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CO_2 EMISSION MONITORING ACCORDING NEW LEGISLATION FOR PASSENGER CARS, LIGHT COMMERCIAL, HEAVY-DUTY, AGRICULTURAL AND NRMM VEHICLES

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ABSTRACT

Agricultural and non-road vehicles with other types of vehicles, are significant source of air pollution in many countries and regions. They account almost three quarters raw emission of $PM_{2,5}$ and and one quarter of NOx emission. Most importantly in Europe agricultural and non-road vehicles contribute approximately with one quater with the emission of fine particlualte matter $PM_{2,5}$ and with 15% emission of NOx. This is mainly because the emission control strategy for non road vehicles including tail pipe emission standards and also in usage compliance are years behind that of heavy duty vehicles, thus therefore the vehicles share the same tehnologies for emission contol strategy. Although the vehicles market is expanding further better control of the emissions for on-road vehicles will be present, so soon non-road vehicles will become the dominant source of CO_2 air pollution in the world.

Key words: diesel engine, CO_2 exhaust emission, application of afthertreatment methodology

INTRODUCTION

Engines for off-road applications (non-road) represent a large share of engines in addition to those used in road vehicles. Engines used in vehicles for non-road applications NRMM (Non-Road Mobile Machinery) belong in this group. The Scenario for future CO_2 standards could be set for the entire off road vehicle, but never the less some issues that should be taken further in considering separate targets for components (such as the gear box, air drag or engine) thus also might not lead to cost-effective solutions. An important aspect of reducing emission of toxic fumes is the methodology of research. Currently, research on emission of toxic compounds from NRMM vehicles is performed mainly in the laboratory. These measurements are applied only to the engine itself, and not to the entire vehicle and therefore the results of such studies do not give full information about emissions and fuel consumption during realoperation. For the ecological assessment of the vehicles, tests under real operating conditions are of the highest importance, because only in this way it is possible to obtain complete information about the actual harmful emission that the exhaust components have. The disadvantage of such research is the high cost of the measuring equipment and the need to adapt the vehicle for the needs of the test. However, it generates reliable results that are impossible to obtain in a laboratory, during tests on an engine or chassis dynamometer.
Legal conditions for the type approval of NRMM vehicles with regard to emissions Guidelines for testing emission of harmful exhaust compounds from NRMM vehicles are contained in the 97/68/EC Directive [1]. The directive developed later introduced changes and additions, which were mainly due to technical progress

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in the construction of engines and the increasing degree of standardization of regulations on a global scale. Hence, the introduced provisions were often common agreements between the European Commission and the US Environmental Protection Agency The desire to harmonize the regulations is an action desirable not only in Europe but throughout the whole world. The Directive pays particular attention to the problem of reducing the NOx emissions. This is connected with the necessity of using an SCR. An important part of the directive, which should be noted, is the statement about the need to include the regulations from the Directive 595/2009/EC relating to the engines of road HDVs in the 97/68/EC Directive. This provision appeared with the introduction of the procedures for type approval testing under real operating conditions. Therefore, it is expected that the engines of NRMM vehicle solutions (which have been well established already in the tests for HDV engines [2]) will be accepted.

