

# **EcoTest Phase 3**

## **Results**

Based on EcoTest Protocol Release 2.0

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## 1 Introduction

The EcoTest was developed by ADAC in 2003 to monitor the environmental behaviour of passenger cars. The developed procedure was described in the EcoTest Testing and Assessment Protocol Release 1 and the first results are shown in Phase 1. In Phase 2 the procedure was further developed concerning the assessment of the result. The updated EcoTest Testing and Assessment Protocol Release 2 is the publication basis for further Phases.

The EcoTest results provide meaningful information to consumers shown by the reactions and questions for further measurements. The results are also an important input for the political discussion, recently the workshop “Car Emissions and Euro5” in Brussels organized by the ADAC on behalf of the FIA. For example diesel vehicles

**Table 1:** Thresholds for carbon dioxide rating.

vehicle class	50 points at g/km CO <sub>2</sub>	10 points at g/km CO <sub>2</sub>
1	60	150
2	60	150
3	70	175
4	85	205
5	105	240
6	130	280
7	160	325

without particulate filter are in their involvement in the quality of the discussion about the ambient air in cities (fine particulate PM10. The development of car technology is shown by the results of latest Diesel emission measurement (particulate filter), by the results of Hybrid vehicles and by the results of natural gas vehicles. Now it is more important to compare the emissions of all types of vehicles.

The testing process as well as the measured cycles and the parameters which are considered have not been changed. The results of EcoTest Phase 3 are based on measurements and the assessment according to EcoTest Testing and Assessment Protocol Release 2. The thresholds for carbon dioxide rating of all vehicle classes are

**Table 2:** Assessment of Pollution and Carbon Dioxide (points and colours)

≥ 45 points	very low emissions
35...44 points	low emissions
25...34 points	average emissions
15...24 points	fairly high emissions
0...14 points	high emissions

**Table 3:** EcoTest rating with points and stars

≥ 90 points	★ ★ ★ ★ ★
70...89 points	★ ★ ★ ★
50...69 points	★ ★ ★
30...49 points	★ ★
0...29 points	★

shown in **table 1**.

For better identification the results of pollution and CO<sub>2</sub> assessment are coloured according to **table 2**. The EcoTest rating is calculated by the sum of pollution rating and carbon dioxide rating. The star rating is given in **table 3**.

## 2 Selection of Vehicles

In Phase 1 the vehicles of the classes Supermini and Small Family were chosen. Of each vehicle the most selling version was compared to the most fuel saving version for both, Diesel and Petrol engine. Using this results the measurement and assessment procedures were developed and verified. In Phase 2 vehicles were not selected from two vehicle classes. On the contrary it was obvious, that there is a big interest for results of the newest and most current vehicles with typical engines. It was important for Phase 2 to include vehicles with the most innovative type of propulsion technology like hybrid or the latest exhaust treatment system like diesel particulate filter and NO<sub>x</sub> reduction system. Using results from Phase 2 some adaptations were done to further increase the evidence of the procedure. In Phase 3 additionally to the latest vehicles more vehicles with diesel particulate filter and two vehicles powered with natural gas were selected. Together with the most interesting vehicles from all Phases now 276 vehicles are available at all. They are divided in

- 1 City (two seats) class
- 13 City class
- 46 Supermini class
- 101 Small Family class
- 80 Family class
- 27 Executive class
- 8 Luxury class

## 3 Results

The tested vehicles are assessed according to EcoTest Testing and Assessment Protocol Release 2. The results of the vehicles tested for EcoTest Phase 3 are shown in **annex1** ordered by vehicle class.

### 3.1 Pollution

The assessment of the pollution is based on a vehicle class independent rating system. The maximum of 50 points is gained if a vehicle fulfils the Euro 4 thresholds of Petrol engines and emits less than 5 mg/km PM during both the NEDC and the ADAC Highway Cycle. Unlike the European emission legislation which tolerates higher emissions for Diesel engines the EcoTest assesses all vehicles based on the same scales.

The range of the results is huge: The maximum of 50 points is for example gained by the Hybrid vehicle Toyota Prius, by the natural gas vehicle Volvo V70 and by the Pet-

rol vehicle VW Polo FSI. In contrast the Diesel Mitsubishi Pajero 2.5 TD and the Opel Vivaro are two of the worst vehicles because they gained only 11 and 0 points.

