

A European Regulation on the Fuel Efficiency of New Cars

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1. Background and objectives

1.1 This report

This paper outlines and discusses a legal framework for the implementation of the Commission's proposal for setting a limit on the average CO₂ emissions from new passenger cars. Specifically it considers a range of design options and the benefits and issues of each. Three issues are addressed in detail. Should:

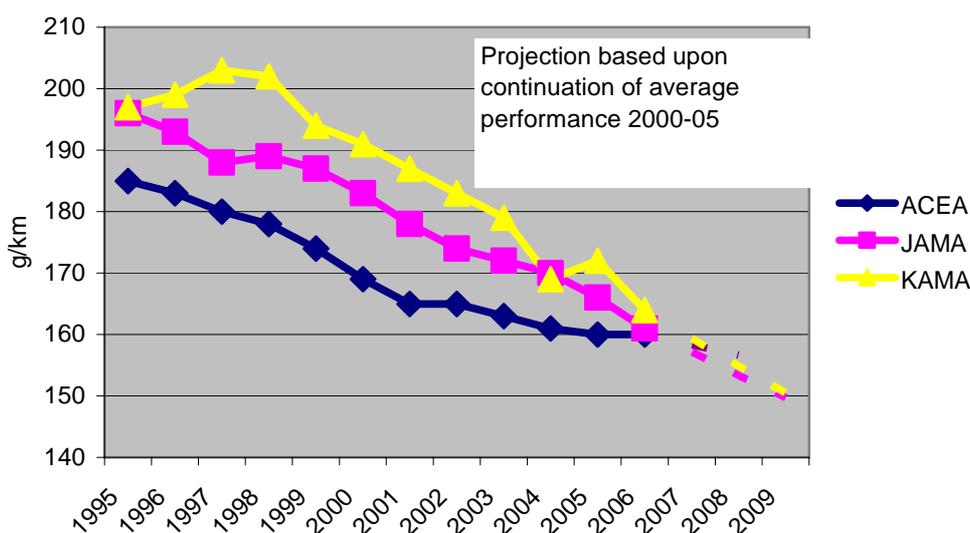
- the legal framework be a directive or regulation?
- the CO₂ baseline take account of vehicle utility and, if so, in what way?
- non-compliance fines or tradable credits be used as the main instrument for making sure that the industry achieves the target?

The paper has been prepared on behalf of the Low Carbon Vehicle Partnership by Per Kågeson, Nature Associates. The views expressed are those of the author.

1.2 Background

In 1998, the European Automobile Manufacturers Association (ACEA) committed to a voluntary agreement with the European Commission to achieve an average CO₂ emissions figure of 140 g/km by 2008 for all new cars classified as M1 in Council Directive 93/116/EEC¹. The European Commission subsequently made similar agreements with the Japan Automobile Manufacturers Association (JAMA) and the Korean Automobile Manufacturers Association (KAMA) for their sales in the EU to average 140g/km CO₂ emissions by 2009. Figure 1 illustrates progress towards the voluntary agreement.

Figure 1. Progress towards voluntary agreement targets



Source: T&E 2006

¹ Sold in the EU with emissions measured according to the test procedure of Directive 93/116/EC. M1 are passenger cars with no more than eight seats in addition to the driver's seat.

Average CO₂ emissions from newly registered cars have declined by around 15 per cent. Almost half of the improvement is still to be achieved in the remaining 1-2 years. Projecting forward the average improvement achieved between 2000 and 2005, it is estimated that by the compliance year the target will be missed by a significant margin:

- ACEA 157g/km (projection for 2008)
- JAMA and KAMA 150g/km (projection for 2009)

UK progress mirrors that of the EU, albeit emissions are higher in the UK, largest as a result of the smaller proportion of diesel vehicles sold in the UK.

There are a number of reasons progress has been slower than anticipated, key amongst these are:

1. consumer preference has been towards higher performance and larger cars
2. progress with tax incentives for low carbon vehicles across the EU has been mixed
3. the three trade bodies have been unable to influence the CO₂ emissions of vehicles produced by their members and there has been no clearly laid out system of burden sharing

In June 2006 the European Council unanimously reconfirmed that “in line with the EU strategy on CO₂ emissions from light duty vehicles, the average new car fleet should achieve CO₂ emissions of 140 g CO₂/km (2008/09) and 120 g CO₂/km (2012)”. The European Parliament called for “a policy of strong measures to reduce emissions from transport, including mandatory limits for CO₂ emissions from new vehicles in the order of 80-100 g CO₂/km for new vehicles in the medium term to be achieved through emission trading between car manufacturers”.

It is clear that the voluntary agreement has failed to deliver the required pace of change and a regulatory framework has therefore been proposed. Without a package of supplementary measures by Member States to support the new framework this is also liable to fail, specifically:

- stronger incentives for the purchase of low carbon vehicles – including taxation differentiated by CO₂ emissions
- improved consumer information and education
- increasing the desirability of low carbon vehicles – including a marketing code of conduct.

1.3 The Commission’s communication

In February 2007 the European Commission declared its intention to propose a legislative framework in 2007 or at the latest by mid 2008 to reduce the average permissible emission from new cars to 130 g CO₂/km in 2012. The communication also proposes a further reduction of 10 g CO₂/km should be achieved by other technological improvements, specifically:

- setting minimum efficiency requirements for air-conditioning systems;
- the compulsory fitting of accurate tyre pressure monitoring systems;
- setting maximum tyre rolling resistance limits in the EU for tyres fitted on passenger cars and light commercial vehicles;

- the use of gear shift indicators, taking account of the extent to which such devices are used by consumers in real driving conditions;
- fuel efficiency progress in light-commercial vehicles (vans) with the objective of reaching 175 g/km CO₂ by 2012 and 160 g/km by 2015;²
- increased use of bio fuels maximizing environmental performance.

