oil and petrol, at consumer level. All alternative fuels I have studied are more expensive to produce and often more expensive to distribute than is the case with diesel oil and petrol. If they are to compete with diesel oil and petrol, it is necessary that they at least initially be compensated for this additional cost.

I propose that the bio-based fuels be fully exempted from the CO2 tax, since their emissions of CO2 do not result in a net addition to total CO2 levels. In the case of bio-based MTBE and ETBE, this applies to the respective part of ether derived from bio-based methanol or ethanol. I further propose that bio-gas, bio-based methanol and ethanol, as well as RME, be initially exempted from energy taxation. Additionally, MTBE and ETBE produced from bio-based alcohols should be exempted from energy tax in regard to the percentage derived from alcohol. Natural gas and motor gas should be granted a 60 to 70% reduction in energy tax.

I further propose that mixtures of up to 5% RME in diesel oil, 15% ethanol in diesel oil, as regards the final and starting boiling point at 95% distillation residue, are taxed based on the properties of the individual mixture components, and not on the mixture as a whole. Furthermore, bio-based ethanol, methanol, ETBE and MTBE mixed with petrol should be exempted from CO2 tax and be taxed according to the factors stated above concerning the pure products ethanol, methanol, MTBE and ETBE.

The tax reduction for the bio-based liquid fuels should, for the time being, be carried out as pilot project exceptions (article 8.2d in EU's Mineral Oil directive) with set time limits. Based on present day calculations, I feel that the

period of time for these dispensations can be set for 8 to 10 years, with a review of tax reductions approximately every other year.

In the case of bio-gas there is already an exception concerning the level of energy tax, with reference to article 8.4 in the EU Mineral Oil directive.

The tax reductions of 60 - 70% for natural gas and motor gas should be possible by not going below the minimum tax level. If this is not feasible, then an exception should be made with reference to article 8.4 of the Mineral Oil directive.

The tax reduction for the mixture of RME and ethanol in diesel oil should, for the time being, be carried out as pilot project exceptions with set time limits. In the case of the mixture of RME, dispensations could, in my opinion, be set for approximately five years. For the mixture of ethanol, dispensations should at first only be awarded for about a year and a half. For the mixture of methanol, ethanol, MTBE and ETBE in petrol, pilot project dispensations should be applied with a dispensation period of up to five years.

Finally, I feel that the regulations concerning engine petrol and the car emissions law should be developed into a regulation concerning motor fuels and a motor emission law. The task of changing and extending the regulations concerning engine petrol and the car emissions law, as well as the presentation of a constitutional proposal for that area, should be assigned to a suitable body or to a specially appointed committee.