Energy use of company cars

Erna Schol and Richard Smokers,
Netherlands Energy Research Foundation (ECN)

1. SYNOPSIS

This paper investigates the potential for energy saving achievable by fleet owners, if they take the energy efficiency of company cars into consideration in their purchasing decisions.

2. ABSTRACT

We have estimated the potential for energy saving which can be achieved by fleet owners who allow the energy efficiency of company cars to play a decisive role in their purchasing decisions. To this end five real fleet cases have been studied. The passenger cars in those fleets have been categorized with the help of a classification system based upon a combination of purchase price and engine power. With this system commercially available passenger cars have been divided into five categories of vehicle types comparable with respect to performance, status and level of comfort. If in each class all vehicles would be replaced by the most efficient car type in that class, the average energy saving for the five fleets is estimated at some 5%. If in each class only those vehicles are replaced which have higher annual capital costs than the most efficient one, we still find a potential energy saving of almost 4%, which in this case is accompanied by a significant reduction of both fuel and capital costs. Fleet owners are either not aware of the fact that energy saving can be cost effective, or have other less rational arguments for not buying the most energy efficient cars among those available. Information campaigns or tax incentives might stimulate fleet owners to realize the assessed potential for energy saving.

3. INTRODUCTION

Following the first motive for energy saving, namely the oil crises in the seventies, it is now the environmental problems such as global warming and air pollution in inner cities which provides a new and strong incentive for the reduction of fossil fuel consumption in the transportation sector (IEA 1991). This sector is in many countries a target group for energy saving policies. The reason for this lies in the fact that transport not only takes an important share in the total final energy consumption (for example in EEC countries 29% (IEA 1992), and 17% in the Netherlands), but also contributes a more than proportional share to the emission of acidifying and other pollutant substances. About half the total oil consumption in EEC countries is used for transportation. In 1990, road traffic accounted for 83% of the energy consumption of the transport sector in EEC countries (78% in the Netherlands). Passenger cars accounted for 67% of total road traffic in the Netherlands.

Of all the passenger cars in the Netherlands 10% have been registered in the name of companies. Although this share in the total number of passenger cars is relatively small, 24% of the total fuel consumption of passenger cars is used by these company cars. This is caused by the fact that the average annual distance driven by company cars is twice that of private cars. Also company cars weigh on average 200 kg more than a private car. Moreover, company cars in the Netherlands represent a large portion of new passenger car sales (35% in 1991). As a consequence the average vehicle size of the car stock as a whole, and thus its energy consumption, is influenced by the sale of second-hand company cars.

This paper will address the potential for energy saving, which can be achieved by fleet owners if they consider the energy efficiency of a car as a serious argument in their purchase decision-making process.

The Centre for Energy Saving and Clean Technolgy (Rutten et al. 1990) made calculations for the Dutch situation, estimating the potential energy saving when only energy efficient cars of 600 kg are purchased. However, such a replacement scheme seems too drastic in the short term context considered here. Many companies supply their employees a car in the scope of fringe benefits. For these fleet owners considerations other than fuel consumption, such as performance, status, comfort, overall costs, etc. play a decisive role in the choice of vehicle types. It is not to be expected that fleet owners will readily abandon this prioritization in the near future. Therefore we will try to show that, even if these values of status and comfort are acknowledged, a significant energy and cost saving can be achieved by purchasing the most efficient cars from those vehicle types which seem comparable with respect to the above considerations of status and level of comfort.

In choosing a type of passenger car for an employee, fleet owners make distinctions in car types for several classes of their employees. For example a luxury car may be purchased for use by the director, while medium-sized cars are offered to the middle management. Acknowledging this wish for distinction, we have taken the present classification of cars as a starting point to calculate of the potential for energy saving by fleet owners. Thus, within each distinguishable car class the difference in fuel consumption will be calculated between a fleet of the most energy efficient cars and the present fleet. We will also consider the possible savings in case only those vehicles which are more expensive than the most efficient one in their class, are replaced by the most efficient model. Potentials estimated in this way seem realistically attainable as the proposed measures do not require a significant change in people's attitudes towards the less material aspects of car use.

Finally some suggestions will be made for measures that may stimulate fleet owners to buy the most energy efficient cars within each car class.

