

DIESELISATION AND THE “ NEW DIESELISTS ” BEHAVIOUR : RECENT DEVELOPMENTS IN THE FRENCH CAR FLEET

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Abstract

The share of diesel among the French car fleet has been growing since 1982. This penetration of diesel cars, combined with a significant fuel price advantage, has important consequences on the fleet structure and on its use. This can be observed in the annual results and the longitudinal analysis from the panel database “ *Parc Auto* ”, maintained at INRETS. At the request of both the Interdepartmental Mission for Greenhouse Effect and of the French Agency for Environment and Energy Management, INRETS achieved an original study in 1995-96, through a specific household survey studying a sub-sample of our panel, focusing on the analysis of the behaviour and the opinions of the “ new dieselists ” households. In this paper we present some methodological aspects and several results of this study of changes for diesel (concerning before/after comparison of car use, reasons put forward, and events that coincided with the change). A data analysis of this sample leads to a typology of the “ new dieselists ”, which is mentioned in the conclusion of this paper. Some recent developments concerning the diesel fleet between 1995 and 1998 are also described in the paper (differential of use between diesel and petrol-driven cars).

1. Introduction

Due to sales in rapid expansion since 1982, the French fleet of diesel-fuelled cars among the households, kept on growing, transforming deeply the structure of the new car sales and the fleet itself, with new segments in the market of the manufacturers, new uses and new users : more and more households are becoming “ new dieselists ”, i.e. opt for a diesel car. The dynamics of this phenomenon has major consequences, a) on the traffic growth [Madre, 91], b) on the fuel demand and, finally, c) on the households mobility behaviour ; that is why it required a specific analysis.

That is also the reason why INRETS annually takes part in a household survey, “ *Parc Auto* ”, allowing to follow the evolutions of car ownership and car use. This source permits quantification and analysis of the penetration of diesel cars in the fleet, which is a determinant factor of traffic growth in France.

Growth of the market share, diversification of the diesel fleet, constancy of the differential of use between diesel and gasoline are some of the most significant facts of the 1985/1995 developments.

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Since 1994, it has been possible to identify in the sample data the “new dieselists” households, i.e. those who chose in the past to replace a gasoline car by a diesel. On this category, a closer analysis was led by INRETS, from a specific survey, in order to characterize the change from petrol to diesel engine, and to analyse and understand the motorists behaviours.

2. Sources of data and methodological aspects

The results presented here are principally supported by two sources, that we describe below :

- the database “*Parc Auto*”, resulting from the annual household surveys conducted by SOFRES (a French polling institute) among a panel sample ;
- out of this large panel of motorists, we have identified a sub-sample of “new dieselists”, on whom we have conducted a specific study with the “*New Dieselists*” survey.

Every year, a household survey, designed by INRETS and SOFRES, financed by ADEME (*Agence de l'Environnement et de la Maîtrise de l'Énergie*, French Agency for Environment and Energy Management) and by the CCFA (*Comité des Constructeurs Français d'Automobiles*, French Car Manufacturers Committee), is conducted among the sample of the SOFRES panel. In each annual wave of this self-administered questioning, the 10,000 panellists describe at the end of the year every car (private cars and lights trucks) of the fleet that is available in their household.

The database “*Parc Auto*”, that we have been organizing and exploiting at INRETS since 1983, gathers all the annual waves of this survey together. The last available wave dates from 1997. This permanent system of information provides one of the national observation tools of the market, of the fleet and of the French households behaviour.

It allows us to follow the dynamic evolutions in car ownership and car use, with the help of both instantaneous global indicators (such as total fleet size, and averages of its mileage and consumption) and longitudinal analyses, using disaggregated pairing of the vehicles observations present in consecutive annual waves of the panel data (for example about the evolution of car mileage before and after purchasing a diesel car in replacement of a petrol car).

