Frequently asked questions about T&E's testing of PHEV emissions

February 2023

1. What did T&E investigate in this test programme?

T&E has investigated the CO_2 emissions and electric range of three new plug-in hybrids (PHEVs): the BMW 3 series, Peugeot 308 and the Renault Megane. The tests were conducted on the road on city and commuting routes, in and around the city of Graz in Austria.

2. Why did T&E decide to conduct these tests?

In 2020, T&E tested the performance of three SUV PHEVs - the BMW X5, Volvo XC60 and the Mitsubishi Outlander - under a wide range of conditions, mostly on longer routes. Since then carmakers have expanded their EU offering of PHEVs to almost a hundred models, including smaller non-SUV PHEVs. T&E wanted to see how these newer, smaller PHEVs perform in city and commuter driving (which carmakers often tout as the optimal use of a PHEV).

3. Who tested the cars?

T&E commissioned the Technical University of Graz to undertake independent testing of all cars. The university is known for its testing of vehicles and it has worked for the European Commission on the development of the new Euro 7 vehicle emission standards.

4. Are the tests representative of real-world driving?

Yes, all tests were conducted on public roads in, and around, Graz, Austria. Tests were conducted on three different test routes using a range of various PHEV driving modes available (e.g with a charged/empty battery) and the cars were driven in a manner representative of typical driving conditions.

5. How did T&E choose the vehicles that were tested?

The models were chosen to represent carmakers and regions in a balanced way within the PHEV market. T&E chose the BMW 3 series because it is the best selling non-SUV PHEV in Western Europe in 2022 and because of its geo-fencing capability (for more on geo-fencing, please see Q 7). The Peugeot 308 and the Renault Megane were chosen because they are new, compact non-SUV PHEV models - opposite to the larger SUV models tested in 2020.

6. What is geo-fencing?

Geo-fencing refers to technology which automatically switches a PHEV to zero-emission driving in a certain zone, for example in the city. BMW was the first carmaker to introduce geo-fencing technology to its cars (known as eDrive Zones) and advertises that the technology works in 138 cities in Europe. Range Rover also recently introduced such technology in their cars.

7. What are the main findings of this testing work?

- When commuting, even when starting with a fully charged battery, CO_2 emissions were 3.1 times the official CO_2 for the BMW, 1.2x for the Peugeot and 1.7x for the Renault. Despite the relatively short, round-trip distance of 55km, when driving into the city and Graz and back.
- When not charged the CO_2 emissions of the tested PHEVs in cities are 5-7 times the official figures.
- The city electric range of the BMW was 26% lower and the Peugeot 47% lower than expected based on official figures. Only the Renault achieved the expected electric range. However, all three PHEVs still have a very limited electric range of less than 50km in the city, a fraction of that of the average BEV.
- BMW's geo-fencing technology cannot guarantee zero-emission driving in cities, with the engine switching on twice while driving in the city of Graz - despite geo-fencing being active and the car having plenty of electric charge.

Overall, the results of T&E's testing show that PHEV models are not getting considerably better at reducing CO_2 emissions, and cannot guarantee zero emissions driving in cities.

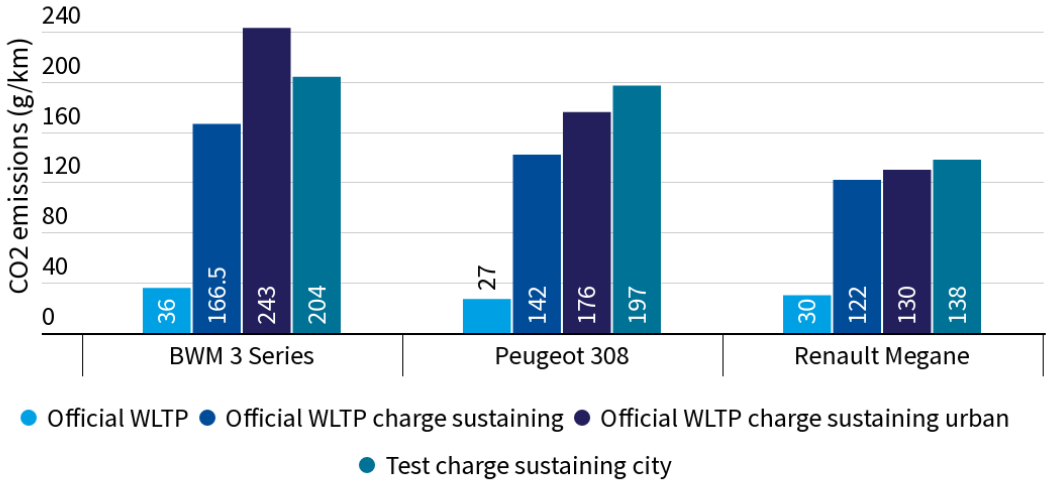
8. How do these results compare to the results of T&E's testing in 2020?

The results of this testing support the findings of the 2020 testing campaign. PHEVs (including even the smaller non-SUV models) still have a very limited real-world electric range and high CO_2 emissions when not charged. Even when fully charged, CO_2 emissions on a relatively short commuter style route (55km) are higher than claimed by official data, indicating that PHEVs are only able to drive very short distances before exceeding their official CO2 values. Carmakers continue to design and sell PHEVs which are not designed to deliver the promised CO_2 savings in the real world with features such as small batteries, no fast charging and powerful combustion engines.

9. In your executive summary, why do you compare the test results for 'charge sustaining' mode in city driving with the overall Official WLTP CO2 and not with 'Official WLTP for charge sustaining urban'?

We compare the results of the PHEV testing with the official WLTP (combined, weighted) number as this is the number that carmakers use for PHEV advertising, ie this is the number that customers see when the deciding to purchase a car and it's also the number used for compliance with EU car CO_2 standards.

Within the report the test results are also compared to the WLTP charge sustaining numbers to assess the difference between the on-road performance in different tests and the WLTP lab based test when the car is not charged. However, this comparison is less important as it is just one of the numbers used to calculate the official WLTP (combined, weighted) number.



10. As recently as 2018, T&E and other NGOs said PHEVs had a role to play in the transition to zero-emissions transport. What has changed?

Before the mass adoption of battery electric cars, T&E believed that drivers would first switch to hybrid and plug-in hybrid models before going fully electric, with the expectation that the PHEVs that carmakers sold would have large batteries and be designed to deliver low CO2 emissions on the road. However, this was before any real penetration of PHEV models on the EU market, so we were unable to analyse their environmental impact. Now with almost 90 models on sale in the EU and

plenty of data on their real-world performance, it is apparent that PHEVs are not the low emission cars that T&E expected carmakers to develop. They have high on-road emissions and fail to deliver the promised climate benefits.

The improvement in the performance of lithium-ion batteries, and penetration of battery electric cars in general, has moved a lot faster than expected. Today more drivers in Europe buy a battery electric car than a plug-in hybrid, and PHEVs are fast becoming obsolete. Coupled with their poor on-road performance, we no longer believe there is any technological need for them in terms of making a switch to zero emissions mobility.