4. METHODOLOGY

4.1. Classification of passenger cars

In order to acknowledge the need of fleet owners for distinguishing between cars for different classes of employees, it will be necessary to divide passenger cars in different classes of more or less comparable vehicle types. The calculations presented in this paper have been carried out for five real cases of fleet composition, and a system of car classification is devised to appropriately categorize these real fleets. The following cases, which differ in fleet size and in economic activity of the fleetowner, have been studied:

Table 1. ***The Five Fleet Cases studied in this Paper***

case	economic activity	fleet size
A	Industry	168
B	Construction	102
C	Bank	82
D	Estate agency	23
E	Social organization	218

Some practical information can be gained from of these cases. There appear to be no company cars with a cylinder capacity less than 1000 cc. There are very few passenger cars with a purchasing price above 65.000 guilders. It seems realistic to divide passenger cars in more or less homogeneous classes characterized by a combination of engine power (as a measure of performance) and purchase price (the latter as an indication of size and level of comfort). On the basis of these practical experiences the passenger cars have been divided in the following five classes:

Prices in Table 2 are indicated in Dutch guilders (1 ecu = 2,21 Dutch guilders). Most of the commercially available passenger car types (Kempen 1992) can be categorized in class 1 (19 car types) and class 2 (23 car types). Only six passenger car types are classified in the upper class. Above 65.000 guilders we are left with only a few brands and a very heterogeneous supply of car types. It is therefore very difficult and not

Table 2. ***Classification System for Passenger Cars based on a Combination of Purchase Price and Engine Power***

class	purchase price (in Dutch guilders)	range of cylinder capacity	typical cylinder capacity
I	15.000-25.000	1,0-1,3 l	1,3 l
II	25.000-35.000	1,4-1,8 l	1,6 l
III	35.000-45.000	1,8-2,0 l	2,0 l
IV	45.000-55.000	1,8-2,0 l	2,0 l
V	55.000-65.000	2,0-3,8 l	2,5 l

very useful to divide the cars above 65.000 guilders in separate homogeneous classes.

For all fleets considered we have left vans and lorries as well as cars with a purchase price above 65.000 guilders out of consideration. The size and composition of the five fleet cases as listed in Table 1 then turns out to be as follows:

After categorizing all passenger cars of all fleets into the above mentioned classes, the fuel consumption of these cars has been determined on the basis of data provided by car manufacturers (Kempen 1992). These data are inferred from the ECE tests for a city driving cycle and for highway travel at constant speeds of 90 and 120 kilometres an hour. By means of weighing these three figures a composite average fuel consumption figure has been obtained. As a weighing ratio we used 26/41/33, representing the annual distances driven by passenger cars in the Netherlands on the three road types more or less corresponding to the

Table 3. ***Categorization of Company Cars in the Fleets of Table 1***

case	fleet size	class I	II	III	IV	V
A	159	0	84	47	27	1
B	101	1	52	33	14	1
C	72	0	22	23	24	3
D	22	0	8	7	7	0
E	217	4	28	185	0	0
total	571	5	194	295	72	5

aforementioned test circumstances. The advantage of using the ECE figures for this purpose is that every car has been tested under the same circumstances. Nevertheless, in practical circumstances many cars will have a higher fuel consumption than the figures provided by car manufacturers. This is caused e.g. by relatively more city driving, an aggressive style of driving, air shafts on top of the car, spoilers, low tire pressures and so on. As company motorists have no incentive to drive economically, their driving behaviour and the effects on fuel consumption could be worse than that of the average motorist. In fact, there is UK evidence that company motorists drive faster than the average motorists (Rowell 1991). Also, the share of annual distances driven on highways by company motorists is higher than average (Ministry of Transportation 1983). Complete data on this subject are, however, not available.

All fuel consumption figures used in this article are taken from the simplest models of the various types of passenger cars available in 1993. Thus, in the various fleets all old cars are thought to be replaced by new ones of the same brand and type. As for most car types only figures for gasoline as motor fuel are available, all the diesel and liquid petroleum gas cars are thought to be replaced with gasoline versions. With respect to the latter restriction it is implicitly assumed that the roughly same differences in fuel consumption will occur between the different diesel and LPG versions within a car class as between the various gasoline types.

4.2. Energy versus costs

One of the reasons why fleet owners do not generally choose the most efficient cars may be that the most efficient cars are often more expensive than the cars they do choose to purchase. Therefore we have also calculated the annual costs of the various car types. The assumptions for this calculation are: The residual value of a car when sold amounts 40 percent of the purchase price; The company cars are depreciated in three years using the annuity method with 8% interest rate; The average number of annually driven kilometres is 30.000, and the gasoline price amounts 1.75 Dutch guilders. Because of a lack of data on the costs of maintenance and repair of each car type, these costs have not been included in the total costs mentioned here. With respect to these cost calculations it should be emphasized that this study is only aiming to assess the order of magnitude of the possible fuel savings and cost benefits. For the various fleets in different countries the details will of course be different, as fuel and car prices as well as taxes will differ.