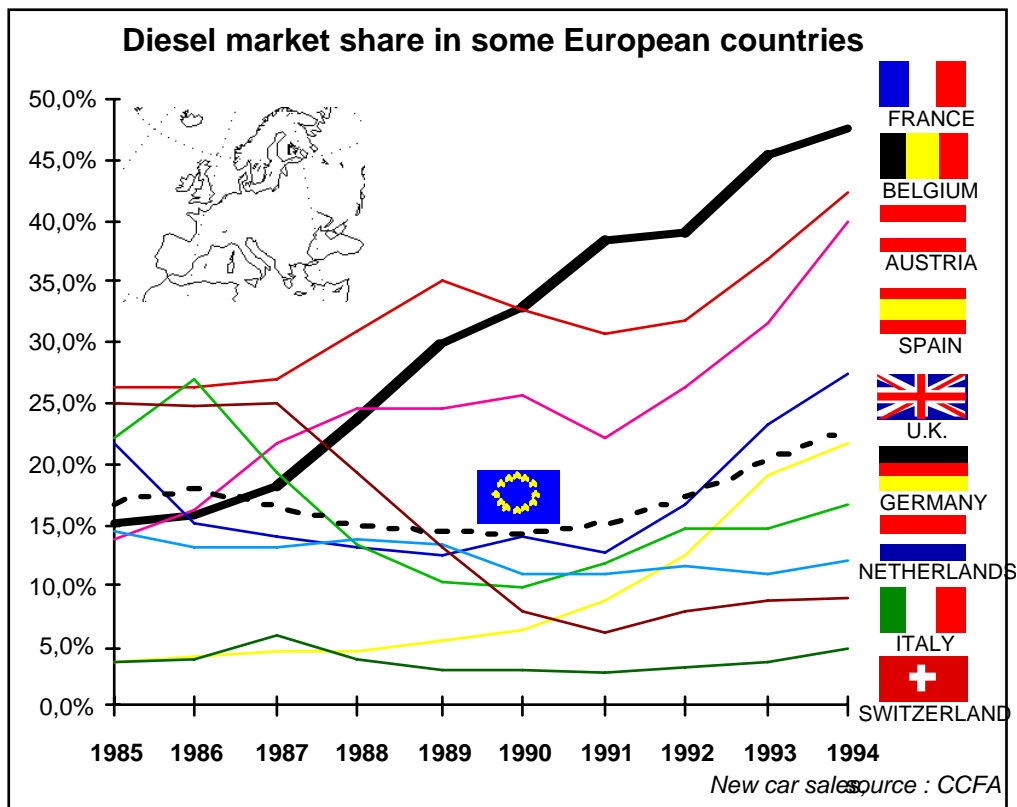
The description of the formerly owned vehicle, was, in addition, introduced in the questionnaire since the wave of 1994. This information allowed the exhaustive identification of the different transitions between both diesel and petrol engine types, without the using of the merging of annual waves. It enabled to identify in the sample of the panel (i.e. in each annual wave) which households were “faithful to petrol”, “faithful to diesel”, “old dieselists”, and finally “new dieselists”.

Focusing on this last “new dieselists” sub-sample of the panel, INRETS led a closer analysis, from a specific survey, at the request and with the financing of the MIES (*Mission Interministérielle de l'Effet de Serre*, Interdepartmental Mission for Greenhouse Effect), also worried about the long term effects of this phenomenon on the Environment. This survey was conducted during summer 1995 among 1,000 panellists (13% of the “*Parc Auto*” 94 wave), who changed from petrol to diesel car.

The results of the “ new dieselists ” survey permit a better characterization of the change for diesel engine, all together in terms of before/after comparison of technical characteristics of the car and of its use, reasons put forward, events that coincided with the change, and opinions of the panellists on diesel motorization. This investigation leads finally to the issue of a typology classifying the “ new dieselists ”, which will be briefly mentioned in the conclusion of the presentation.

3. Market and fleet size and structure (end of 1994 and recent developments)

In France since at least 1982, diesel sales have been rapidly expanding over the market of the new sales. With the exception of Belgium, the share of the diesel among most of our next-door neighbours in Europe has not grown in so spectacular a manner ; the national market shares vary greatly according to fiscal policies and current regulations (see for example [Orfeuill, 93]). However, from 1990 to 1994, the diesel car market share seems to have grown again in Europe ; this can be noticed in all countries, especially in Germany and Great Britain.



More recently, in the last three years (from end of 1994 to end of 1997), the diesel car market share has steadily set up above 40% in four countries : 53,3% in Austria, 49,8% in Belgium, 42,2% in Spain and 41,8% in France, and is near 35% in a fifth : Luxembourg, in 1997, [CCFA, 98]. In this period, differences between national markets remain important, but the average share for the 17 European countries does not change, from 22,6% to 22,3%.