The average of the Petrol vehicles has lower emissions than the Diesel: 126 Petrol vehicles achieve the green area. The Toyota Avensis 2.0 D-KAT with particulate trap and DeNO<sub>x</sub> catalyst is the first Diesel in the green class of pollution with 45 points. Other Diesel cars with PM trap come close to the highest class. Thus PM traps are a very effective instrument to increase the environmental behaviour of Diesel vehicles, specially if NO<sub>x</sub> reducing measures are done or even Euro 4 is fulfilled.

The worst Petrol car, the Daihatsu Copen, achieves 28 pollution points.

The differences in the results correspond sometimes to the emission classification of the vehicle (Euro 4, Euro 3). But there are differences in the particular behaviour and NO<sub>x</sub> emissions of several cars. As the core stories show some cars fulfil Euro 4 but fail during the ADAC highway. This is due to the test cycle optimised development.

**Conclusion: The emissions of vehicles which gain the 50 points maximum are as low that further improvements are not necessary according to the state of knowledge today. The results show that Diesel vehicles with particulate filter could reach petrol vehicles.**

### 3.2 Carbon Dioxide CO<sub>2</sub>

The Carbon Dioxide emissions are based on the fuel consumption: from 1 litre of Petrol about 2380 g, from 1 litre of Diesel fuel about 2750 g CO<sub>2</sub>. Thus from 1 litre Diesel fuel about 16% more CO<sub>2</sub> than from 1 litre Petrol. The advantage of the Diesel concerning fuel consumption in principle is shown alleviated according CO<sub>2</sub> emissions.

As described in chapter 2 a class depending scale is used. This enables a clear differentiation within the particular classes. The decision for that class depending scale is furthermore considered to provide information to the consumer which is related and relevant for his particular demand. Therefore the decision for a car class is made and then the EcoTest results enable to choose a vehicle with a good environmental performance.

Also the CO<sub>2</sub> assessment shows considerable differences. The best vehicles are the Skoda Superb 1.9 TDI (41 points), the Rover 75 2.0 CDTi (40 points), the Hybrid Toyota Prius (39 points) and the Volvo V70 with natural gas (37 points). The best rated Petrol vehicle is the Opel Signum 2.2 direct (34 points) providing Petrol direct injection technology.

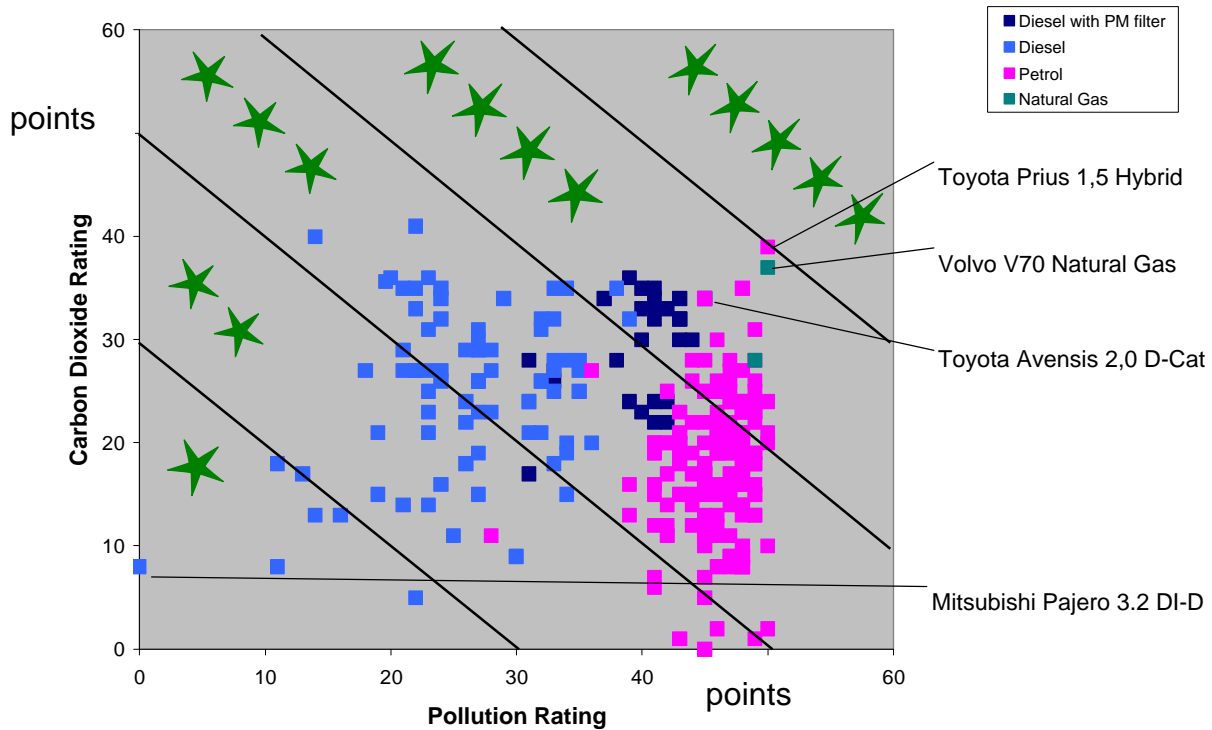
At the end of the list one can find the Ford Streetka 1,6 with only 0 points.

