Key Messages from AMF Research

Annex 55 **February 2020**

Real Driving Emissions and Fuel Consumption

Operating Agent: Argonne National Laboratory, United States
Partners: Canada, Denmark, Finland, Sweden, Switzerland

Major Conclusion

To obtain reliable fuel consumption and emission data, test procedures have to reflect real driving behaviour. Such test procedure further helps ensure compliance of vehicles and identifying defeat devices. The world harmonized light vehicles test procedure (WLTP) could achive this. Another useful method is on-board measurement through portable mesurment equipment (PEMS).

Background

The levels of air pollutants from internal combustion engine (ICE)-powered vehicles that are being sold in the marketplace today are much lower than those from earlier vehicle generations. This change is largely the result of technology forcing regulations to control the exhaust emission rates of various air pollutants such as hydrocarbons, carbon monoxide, oxides of nitrogen (NOx), particulate matter (PM), and particle number (PN). Over time, changes to those regulations have reflected the extraordinary advances in fuels, engines, and emission control technologies that have been produced by automotive researchers/manufacturers over the past decades. There is evidence to suggest that the performance of vehicles may not be fully captured in compliance or type approval tests, even though they are conducted with varying driving cycles and in environmentally controlled laboratories. This became particularly visible in the wakes of Diesel-gate which led to accelerated introduction of RDE methods in Europe and elsewhere. This project aimed to develop an emission rate and fuel consumption inventory of vehicles driven on-road in varying countries in typical seasonal corresponding climates, using vehicles fueled with advanced, renewable, and conventional fuel. Vehicle performance was investigated over typical regional driving conditions such as city, highway, arterial and congested routes. The objective of this project was to explore real driving emissions and real-world performance of vehicles operating under a range of worldwide driving conditions.

Research Protocol

In Annex 55, six contracting parties collaborated in gathering and analyzing information regarding emissions and fuel consumption through laboratory and on-road measurement of performance and emissions of production vehicles. Vehicle technologies spanned conventional gasoline and diesel vehicles of varying age, alternative fuel vehicles including ethanol and

natural gas as well as hybridized vehicles. On-road vehicle operation was performed under typical climatic conditions experienced in the member countries covering urban, rural and highway driving.

Key Findings

Of the tested vehicles, 94% showed a higher fuel consumption and emission of CO2 when tested in the certification cycle (NEDC) compared with the manufacturer declared values.Compared with normal use (PEMS) the deviation to the declared values was even higher. If the test procedure better represent real driving behaviour (WLTP) the difference was significantly lower as can be seen in Figure 1.

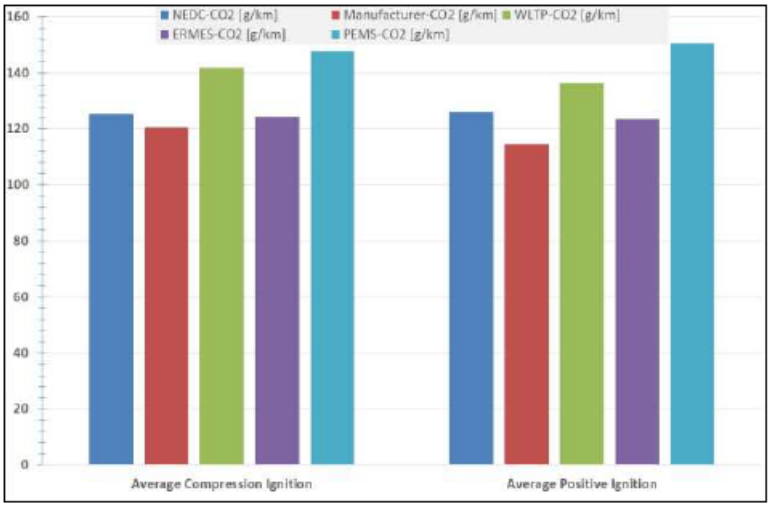

Figure 1: Average CO2 emission in g/km for cars with compression ignition and positive ignition engines

Key findings from the project can be summarized as follows:

- The test cycle have to be developed to represent real driving conditions for certification data (fuel consumption, CO2 emissions and exhaust gas emissions) to agree well with normal use.
- Real driving testing further helps ensure compliance of vehicles with emissions targets across the entire operating range.
- Engines with compression ignition (diesel) showed better agreement of RDE fuel consumption and CO2 results compared to certification data than spark ignited engines (gasoline, compressed natural gas/CNG and ethanol/E85).
- Low ambient temperature testing assures that after treatment systems are also effective at harsh ambient conditions. Highway driving of diesel vehicles showed little sensitivity to temperature; urban driving resulted in higher NOx emissions at lower temperatures.
- Real driving methods can help assess the real-world impact of new fuels, e.g. alcohol fuels and paraffins, in different climate regions where cold-starting etc. could be an issue.
- However, it is not the objective of RDE to achieve maximum repeatability or likeness to WLTP but rather to ensure the robustness of the emission control in all reasonable operating conditions. Secondary, RDE seriously counteracts the use of defeat devices.