In France, at the end of 1993, with a national market share very atypical in Europe, the diesel represents one half of the registrations of new cars of the year, and has reached a ratio of one quarter in the fleet owned by the households ; this value is comparable to that which was found in the “National Transport and Communications Survey” of 93-94, INSEE-INRETS.

More recently, the diesel cars market share decreased from 46,5% in 1995 to 41,8% at the end of 1997, while the share in the national households fleet grew from 31,5% in 1995 to 33,3% at the end of 1997, [Hivert, 99]. We can now temporarily assume the value of 34,1% for the fleet at the end of 1998, and except in the case of an unexpected drop, the diesel will have grown from 2% to more than 33% of the fleet in the course of the last two decades of this century.

While developing, the universe of the diesel diversifies :

- the difference of sale prices between motorizations has lowered significantly ;
- the structure of the households fleet (and the offer of the manufacturers) has deeply changed : lower end and the middle of the range steadily grow (even at the end of 1997), as well as the share of 6 to 9 horsepower ;
- as to the users, diesel world remains distinctly defined (men, active and especially independent, living in rural areas or in small conurbations), but the percentage of these categories of users are constantly decreasing, while the categories of women, elderly citizens, and city inhabitants driving diesel are conversely increasing ;
- diesel penetrates all social categories, with an accelerated development among the most financially comfortable, executives or retired people (in five years from 1990 to 1994, the most comfortable households have increased their fleet from 7 to 9.6 million units, the growth being divided into 1.8 million of diesel and .8 million of petrol);
- diesels are more multi-purposes than their petrol counterparts ; the image of diesel perceived as a large touring car is today out of date.

4. Use differential between petrol and diesel

Means of mileage and consumption declared by the panellists inform of the annual use of this booming fleet :

- for more than seven years and in spite of the down-market growth, the average car mileage of the diesel fleet has remained at a level of about 20,000 km per year, i.e. at approximately 8,000 km more than the petrol fleet (here the values are rounded, but the yearly variations remain inferior to the limits of the 95% confidence interval). However in the most recent years (1995 to 1998), the average car mileage per diesel is slowly decreasing from 20,000 to less than 19,000 km per year, even if annual variations remain non significant.

- with 6.6 litres/100 km (compared with 7.9 for a petrol car), diesel saves more than 1 litre of fuel per 100 km, that is to say a consumption gain of 6%, converted into oil-equivalent.
- but regarding total annual consumption, and keeping in mind the average prices (in current francs) at the pump², the yearly rounded balance (1300 litres per year for a diesel

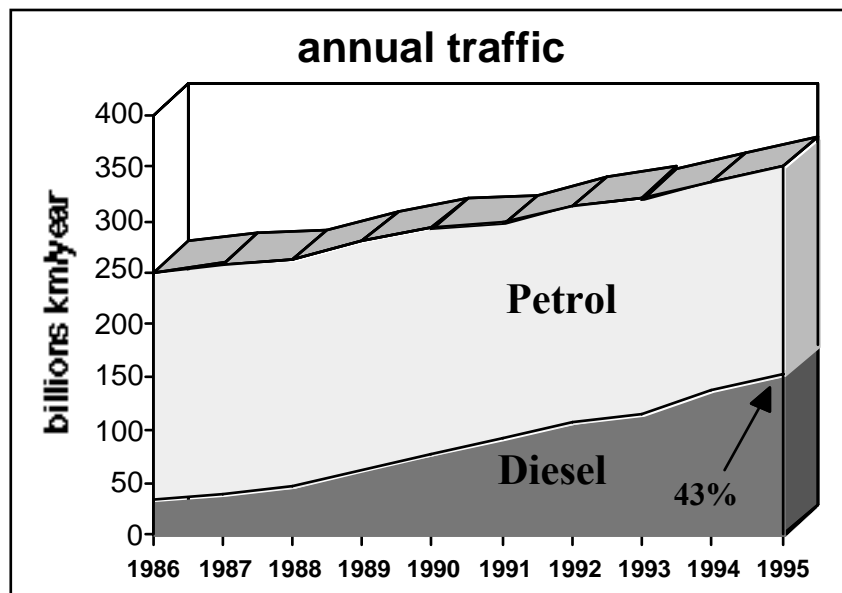
² For every year of our study, diesel remains between 29% and 33% cheaper than petrol (mean French fuel prices, according to Oil Professionnal Committee). In 1997 for example, the mean price for leaded and

compared to 900 litres for a petrol car) results in a comparable and stable fuel expenditure, for several years, in the area of 5,000 French Francs per year, whatever the motorization is.