The Commission does not propose any fuel efficiency targets for cars beyond 2012 but says that it will support research efforts that will deliver a 40 per cent reduction in CO₂ emissions from cars for the new vehicle fleet in 2020. This would correspond to a new car fleet average of 95 g CO₂/km.

1.4 Design issues

In designing a regulatory mechanism to reduce the CO₂ emissions of new cars sold in the EU there are numerous questions that need to be resolved:

1. to what extent should the regulation be at an EU level – or left to the discretion of individual Member States?
2. who should be the regulated party - Trade-body, European Company, National Company, other?
3. how can the diversity of vehicles produced by the European motor industry be retained and negative effects on the competitiveness of the industry minimised
4. how can improved environmental performance be achieved at the lowest cost?
5. what target years and target levels are appropriate?
6. should trading be permissible? If so, should this be a closed system or allow exchanges with other CO₂ trading systems, such as the EU Emissions Trading Scheme?
7. what levels of penalties should be applied for non-compliance and to what use should income be put?
8. what reporting and monitoring mechanisms are appropriate?
9. what supplementary mechanisms are necessary and appropriate?
10. what will be the effect on consumers?

These are addressed in the following sections.

2. Who and what could be regulated?

This section discusses whether an EU regulation is necessary or whether the EC could require Member States to achieve the targets. It also addresses options for who should be regulated.

There are two basic options for regulation:

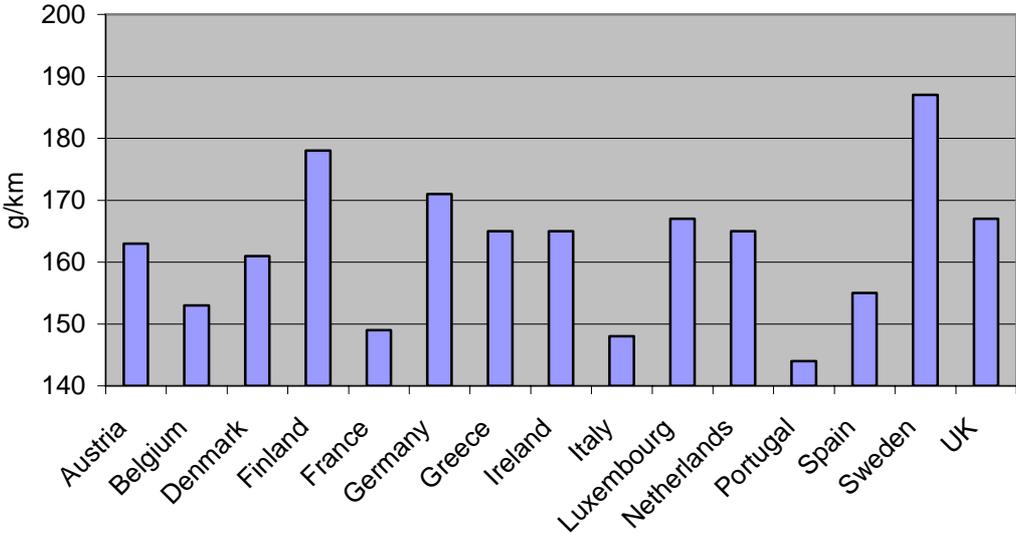
- a Community Directive establishing a legal framework and responsibility for Member States to achieve the target level
- a European regulation of the motor industry enforcing the target level

² However, the fuel efficiency in light commercial vehicles does not have anything to do with passenger cars!

2.1 A framework directive

In a case where Member States are given the responsibility for achieving a common target level, they could be allowed the flexibility to trade credits with one another to help achieve the objective. This flexibility would reduce the overall cost of the directive but would lead to significant costs and benefits for different Member States due to the wide range of current performance as illustrated in Figure 2. The figure illustrates 10 of the EU15, including the UK, would be expected to need to buy credits to meet a common target for Member States – in view of the high current level of emissions. The principal beneficiaries would be some new members of the EU plus Portugal, France and Italy.

Figure 2. New Car CO2 Emissions in the EU15



T&E 2007

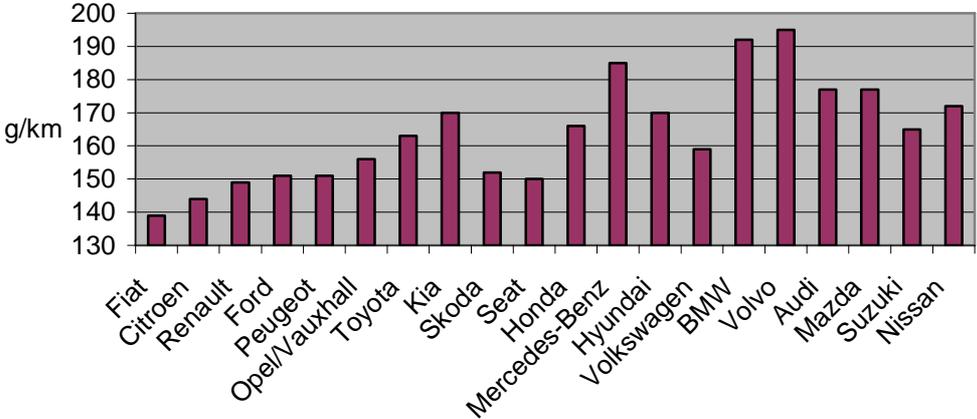
This approach provides flexibility for Member States to achieve the target in the most appropriate way for their local market. However, it has the potential to further fragment the EU vehicle market. Furthermore, in theory, a Member State could, by buying credits from other Member States, simply meet the costs of the measure and therefore provide an effective subsidy for high emissions vehicles. This is most likely in Sweden and Germany where there is a preponderance of manufacturers of high emitting vehicles. The scheme could therefore operate as a de facto state aid. Such policy measures will make the automotive industry adjust the pre-tax price in order to optimize their market shares in a way very similar to the current practice used to neutralize the effect of high sales taxes.