5. RESULTS

Table 4 gives an indication of the differences in fuel consumption between car types within the various classes. The excess fuel consumption of the average car and of the least efficient car in each class are stated as a percentage compared with the most efficient car. For example, in class I, the average car uses over 9% more fuel than the most efficient car and the least efficient car uses 27% more fuel.

The total amount of fuel that could be saved if every fleetowner would buy only the most energy efficient car within each car class, has been calculated for the five cases. The results are presented in Table 5.

The fuel savings per car are simply obtained by dividing the total energy saving of a fleet by the total number of cars in that fleet. It is obvious from Table 5 that the potential fuel savings differ drastically from fleet to fleet. Fleet E turns out to be a large fleet equipped with relatively efficient vehicles. All company

Table 4. *Excess Fuel Consumption of the Average and Least Efficient Car in each Class above that of the most Efficient Car, expressed in Relative Units.*

class	average excess fuel consumption	excess fuel consumption of least efficient car in class
I	9.26%	27%
II	15.57%	40%
III	8.59%	21%
IV	11.18%	29%
V	6.15%	23%

Table 5. ***Total Fuel Savings of the Fleets if in each Class all Cars would be replaced by the most Efficient Type in that Class***

case	fleet size	# cars replaced	fuel saving relative	fuel saving (litres of gasoline) total	per car
A	159	133	5,0%	17367	109
B	101	99	7,4%	16482	163
C	72	67	8,5%	14235	198
D	22	20	6,8%	3345	152
E	217	213	2,0%	9345	43
total	571	532	4,9%	60774	106

cars of this fleet are of the same brand. It is unknown whether the choice for this brand is based on whole life- cycle costs, fuel consumption alone, other arguments or combinations of these arguments. Given the uncertainty in the fuel consumption data provided by manufacturers and the mentioned differences in

Table 6. ***Energy and Cost Savings in case only those Vehicles are replaced which are more Expensive than the most Efficient Car in each Class.***

case	fleet size	# cars replaced	fuel saving (litres of gasoline) relative	total	annual cost savings per car (in Dutch guilders) fuel	capital
A	159	111	4,2%	14340	158	249
B	101	72	5,5%	12255	212	248
C	72	50	7,5%	12576	306	393
D	22	13	4,9%	2403	191	335
E	217	28	1,2%	5460	44	107
total	571	274	3,8%	47034	144	216

consumption under test conditions and in practice, the saving calculated for fleet E is to be considered marginal. This, however, is certainly not the case for fleets A to D, and we find that significant energy savings can be achieved for these fleets. The relative potential energy saving of these fleets together appears to be of the order of 5%. At a gasoline price of 1.75 guilders the five fleet owners together can save a total of 106.350 guilders on their annual fuel costs, or correspondingly 186 guilders per car per year.

The question remains, of course, whether the most fuel efficient car is also the cheapest car in terms of annual costs. In all five classes this appears not to be the case. In class I the most efficient car is 20% more expensive than the cheapest car. For class II the difference amounts 3%, for class III 6%, for class IV 4%, and for class V only 1%. Regression analysis shows that there is no significant relationship between purchase price and fuel efficiency of a car.

One could now consider a 'no lose' change where companies replace, in each class, only the cars which have annual costs higher than or roughly equal to those of the most efficient one. In that case a reduction of both fuel consumption and annual costs may be achieved. The resulting energy savings and cost benefits of such replacement scheme are presented in Table 6.

In Table 6 the cost savings per car are defined as the total savings devided by the total number of cars in each fleet. We see that, even with this cost related restriction on the number of cars replaced, still an overall energy saving of some 4% is achievable. Although the total number of cars replaced in this scheme is only half the number replaced in the more rigorous scheme of Table 5, the overall energy savings are only 1/5 less, while the savings in this case are accompanied by a considerable cost benefit. The total cost benefit for the five fleet owners together is roughly 200.000 guilders. Divided by the total number of cars in these fleets this comes down to an annual saving of 360 Dutch guilders per car, or divided by the number of cars replaced 750 guilders for every replaced car.

6. MEASURES

From the above it is more than clear that non-negligible economic profit can be gained by fleet owners who allow fuel efficiency to be a decive argument in the choice of vehicle types. Yet, the five cases teach us that most fleets do not even come close to the most energy efficient composition as possible within the framework of a distinction of car types in different classes. This examplifies that financial arguments alone are not decisive in the fleet owners' purchasing decisions, which means that extra incentives are needed to coax fleet owners to buy more efficient cars.