It seems as if the diesel owners, within a constant budget, attempted to maximise their covered mileage. The savings achieved with a cheaper fuel fill the tank and not the purse of the “dieselists”.

More recently, the values of this annual fuel budget per car seem to have grown, while the values of the annual consumption per car remained about the same : in 1995, the petrol/diesel average expenses per car are 5,200/5,100 FF per year ; in 1996, they are 5,500/5,700 FF, and in 1997 5,700/5,600 FF.

The penetration in the fleet, the very large differences of mileage (for a comparable annual budget) make diesel a powerful lever of the traffic growth in France. At the end of 1995, the diesel represented 43% of the annual traffic (153 billions km, compared to 199 for petrol). At the end of 1997, the diesel represents 44% of the annual traffic, which is 363 billions km. Different studies, with various assumptions for fuel prices, forecast that this share will reach a value between 40 and 50% for the year 2015.



In order to analyse and anticipate the growth of traffic and consumption, it appears fundamental to understand the dieselisation processes on the level of the micro-economic behaviours appears fundamental. Among the motorists, it seems interesting to focus the study on those who are replacing a petrol car with a diesel car (a number which is steadily increasing).

5. Transitions between both engine types

Even if dieselisation is partially induced by the development of multi-ownership, the number of households previously owning a petrol car and changing for diesel motorization

unleaded petrol is 633.50 FF/100 litres, while the mean price for diesel is 443.00 FF/100 litres. The French government has recently decided (1998) to reduce progressively the tax differential to the mean European difference.

notably grows : for example, over the past five years (1989/1994), the annual growth rates in fleet size were 2.1% for the total French fleet, compared with 19% for the diesel fleet and -1.7% for the petrol fleet. More recently, this dynamic seems to be slowed down : from 1994 to 1997, the rates were 1.63% per year for the total fleet, 4.35% for the diesel fleet and 0.33% for the petrol fleet.

At the end of 1994, 3.2 million diesel cars (13% of the fleet) were bought in replacement of a petrol car. Here again, the share of motorists who have remained faithful to their type of motorization, or those who have changed for diesel or for petrol, are comparable to the results obtained in the in the “National Transport and Communications Survey” of 93-94.

Over different periods (purchases from 1985 to 1990, in 1991 and in 1992, and finally in 1993) our longitudinal investigations in the panel data base, matching up the vehicles over three successive annual waves of “Parc Auto”, have shown the following results [Hivert, 93 and Jun. 95].

• *The replacement of a petrol car by a diesel car :*

- concerns motorists who already had a high annual mileage with their petrol cars (15 to 16,000 km/year vs. less than 12,000 km/year in the total petrol fleet) ;
- is moreover accompanied by a substantial increase of annual mileage (variation about + 3 to + 4,000 km, observed in the year following the replacement).

On the first and longest period (1985/1990), we have shown that this increase occurs without a significant decrease in the mileage of other available cars in the household.

• *The opposite replacement (return to petrol) :*

- concerns “ average dieselists ” (19 to 20,000 km/year) ;
- appears to be accompanied by an important decrease in annual mileage (- 4 to - 5,000 km, observed in the year following the replacement). The sample size for this “ old dieselist ” transition, however, makes this last result of little significance.

6. Transitions observed through the “ new dieselists ” survey

The specific “ new dieselists ” survey allows the presentation of a more precise image of these evolutions, without relying on the longitudinal merging of observations. The evaluation method is also slightly different (mileage and consumption are not those declared for the 12 months - before and after purchase -, but are global average estimates for the two cars ; the fuel budget will be estimated on this basis, in constant 1995 Francs.

For a petrol mileage that is already high, the transition to diesel results in an increase of + 3,400 km. This growth is uniformly distributed between all the travel purposes and all the network types (urban roads, country roads and motorways).

from petrol to diesel : variations per car

	before	after	$E_t(t+1 / t-1)$
annual mileage (km)	16,000 km	19,400 km	+ 3,400 km
unit. consumption (litres/100 km)	8.42	6.56	
annual consumption (litres)	1,290 l	1,250 l	+ 85 koe
annual fuel budget (FF 95)	7,300 F	4,800 F	- 2,500 F
unit. fuel expense (F/km)	0.48 F/km	0.25 F/km	

Although the unitary consumption is lowered from 8.4 to 6.6 litres/100 km, the transition results in an increase of the annual consumption of 85 kilo-oil-equivalent (namely more than 110 litres of super), while the annual fuel budget is reduced by 2,500 FF.