If, on the other hand, the governments of the two trading Member States, respectively compensate and charge the customers, the outcome would not differ from a case where the industry on a corporate level is selling and buying credits.

2.2 An EU regulation

The alternative approach is an EU regulation on vehicle manufacturers to require them, on average, to produce vehicles achieving the target level. This approach places the responsibility on the vehicle manufacturer. The range of performance amongst brands varies widely (Figure 3) and burden is not therefore equal. Assuming some form of trading is permissible there will be significant capital flows between producers of predominately high emission vehicles (Volvo, BMW and Mercedes-Benz) and low emissions vehicle producers (PSA and Fiat). Furthermore, manufacturers are unable to influence vehicle taxation regimes and therefore only have partial influence over the vehicles being sold. Without favorable fiscal incentives for low carbon vehicles and appropriate consumer information, the cost of achieving the target level will therefore rise.

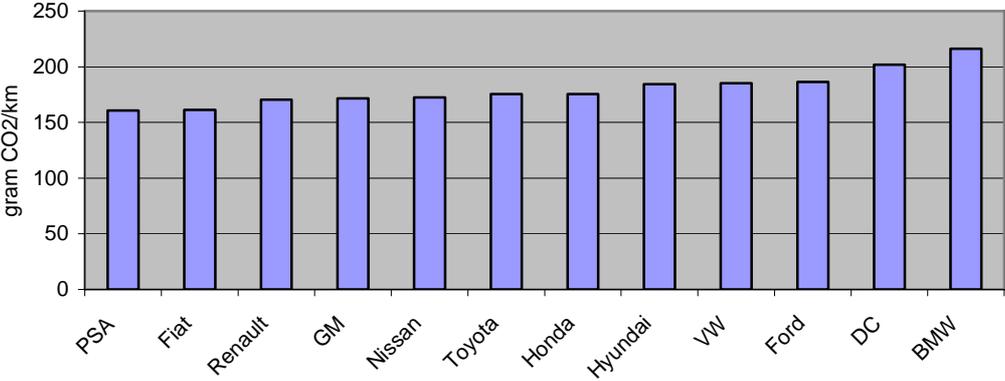
Figure 3. Average new car CO2 emissions by Brand



Source : T&E (2006).

While Figure 3 shows average new car emissions by brand, Figure 4 displays the average emission by car corporation. By allocating the responsibility on a corporate level, the industry is given greater flexibility in delivering the target. The figures suggest that even if the producers of large cars is given some compensation for utility, some corporations will still be unable to meet the target level without trading.

Figure 4. Corporate fleet average emission



Source: SAM Research and WRI (2005)

The analysis indicates the need for car corporations to trade emission credits in order to achieve the overall target at least possible cost. The alternative to tradable credits is to use a high non-compliance fee that will make most consumers choose cars that meet the baseline. These two instruments for making the market comply will be analysed in later sections of this paper.

2.3 A hybrid approach

In view of the shared influence of both Member States and vehicle manufacturers in delivering low carbon vehicles, a hybrid approach could also be considered. This would require vehicle manufacturers in Member States to achieve the target either through their own efforts or trading. Such a scheme would be administratively more complex and involve a much larger number of individual entities being required to meet the target level (most of which would be owned by the same European Companies). This approach would, however, encourage Member States to support the market for low carbon vehicles to avoid the need for national businesses being significantly disadvantaged. It may however lead to further fragmentation of the EU market.

2.4 A preliminary conclusion

A preliminary conclusion on the choice between a framework directive and an EC regulation is that the former should be avoided for three reasons:

- the wide range of performance between Member States would create significant challenges and high costs for some countries
- applying Member State responsibility would further fragment the EU vehicle market and cause distortions
- the overall cost of achieving the target will be higher

On balance, placing the responsibility for achieving the target on vehicle manufacturers on a corporate level, but encouraging Member States to employ fiscal incentives and improved consumer information to support the market is considered the optimal approach.

2.5 What entity should be held responsible?

As noted above allocating the responsibility for achieving the target to car corporations on a European level would provide manufacturers maximum flexibility. If a corporation preferred to put the liability with each brand and subsidiary, it should be allowed to do so. To go one step further and delegate the responsibility to trade bodies in all of the 27 Member States is also feasible but should be avoided as it significantly raises the number of regulated parties and the administrative costs. Decentralising responsibility to the national level would also require a much higher number of transactions in the CO₂ credit market. Making companies in individual Member States liable would only make sense in a case where Member States are responsible for attaining the target.

2.6 CO₂ emissions baseline or fuel efficiency standard?

It is not self-evident that regulating specific CO₂ emissions is better than regulating fuel efficiency. In January 2007, the European Commission published a proposal for revising the fuel quality directive, which if accepted by the Council and the European Parliament, means that well-to-wheel carbon emissions from road transport fuels shall decrease, per unit of energy, by 10 per cent by 2020. In addition, the Commission proposes in its communication on CO₂ emissions from new cars that the automotive industry shall be granted a 10 gram discount on the existing 120 g/km target as a reward for undertaking measures that reduce emissions in ways that are not reflected by the current test cycle, among them increased use of biofuels. Taken together this means that the promotion of a gradual shift to non-fossil fuels is encouraged in addition to seeking to improve new car CO₂ emissions.

Improving the fuel efficiency of new vehicles is important regardless of the fuel used. Biofuels are not carbon neutral and in limited supply. It is therefore logical of the Commission to suggest that the fleet average emission CO₂ value for new cars shall apply also to flexible-fuel and bi-fuel vehicles that can run on both fossil and renewable fuels. However, it is equally important that cars that can make use only of a biofuel are fuel efficient. Such vehicles are currently not covered by the official test cycle. Regulating the energy per car kilometre might therefore be better than introducing an emission limit value. A solution of this kind would also facilitate the potential future extension of the scheme to vehicles that use hydrogen or electricity.