6.1. Fuel efficiency information campaigns

First of all information campaigns can be set up to make fleet owners aware of the possible energy and cost savings associated with the use of more efficient cars, as outlined above. Such campaigns should be based on the results of a more detailed study than the order-of-magnitude estimation presented in this paper. A more thorough study should also include diesel and LPG vehicles, and above all calculations should be made on the basis of whole life-cycle costing, including maintenance and various taxes.

6.2. Taxes

Apparently the cost benefits of efficient cars calculated above do not balance the non-material qualities of the less efficient and more expensive cars that fleet owners do buy. In that case an extra financial stimulus might tip the scale. In the Netherlands there are several taxes on car property and use such as: tax on motor fuel, VAT, purchase tax, annual property tax and, in case of car use for business purpose, income tax. In Italy, a variabilization of VAT had a significant effect upon the fuel economy of private cars. In this country the VAT is charged at 19 percent on cars of which the engine capacity is less than 2000 cc, and above this the rate is doubled (TEST 1991). However, on company cars the variabilization of the VAT will have no influence. A more obvious measure would be to increase the variable costs by putting an extra tax on motor fuels. However, if taken in one country only, such a measure stimulates motorists who live near the border to fill up their tank in a neighbouring country and moreover this measure can not be aimed at fleet owners specifically. Therefore, governments that want to stimulate the purchase of efficient cars by fleet owners, could introduce a surcharge on the property tax for company cars. The property tax is payable every year on cars by their owners and is progressively related to the vehicle weight. In case of a fixed surcharge on the property tax the amount should in each class at least equal the difference in total annual costs between the most efficient car and the cheapest car. In case of a variable surcharge the height might increase with the energy consumption of the car, as measured in standardized test cycles. The proceeds of this property tax could be used for example to finance the above mentioned fuel efficiency information campaigns. Recently a reform of the purchase tax has been proposed in the Netherlands. The proposal aimed to stimulate the purchase of fuel efficient and less polluting passenger cars, by a rebate for 'clean' cars and a surcharge for less efficient and more polluting cars. After discussion in parliament it was decided that the proposal should be adapted and so implementation has been postponed. An other option is to reform the treatment of company cars in the income tax. In the Netherlands in 1990 the income tax has been reformed in the wrong direction, because the number of company cars in the share of new sales increased from 25% for 1990 to 35% after the income tax reform. One way to correct these shortcomings of this recent income tax reform would be to make a difference in the value added to personal income for company cars within each car class progressive with fuel consumption. Table 7 shows an example of the correction that eventually could be made revenue-neutral. At this moment 20% of the retail list price of the company car must yearly be added to the personal income.

Also in some other countries proposals have been made to stimulate the purchase of fuel efficient company cars. E.g. Potter (1992) has proposed a reform of income tax treatment in response to the Inland Revenue Consultative Document (1992) in the UK. He proposed measures such as to charge private mileage as a percentage of retail list price and a tax for the employees who park at work on places with a high annual rental value. In Ontario, Canada, a 'feebate' scheme was established in 1991. In this scheme fleet owners have to pay for a company car of the least economical category a purchase tax of $7.000. On the other hand a fleet owner who buys the most efficient car, receives a rebate of $100 (TEST 1991). A similar 'feebate' scheme has been proposed in California.

Table 7. ***Proposed Value Added Scheme for Income Tax***

Grade of car fuel efficiency within each car class	Value added % list price Class I, II, III	Value added % list price Class IV, V
Most efficient cars	15	20
More than 5% less efficient	20	25
More than 10% less effcient	25	30
More than 15% less efficent	30	35
More than 20% less efficient	40	45

7. CONCLUSIONS

Preliminary calculations, with limited available data, have shown that a significant energy saving can be achieved by owners of passenger car fleets in a very cost effective manner. The total potential, in the cases studied, amounts some 4 to 5% of the present fuel consumption. This can be realized by simply making a more energy concious choice between the commercially available cars of today, even without seriously sacrificing the desire to involve non-rational arguments of comfort and status in the purchasing decision. The annual cost benefit for an avarage fleet of passenger cars is estimated to be some 360 Dutch guilders per car, but may in some specific cases even surmount 700 guilders per car.

Given the fact that about one quarter of the fuel consumption of all passenger cars in the Netherlands is taken up by company cars, realisation of the assessed potential energy saving might contribute significantly to the reduction of fossil fuel consumption in road traffic.

For this reason more research in this field is desirable. In order to stimulate fleet owners to buy more efficient company cars, schemes have to be developed which are based on more realistic and complete data.

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