As expected the Diesel cars perform better than the Petrol.

**Conclusion: Unlike the situation of pollution the further reduction of CO<sub>2</sub> emissions is also on the schedule for the future for the Diesel as well as for the Petrol vehicles.**

### 3.3 EcoTest Rating

Except the two City classes (1 and 2) each class has a 4 stars car which means a specially ecological one.



**Figure 1:** Comparison of Pollution and Carbon Dioxide Rating for all tested Diesel and Petrol vehicles.

With 89 points the Hybrid Toyota Prius is still the overall winner. It is only short of the 5 stars (90 points). The second best vehicle meanwhile is, the Volvo V70 with natural gas 87 points represent the natural gas engine technology. This result shows a high potential for the natural gas engine technology. With 79 points the Toyota Avensis 2.0 D-Cat are on 5th place and is the best diesel vehicle. The poorest Petrol is the Daihatsu Copen with 39 points, the poorest vehicle tested are the Opel Vivaro Life 2.5 CDTI (8 points).

The average of the Petrol vehicles is 64 points, higher than the Diesel (55 points). Clearly better is the average of diesel vehicles with particulate filter (70 points).

**Figure 1** shows the results of Pollution rating against Carbon Dioxide rating. The clear advantage of the Petrol cars according the pollution emissions is shown while the Diesel in general have better carbon dioxide ratings. The range of both CO<sub>2</sub>- and pollution rating is bigger for the Diesel than for the Petrol cars. This shows that the emission technology of the Petrol vehicles is already on a higher level. But Diesel vehicles with particulate filter gain on.

**Conclusion:** The latest engine technologies (Petrol direct injection and FSI, natural gas vehicles, Diesel PM traps and DeNOx catalysts) result in clear improvements compared to the conventional ones. Diesel and Petrol cars with that technologies are close together. Hybrid technology is clearly ahead others concerning the environmental impact, but followed close-up by natural gas vehicles.

## 4 Summary

The results of pollution rating show that in general Petrol vehicles are still better than Diesel vehicles. Vehicles which gain the 50 points maximum in Grade Pollution have no need for further improvements according to the state of knowledge today concerning their pollution emissions. Thus the focus for future development is the improvement of the Diesel technology. The EcoTest results show the effectiveness of the Diesel PM trap and the DeNO<sub>x</sub> catalyst to equal the pollution level with today's best Petrol and Hybrid vehicles.

Generally Diesel vehicles gain higher carbon dioxide ratings. Nevertheless a further reduction of CO<sub>2</sub> is indispensable for Petrol vehicles as well as for Diesel vehicles.

Vehicles with the latest technology (Diesel PM traps, DeNO<sub>x</sub> catalysts, hybrid technology, natural gas technology...) score significantly higher in the EcoTest than the vehicles with conventional technology.

A decisive goal for the future is to fulfil the Euro 4 Petrol car standards not only for the NEDC driving cycle but to keep this level also "off cycle", e.g. for the ADAC highway driving cycle.

The EcoTest is created and conducted to monitor this development which is expected for the near future.