3. Should vehicle utility be taken into account?

A key consideration is the extent to which the inherently higher emissions from larger vehicles should be allowed for in the regulation. Larger vehicles are said to have a greater utility.

Families with more than two or three children need large cars that are also useful, for instance, as taxis. Some vehicles are required for towing and therefore require greater power. For some models such as sports cars, executive vehicles or SUVs high performance is a consumer choice. It is a matter for debate whether these vehicles should be compensated for their higher emissions. Japan and China have introduced regulations for the fuel efficiency of new cars that take account of the extra utility offered by large vehicles. The United States enforces a corporate fleet average fuel efficiency requirement which does not reflect differences in size and utility although there are exemptions for light trucks.

In order to achieve political agreement on the cars CO₂ regulation it is probably necessary to take some account of vehicle utility. Otherwise specific manufacturers will potentially incur significant new burdens and others large credits (Figure 5). Specifically, German and Swedish companies will be disadvantaged compared to those in France and Italy. Potentially large capital flows as a result of the regulation are likely to be unacceptable to those disadvantaged (assuming trading is permitted). However, in order not to unacceptably compromise the fleet average target, it is essential to design the compensation to avoid overcompensation, encourage downsizing and not introduce perverse incentives. Table 1 shows passenger car registrations' breakdown by segments in EU15. Close to 70 per cent of all new registrations in 2006 were cars in the two smallest market segments, "small" and "lower medium". However, the combined sales of Sport Utility Vehicles and Multi Purpose Vehicles rose five fold between 1990 and 2006. The increase in vehicle weight and power is a key factor for the voluntary agreement target being missed.

Table 1. Specific emissions from new registrations in 2006 by segments in EU15 + EFTA.³

Vehicle segments	Share of sales, %	Average CO2 emission g/km
Small	35	140
Lower medium	33	155
Upper medium	12	175
Executive	11	215
SUV/MPV	9	190

Allowing large cars to emit more CO₂ without penalty (compared to smaller cars) eases the burden upon manufacturers of these vehicles. However, compensating for size (utility) has risks in terms of delivering the required improvements in CO₂ emissions. Compensating for the higher utility of large cars reduces the incentive to down-size – the cheapest way of reducing emissions – it therefore leads to higher overall costs.

In recent years the trend has been for manufacturers to move “upmarket” into larger model segments to increase profitability.⁴ Allowing for vehicle utility will, to some extent, support this unsustainable trend. Furthermore, consumers of new large cars are willing to pay a premium for luxury, fashion and utility allowing manufacturers to increase the margin on these vehicles. Two surveys on advertising carried out in the UK and Germany point towards more intensive advertising for vehicles with high CO₂ emissions.⁵ If as a result of the compensation, the market share for large cars, SUVs and MPVs increases, the overall fleet target of 130 grams might not be reached. This may argue in favour of not allowing the emission limit curve to fully compensate the producer and the customer for the extra energy needed to move a larger car.

Introducing regulation will create winners and losers but the use of a utility measure reduces the distinction between these extremes and eases the market transition to lower carbon models reducing the risk of short-term losses of profitability and jobs. It will, however, make overall compliance more expensive and might lead to a situation where the Community hesitates to enforce stringent long-term fuel efficiency standards. One approach may be to offer producers of large cars a baseline that takes account of size but where the differentiation for utility diminishes over time.

Whatever utility function is applied, a large car should not be overcompensated proportional to the extra emissions caused by its higher weight and its larger front surface. By only compensating for part of the extra power needed (all else equal), the risk diminishes that benefits of the regulation will be offset but upsizing in the market and potentially a failure to achieve the fleet average target. Figure 5 shows two potential forms of regulation - with and without the utility function. Limit Curve 2 applies a utility function and therefore allows higher emissions for larger vehicles and aims on average to achieve the target level. Limit Curve 1 has no utility function and larger, higher emitting vehicles are disadvantaged.

³ *Options for legislative approach of the EU CO₂ & cars policy*, Ulrich Höfner and Karl-Heinz Zierock, power-point presentation, 16 February 2007, Institut für Energie- und Umweltforschung, Heidelberg.

⁴ Citigroup Global Markets Ltd, *CO₂ - A new Investor Issue for 2007. Time to take Note of Mix Threat to European Automakers*, 2007.

⁵ BUND für Umwelt und Naturschutz Deutschland, *Die Werbung Deutscher Automobilhersteller*, 2006, and Friends of the Earth, *Government and industry must do more on greener cars*, press release, London 10 November 2006.

The Figure 5 shows three vehicles: A, B and C. Vehicles A and C have a similar utility. Table 2 illustrates the impact of the utility function for the 3 vehicles.