- A particular case of transition : those who have changed their place of residence or of work (one quarter of the sample) have a much more pronounced increase of mileage than the others (always from one before-mileage per car close to 16,000 km). They slightly increase their share of “home-to-work” and “professional” purposes, while the others slightly increase their share of “daily mobility” and “holidays” purposes.

We can, moreover, denote (in “Parc Auto” 94 and in other recent waves) that the diesel is much more widely used when the driver lives far from his workplace : when the cars are used for home-to-work travel, we count 40% of diesels if the home-to-work distance is greater than 40 km, compared to 27% if the home-to-work distance is less than 10 km.

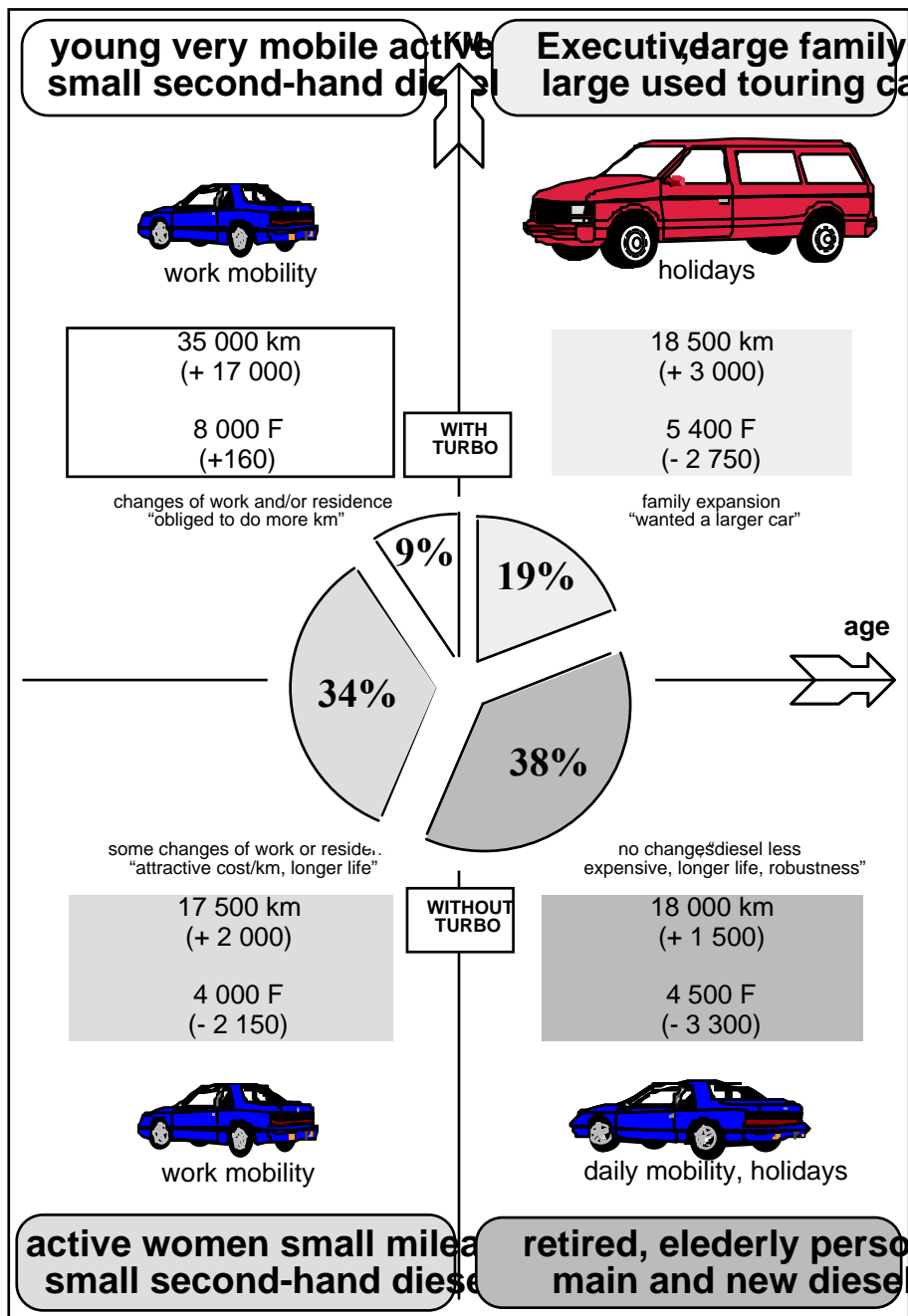
- Another particular case : the retired people have a very weak mileage differential (+ 500 km from a before-mileage per car close to 15,000 km). When the mobility for work stops at the time of retirement, a drastic modification of the travel behaviour is noticed. However, the questionnaire did not retain the retirement as an event coinciding with the purchase.