Figure 5: Effect of taking account of vehicle utility

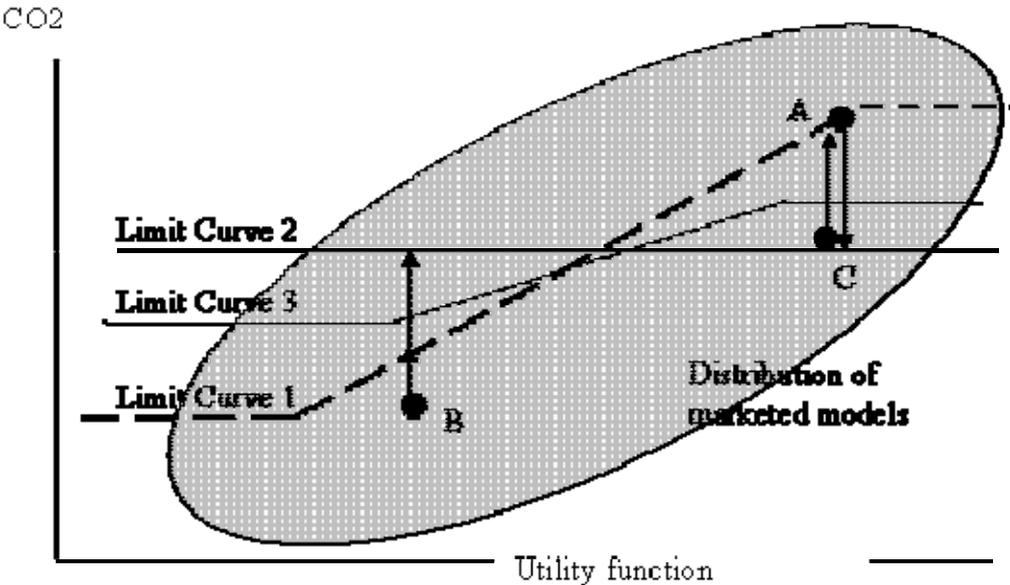


Table 2. Effects of differing limit curves.

Vehicle	Limit Curve 1	Limit Curve 2
A	No penalty	Penalty
B	Small credit	Large credit
C	Large credit	No penalty

Limit Curve 2 (no utility) will significantly encourage downsizing compared to Limit Curve 1 and significantly encourage adoption of new technology – particularly to higher emission vehicles that would otherwise pay a significant penalty. However, there will be significant market adjustment and manufacturers focused on producing predominately larger vehicles would be disadvantaged.

Over time it is probably desirable to reduce the slope of the limit value curve (illustrated in the figure as Limit Curve 3). This recognises in the early years manufacturers of larger vehicles need time to adapt, but in the longer term the market is incentivised to downsize as much as possible and drivers of smaller vehicles are rewarded accordingly.

The limit curve should, probably, be flat-ended in both ends. At the lower end, it will be difficult for manufacturers to reduce fuel consumption per square cm below a certain threshold as the front area cannot diminish indefinitely and as certain features of a car have to be more or less the same regardless of its size. At the upper end, it does not make sense to accommodate

passenger cars that are longer than five meters or wider than 1.9 meters.⁶ A manufacturer of SUVs, limos, or MPVs, who wants to make his vehicles even longer or wider, would have to endeavour to make them extra fuel-efficient for their size.

It is probably more effective to use a continuous function for utility rather than a segmented approach as the latter would give rise to an “edge effect” where automakers would seek to ensure a vehicle just fell into a given banding category. A continuous utility function could be expressed as gram per square cm (rather than square dm).

One should be aware of the potential need for increasing the long-term stringency of the standard if significant upsizing of the fleet occurs as a consequence of compensating for higher utility.

4. What utility measures are appropriate?

The form of the Utility Function is particularly important. The vehicle “footprint” (wheelbase x track width) is a credible option as it cannot readily be manipulated to increase the permissible emission. The specific fuel consumption, however, does not necessarily increase in proportion to volume or bottom area. Vehicle volume is an alternative but would potentially provide a perverse incentive for vehicles to be designed as aerodynamically as possible. ACEA has proposed that weight should be used for the utility function, as in China and Japan. However, this rewards heavier vehicles, whereas the intention is to encourage down weighting to reduce emissions. Further work is needed to optimise the choice of utility function.

A key consideration is the extent to which the utility function takes account of the higher emissions for vehicles with more than five seats. MPVs equipped with seven seats have a clear utility value which makes them useful for large families and as taxis. To make room for two extra seats in the rear, they have to be somewhat taller than the conventional car. Whereas their length and width do not necessarily differ from other large cars, this would tend to indicate interior volume should be considered. However, if an MPV with seven seats were to be given a higher baseline value than other cars with the same vehicle foot-print, this may cause customers to buy the MPV and remove the two rear seats, if they by doing so could get a roomy car for a lower price. Rewarding vehicle volume is also problematic as it would give SUVs and other tall vehicles an advantage over other cars of the same length and width

When enforcing stringent CO₂ emission standards on passenger cars, there is a risk that part of the market will shift to other light duty vehicles if, as a result of the reform, the incremental cost of choosing a small van or a pick-up truck with five seats has diminished or even become negative. It is therefore essential that the European Commission presents a similar scheme for vans and light lorries.

⁶ The footprint would, of course, be smaller than 5.0x1.9 meters as parts of the vehicle bottom area would fall outside the area defined by the wheelbase and the track width. The latter might have to be defined as the distance between the inside of two opposite wheels in order to avoid giving manufacturers an incentive to equip the car with wide tires (which would raise rolling resistance).

5. Should trading emission credits be permissible?

Trading CO₂ emission credits achieves attainment of the target at lower cost by allowing vehicle manufacturers that over-achieve the fleet average requirement for a given year to sell its surplus credits (equal to the difference between his achievement and the baseline) to another company that needs additional credits.

Trading could be mandatory or voluntary. In the first case, all credits from over-compliance would be sold on auction by an EU agency in charge of the scheme (and the revenue returned to the sellers). This means that a potential seller could not withhold surplus credits from the market, which could potentially increase the costs for competitors that are unable to achieve the fleet average target for their own sales. The sellers would profit from the proceeds, and the buyers would have the advantage of not having to undertake measures costing more than the equilibrium price of the auction. A mandatory trading scheme would potentially prevent manufacturers with credits banking surplus certificates for a future year (unless the scheme rules permit some level of banking).

A voluntary trading scheme may have less market liquidity as some companies with credits may choose to bank certificates for their own future use, or to raise the market price of credits in the market to disadvantage competitors. One approach would be to manage the level of banking that is permissible (for example to only allow x% of certificates to be carried forward for use in future years and to only allow certificates to be banked for a limited number of years). Any certificates not used would be surrendered and valueless. An alternative approach would be to gradually reduce the value of credits that are not used. One option might be to rule that they lose half their value if not used within 12 months and that the remaining value is halved for every additional twelve months that pass. In a case of mandatory trade, however, the rule must be that the corporation must submit any excess credits for auctioning already after, say, three months.

It would be perverse for the scheme to prohibit trade between manufacturers for their mutual benefit. The administrative cost of credit trading will be small as the system for registration and monitoring of compliance would be the same for a scheme that does not allow trade. To achieve least cost compliance trading is essential. Reducing emissions at the lowest possible cost is important to ensure the cost to customers is acceptable and does not significantly affect the new car market and to encourage regulators to establish and maintain appropriate targets.

A further consideration is whether the trading scheme should be closed or open to permit trades with other schemes such as the EU ETS. However, there is a principal difference between credits for specific emissions or fuel consumption on the one hand and allowances matching actual emissions on the other. The latter are also influenced by annual mileage and driving style. An open scheme also has an anomaly in that new cars will continue to emit CO₂ for the next 15-20 years whereas credits would be purchased at current prices – which are likely to be significantly lower than those needed for making the EU comply with more stringent future emission targets.

Since it will take 15-20 years to replace the entire European car fleet it is important to encourage the early introduction of new technology given the anticipated rising marginal CO₂ abatement costs for post-Kyoto commitments

6. Penalties and Rebates

Some mechanisms for dealing with non-compliance must be incorporated with the regulation. The American CAFE Act requires each manufacturer to meet a fleet average target at the corporate level. Fines are used to punish non-compliance and encourage corporations to meet the terms. Europe could introduce a similar system but the penalties would have to be high to make non-compliance the last resort.

In a system where the baseline is differentiated for vehicle foot-print, non-compliance can occur because of shortcomings among small or large vehicles. However, if compensation for the utility of size is moderate, the risk for non-compliance could be expected to be larger among producers of large cars. Fines can be contemplated as a stand alone solution or in combination with tradable credits. The risk of having to rely on them would be greater in the first case and suggest higher penalties would be necessary.

To diminish the risk of missing the overall fleet average target, the penalty should be higher than the anticipated marginal abatement cost. Since non-compliance may occur in any size group it would have to be set at a level that clearly exceeds the marginal compliance cost of all segments. The automotive industry has argued that the cost of achieving an average of 130 gram in 2012 is, indeed, very high. Other experts dispute this estimate, but to be on the safe side, this might be the right level for the penalty.

It will be important to establish an appropriate penalty system from the start of the regulation in order for manufacturers to make appropriate judgements regarding the least cost solution. If the penalty is not established from start set at a rate that acts as a deterrent, the rate of progress is likely to be diminished. It will also be essential to undertake an assessment of the system after a few years to make sure that the established level is appropriate.

6.1 Using the revenues

A system of fines will eventually produce revenues raising the issue of how these should be used. Four principal ways of utilizing revenues can be identified:

1. Fines could be collected by Member States and used by their treasuries. This would be regarded as a form of taxation, which would complicate the EU decision-making process.
2. The fines could be distributed among manufacturers or importers according to their individual degree of over-compliance. If recycled in this manner, the flow of money between manufacturers would be similar to the outcome of a mandatory tradable credit system. In this case the net-flow of capital would increase as the fine would by definition be higher than the equilibrium price in the credit market.
3. The proceeds could be returned to the industry on the basis of sales (same amount for all cars regardless of CO₂ performance). Compared with the second alternative (above), this would, however, weaken the incentive among producers to reduce emissions below the baseline.

4. The revenues could finance an EU fund for the promotion of low-emitting vehicle technologies. This alternative makes sense in a situation where non-compliance fines are used in combination with credits trading (and where the proceeds are relatively small).

7. Reporting and monitoring

Introducing a European CO₂ baseline and, possibly, a scheme for tradable credits cannot be done without addressing a number of practical issues. The system for reporting and monitoring specific CO₂ emissions from new registrations can build on the current model, but the introduction of a corporate fleet average requirement raises new issues. The relevant national agencies must be supplemented by a European agency or clearing centre, to which the former report the CO₂ credit surpluses or deficits for the sales of each corporation. This common agency could also be in charge of auctioning credits (in a case of mandatory trade) and non-compliance penalties, and the redistribution of revenues.

8. Minimising market disturbance

The introduction of a regulatory mechanism to significantly reduce CO₂ emissions will result in a degree of market adjustment with winners and losers. Market distortions can however be minimized by ensuring that:

1. The regulation is technology neutral
2. The industry is given adequate notice of changes and clear long-term targets
3. Tax and public information policies complement regulation and encourage the sale of lower carbon vehicles
4. Penalties are rebated to overachieving companies and do not result in a net cost to industry

The target of 120g/km was originally proposed in 1995, to be met in 2005. The industry should not therefore be surprised by the proposed strengthening of requirements beyond the agreed 2008/09 target of 140 gram per kilometer. Given the long development cycles for new models, the extent to which the proposed target is attainable however remains a key issue of debate.

At the recent rate of progress (illustrated in Figure 1), by 2012 average emissions would be 148-151g/km for the three trade bodies. The proposed target therefore requires a significant acceleration of progress beyond current business as usual projections. However, an additional reduction of 10 g/km four to five years beyond the 140g/km voluntary agreement target is consistent with existing policy.

Designing the regulation in a way that to a degree compensates for vehicle utility will reduce market disruption and provide greater flexibility. Undoubtedly the demands for reduced CO₂ emissions will have a profound effect on the motor industry in the next 20 years although the precise implications are difficult to assess. It should also be noted profound change in the industry would anyway be expected due to the creation of new markets, changing cost bases, the need to address overcapacity and to reduce costs. The European industry currently pro-

duces vehicles with lower average emissions than overseas competitors providing a competitive advantage as demand for low carbon and fuel efficient vehicles grows.