These variations per car are, however, insufficient, and cannot give a precise idea of the elasticity of the diesel ownership to the households income (or to the fuel prices). To approach this value, one must remain aware of, for each class of income, of the quantities of petrol and diesel used by all the cars in the family (according to rates of dieselisation of the household).

7. A typology of the “ new dieselists ”

A multidimensional data analysis has ultimately lead to a typology of the “ new dieselists ” sample, allowing to emphasize some important behavioural disparities, in car use, motivations for ownership, and opinions about diesel motorization [Hivert, 96]. Our sample can finally be divided in four classes, as shown in the figure on next page.

Class 1 (38%) — is composed of older drivers, without change in situation (residence, work, family), living often in suburbs and in medium conurbations ; we will find here the new diesels of the retired class (often with only one car), medium sized cars without turbo, used daily and for holidays, with a low increase of mileage and high savings in fuel budget.



Class 2 (34%) — the “dieselists” are here younger, with lower incomes (with some changes of residence place), living in the periurban area of large conurbations ; we will find here secondary and often second-hand cars, in the low end of the range and without turbo, used for work by young, active women (members of intermediate professions), and in households of one to three people. Mileage increases of 2,000 km for savings of 2,150 FF.

Class 3 (19%) — group some of the most comfortable, largest, and often multi-car, households ; head of family is usually over 35 years, and they often live in the city centre of large conurbations, like Paris) ; having expanded their family, wishing a larger car, they replace their main car, powerful and high ranking, with a turbo diesel, often of foreign make, which will be notably used for holidays.

Class 4 (9%) — the youngest active “dieselists” (also members of intermediate professions); living with low incomes, in couples, in small conurbations and in periurban areas, having frequently changed work and residence place, they declare they were obliged to do more kilometres ; they choose a small second-hand diesel and become the biggest drivers with an increase of + 17,000 km, maintaining the same fuel budget.

Those who drive the less justify their purchase of a diesel, judging it attractive for low values of mileage, and insist upon its durability and longevity.

Those who drive the most think that to write off the cost of this equipment requires an intensive use, i.e. a great annual mileage.

8. Conclusion

If we omit the major question of the harm caused by the micro-particles, the unitary balance sheets of consumption-exhausts still appear favourable towards diesel motorization.

However, the fiscal advantages (tax on the fuel and lenient calculations of the fiscal power tax) which diesel motorization plays upon in France greatly favours its development and a more intense usage.

Over the course of an average year, a diesel car :

- has a considerably higher mileage ;
- consumes more (for the same fuel budget) ;
- emits (at least in the case of CO₂) more than a petrol car.

In switching from petrol to diesel, motorists can drive more, spending half less per kilometre.

It may be possible that the Authorities envisage to change this situation, consider new policies (begin for example to reduce the tax differential between both fuels). Consequently, the new sales seem to slowly (and durably ?) start to decrease, in 1995 and 1996.

The study on the “ new dieselists ” has shown very contrasted behavioural differences in motivations and in car use, with an average mileage per car varying from less than 10,000 to more than 30,000 km/year.

The motorists who opt for diesel :

- do not all share the same rationality, or the same motivations ;
- do not all have increasing travel needs ;
- but can profit (as nearly all do) of the attractive savings at the pump, to drive more.

The survey questionnaire ends with a test of the “resistance” of the “ new dieselist ”, to possible fiscal changes about diesel :

- if a new special tax label would be imposed on diesel cars (without specifying the amount) one out of two “ dieselists ” said they would return to petrol (28% would stay with diesel and 24% were neutral) ;
- if the diesel fuel would be at the same price as petrol, one out of four would return to petrol, while 43% would stay with diesel, and 32% were neutral.

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