The timescales for decision making are important. Introducing a stringent CO₂ baseline with relatively short notice requires the industry to make investment decisions without full knowledge of the market in which it will be operating. This is not unusual, but risks can be reduced by providing certainty of the regulatory framework for a long period – until beyond 2020 and an indication of the penalties or CO₂ credit market price. This could be achieved by the EU to guaranteeing a floor price for the credits (i.e. the EU or Member States promise to buy at that price). This would encourage manufacturers to try to reduce emissions well below the baseline for different foot-prints. A ceiling for the price of credits would not be needed as the non-compliance fine could be considered a buy-out price.

If there is uncertainty about the level of long-term targets, the Community could decide on bands (upper and lower limits) for the future baselines, for instance, for 2016 and 2020, which are gradually tightened as those target years come closer. This would give the manufacturers an early signal about what is the minimum expected from them, while at the same time keeping the door open for the possible market introduction of new materials and technologies. Alternatively the Commission could set a target based upon an annual rate of future projections.

9. Customer's perspective

The overall level of sales in the European market need not necessarily be affected by the introduction of CO₂ regulation and will depend upon how customers adapt to the new situation. There are four principal ways consumers may adapt:

1. Customers who put high value on power and performance may choose to pay the incremental cost of advanced materials and engine technologies that will deliver high performance at lower CO₂ emissions. These vehicles will probably remain above average in their emissions. The cost of purchasing these vehicles will therefore rise to cover the cost of the technology and any penalty the company may incur for supplying a vehicle with relatively high CO₂ emissions. Consumers requiring these vehicles are likely to be relatively price insensitive but the higher costs are likely to mean the high level of margin manufacturers currently achieve may be squeezed by the higher cost of these vehicles .
2. Other customers may, for economic reasons prefer to accept a somewhat less powerful car than they would have chosen prior to the regulation. The extent to which this happens will depend upon how the regulation and other complementary measures affects the price of vehicles. These vehicles will tend to have lower CO₂ emissions and may benefit from any redistribution of penalties from high emission vehicles. Manufacturers may therefore be able to increase margins on these vehicles – or increase turnover by making them relatively cheaper.
3. A further approach to consumer adaptation is to downsize and select a smaller car than previously. This strategy is beneficial for manufacturers of small to medium sized cars. It will increase sales and address overcapacity and currently low margins in these market segments. There would however be a downside for producers of large cars, MPVs and SUVs that may suffer lower market shares.

4. Some consumers may postpone the purchase of a new car. The extent to which regulation affects overall demand will be important both in terms of the impact upon the industry and environmental benefits – particularly for air quality where new models are significantly cleaner. However, this type of response, if it occurs, is only likely to be temporary.

The extent to which purchasers of larger vehicles are compensated by any utility function will profoundly influence the impact of the regulation on consumers, and the overall effectiveness of the regulation. Specifically the degree of incline of the utility function and CO₂ emissions baseline will influence the extent to which drivers of larger and higher emitting vehicles are compensated by drivers of smaller more efficient vehicles and therefore the burden-sharing among different categories of customers.

As companies and wealthy households often buy large cars, they will gain from a steep incline, while low-income households will lose. A flexible system (based on tradable credits) will benefit all categories of customers as it will help producers to meet the baseline at least possible cost.

Adjusting to the new regime need not necessarily increase costs significantly. The Society of Motor Manufacturers and Traders (SMMT) UK suggest that a reduction of up to 30 per cent in average fleet CO₂ emissions could be achievable if every customer chose the most fuel efficient vehicle in its category.⁷ While buying the most efficient model in each segment, typically diesel-fuelled, may cost more than the average car of the same size, it will reduce the variable costs. Cutting the fleet average emission by 30 gram per kilometer (from 160 to 130) means that the average diesel-fuelled passenger car will consume 231 liters less when driven 20 000 kilometers per annum, thereby saving its owner from a fuel expense of at least 230 Euro (more in Member States with a high excise duty). Over the life of the vehicle the accumulated sum will exceed 2,000 Euros.

The annual cost of road fuel makes up a relatively large share of the transport costs of most families. Low-income households, which generally cannot afford to buy new cars and tend to own a majority of all cars older than 8-10 years, depend on the preferences of the rich, who often choose cars without paying much attention to fuel cost. Low and medium income families are more vulnerable than companies and wealthy households to the steep increases in fuel costs and vehicle taxation that might be required to achieve longer-term CO₂ objectives. Regulation of new car CO₂ emissions can therefore be considered a socially inclusive policy since in the future more efficient second-hand cars will be cheaper to run. Broad access to low-carbon fuel efficient cars will help sell the climate change mitigation policy to the public that otherwise may focus on the potential increase in the cost of using the car.

10. Supplementary measures

A number of supplementary policy measures can be identified. They can help the industry convince the market that fuel efficiency is something to strive for. The existing European scheme for labeling CO₂ emissions from new cars can be improved. Several Member States have already introduced systems where cars are divided in bands depending on their specific fuel consumption and CO₂ emissions, or are in the process of doing so. Differentiating vehicle

⁷ Department for Transport, *Low Carbon Transport Innovation Strategy*, May 2007, with reference to SMMT.

and company car taxation for CO₂ emissions is another possibility. Rebates on parking fees and congestion charges may also be used for promoting fuel efficient cars but they should not be designed in a way that encourages driving.

If a skewed baseline, that takes account of vehicle utility, is introduced, there may be cause to consider a European labeling system that tells the customer to what extent the individual car fails to meet or underscores the bench-mark. This means that the bands introduced by the United Kingdom and other Member States may have to be adjusted for the vehicles' footprint. An alternative option would be to stick to the current bands which promote down-sizing of both vehicles and engines.

Member States that promote vehicles that can use alternative fuels regardless of how much fuel they use per 100 kilometers will have to reconsider their incentives in order to contribute to the overall European fleet average target. Sweden currently provides large benefits to owners of flexible fuel vehicles (FFV) provided that the car does not emit more than 218 gram CO₂ per kilometer, which means that even some vehicles with emissions falling within the United Kingdom's F band are heavily subsidized.⁸ As a result, the average fuel consumption (petrol-equivalent) from the country's ethanol-driven new cars rose from 6.9 to 8.2 liters per 100 km between 2004 and 2006.⁹

The incentives provided are sometimes so large that they may violate the Community's rules on state aid, especially if they are also tailor-made to fit the interests of a Member State's car industry. The European Commission has recognized the risk associated with high registration taxes but not observed that large subsidies can create the same type of distortion. There may, thus, be need for EU guidelines in order to avoid disproportional subsidies and market distortions. Such guidelines could also provide guidance on how Member States may design incentives for the promotion of low-emitting models.

11. Summary and conclusions

This paper discusses options for the design of the legal framework for the implementation of the Commission's proposal for setting a limit of 130 gram per kilometre on the average CO₂ emission from new passenger cars. It describes two basic options for regulation:

- A Community Directive establishing a legal framework and responsibility for Member States to achieve the target level; and
- A European regulation of the motor industry enforcing the target level

The first approach provides flexibility for Member States to achieve the target in the most appropriate way for their local market. However, it has the potential to further fragment the EU vehicle market and may encourage Member States to provide subsidies for high emissions vehicles by governments buying surplus credits from other Member States. A regulation would allocate responsibility for achieving the target to car corporations on a European level and provide manufacturers maximum flexibility as it allows them to balance emissions credits among all of their brands. It is preferred as a lower cost option.

⁸ Owners of an E85-cars living in down-time Stockholm can enjoy exemptions from taxes and parking fees amounting to more than €2,000 per year.

⁹ The Swedish National Road Administration, *Bilarna blir snålare – men betydligt mer krävs för att nå klimatmål*, 2007-03-13.

In the design of the regulation a key consideration is the extent to which the inherently higher emissions from larger vehicles should be supported. Accounting for utility will reduce market distortions and help to avoid short-term losses of capital and jobs. It does, however, reduce the incentive to downsize – the cheapest way of reducing emissions – it therefore leads to higher overall costs. To ensure the target is achieved any account of utility should avoid over-compensation, encourage downsizing and avoid perverse incentives (such as rewarding heavier vehicles) The emission limit curve should not therefore fully compensate the producer and the customer for the extra energy needed to move a larger car and over time it will be necessary to reduce the slope of the limit value curve. This recognises in the early years manufacturers of larger vehicles need time to adapt, but in the longer term the market is incentivised to downsize as much as possible and drivers of smaller vehicles are rewarded accordingly.

The curve should probably be flat at both ends. At the lower end, it will be difficult for manufacturers to reduce fuel consumption below a certain threshold as the front area cannot diminish indefinitely and as certain features of a car have to be more or less the same regardless of its size. At the upper end, it does not make sense to accommodate passenger cars that are longer than five meters. It is probably more effective to use a continuous function for utility rather than a segmented approach as the latter would give rise to an “edge effect” where automakers would seek to ensure a vehicle just fell into a given banding category.

The form of the Utility Function is particularly important. The vehicle “footprint” (wheelbase x track width) is a credible option as it cannot readily be manipulated to increase the permissible emissions. The specific fuel consumption, however, does not necessarily increase in proportion to volume or bottom area. Vehicle volume is an alternative but would potentially provide a perverse incentive for vehicles to be designed as aerodynamically as possible. ACEA has proposed that weight should be used for the utility function, as in China and Japan. However, this rewards heavier vehicles, whereas the intention is to encourage down weighting reducing emissions.

To achieve least cost compliance trading in CO₂ credits is essential. Trading achieves attainment of the target at lower cost by allowing vehicle manufacturers that surpass the fleet average requirement for a given year to sell its surplus credits (equal to the difference between his achievement and the baseline) to another company that needs additional credits. Trading could be mandatory or voluntary. In the first case, all credits from over-compliance would be sold on auction by an EU agency in charge of the scheme (and the revenue returned to the sellers). A voluntary trading scheme may have less market liquidity as some companies with credits may choose to bank certificates for their own future use, or to raise the market price of credits in the market to disadvantage competitors.

A closed trading scheme is seen as a better solution than an open one linked to the EU ETS. An open scheme has an anomaly in that new cars will continue to emit CO₂ for the next 15-20 years whereas credits would be purchased at current prices – which are likely to be significantly lower than those needed for making the EU comply with more stringent future emission targets.

Non-compliance penalties must form an element of the scheme which should be established at a level that encourages targets to be met through the introduction of technology, downsizing or the purchase of credits. The marginal cost of achieving the target level through deployment of technology provides a basis for establishing the level of fines. Revenues created could be

distributed among manufacturers or importers providing an incentive for over-achieving the target.

The timescales for decision making are important. Introducing a stringent CO₂ baseline with relatively short notice implies requires the industry to make investment decisions without full knowledge of the market in which it will be operating. This is not unusual, but risks can be reduced by providing certainty of the regulatory framework for a long period say, until 2020.

With uncertainty about the feasibility of the long-term targets, the Community could decide on bands (upper and lower limits) for the future baselines, for instance, for 2016 and 2020, which are gradually tightened as those target years come closer. This would give the manufacturers an early signal about what is the minimum expected from them, while at the same time keeping the door open for the possible market introduction of new materials and technologies.

Supplementary fiscal incentives and other policy measures will help to shift the market in favour of low carbon vehicles and assist the industry in convincing the market that fuel efficiency is something to strive for and achieve the target. EU guidelines might be needed in order to avoid disproportional subsidies and market distortions.