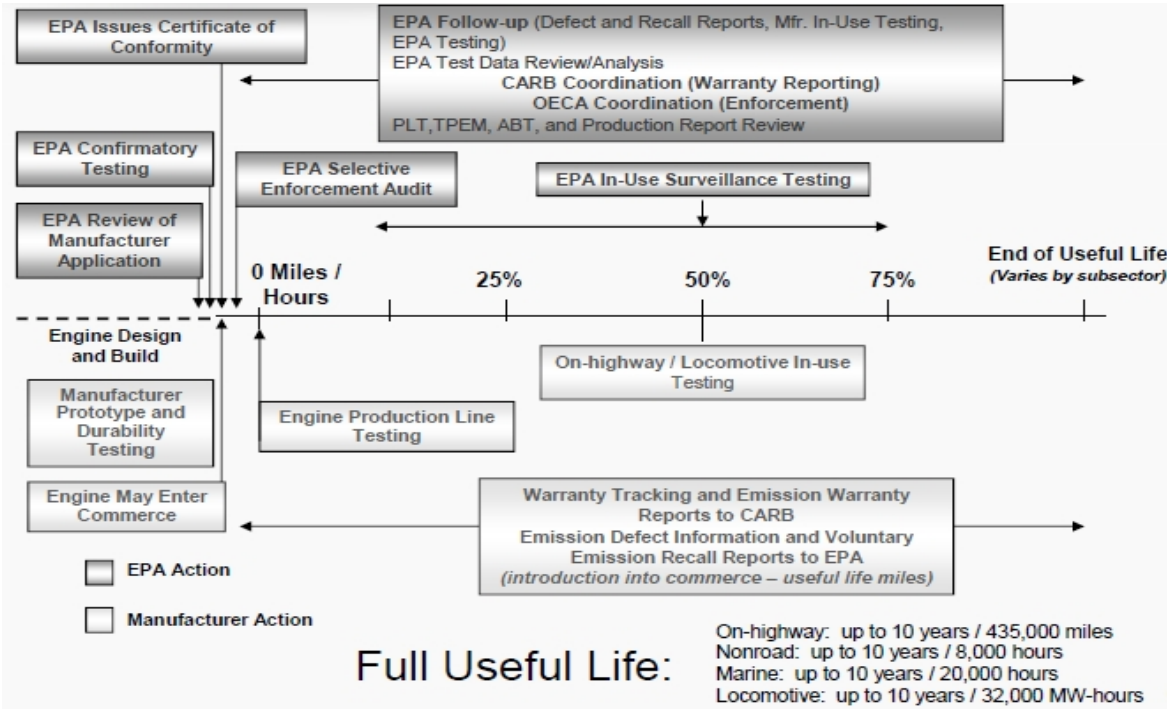

Figure 1. Diesel Engine Emissions Compliance Tools Overview [3]

Manufacturers also believe that the 2030 target should be validated in 2022 to take into account the latest fuel efficiency technologies and the CO_2 performance of future heavy-duty vehicles, especially trucs. In the long run, the potential benefits of a well-to-wheel approach should also be considered, given the importance of an integrated approach to further reducing CO_2 from trucks. Data required for testing and inspecting heavy-duty vehicles should be made accessible to parties with regulatory obligations in order to allow for independent verification. These data should, for instance, be available to the technical services assigned to perform the necessary inspections and tests, as well as to the type-approval authorities providing the type-approval certificate by granting obtained vehicle data. However, making such certified data publicly available is not necessary to allow for independent testing by a third party. Any type-approval authority or other authorized authority of a member state in the European Union, as well the European Commission, can indeed access the data of a specific vehicle and provide these to a qualified third-party testing organization for legitimate verification purposes. The qualification of the laboratory performing the test could be verified through a proper accreditation process, confirming that the laboratory has the right technical expertise to perform the test, but also that it follows administrative procedures [4].

FAIRLY REFLECT DIVERSITY OF THE VEHICLE MARKET

Future CO_2 standards for heavy-duty vehicles should take into consideration the different configurations and cycles of vehicles. Hence, a specific baseline has to be set for each vehicle subgroup to which the reduction target should be applied, combined with flexibilities such as banking and trading of CO_2.
Such a system would ensure a fair approach to delivering CO_2 reductions across the fleet, while in parallel reflecting the complexity and diversity of the market and use cases. It also makes sure that all manufacturers share the responsibility to reduce CO_2 and that there is no discrimination with regard to the product portfolio of a particular manufacturer. That is why the cycles used for setting the limits should be as close as possible to the EU 'real world' situation of each vehicle sub-group, allowing for the fleet reduction targets to be distributed equally over the various vehicle sub-groups. Each vehicle sub-group should be defined in a way that: matches reality scenario and it is credible; sub-groups should be defined based on the main real-use conditions/applications according to the mission of the vehicle (cycle, load, etc.). In order to ensure that there will be a representative number of sub-groups. Enough to: off-differentiate between technologies and specifications; in function of the use cases and the missions concerned (e.g. consider separate sub-groups for high-capacity vehicles, such as the European Modular System). Allow for fair targets for different manufacturers with different portfolios. The guarantees, that definitions are enough robust, both today and also in light of future product changes. Boundaries and loads/cycles should be robust in the short term, but should also allow introducing on-road verification tests. The EU truck industry believes that this approach is the most workable and reasonable way forward; it helps to avoid division of the market on the one hand, and allows for a single fleet ambition level on the other. Flexibilities should be provided for the different vehicle groups and sub-groups, by enabling the transfer of CO_2 credits and debits between the groups. For each sub-group, a reference value has to be set as the baseline and the defined fleet ambition level should be applied accordingly [5].
Flexibility that should ensure will be provided by means of a credit system, with CO_2 credits and debits being calculated on the basis of absolute tones levels of CO_2 for each single vehicle and allowing for averaging over all vehicle sub-groups divisions. The generated credits and debits could then be used within a certain time frame (valid three years backwards and five years forward), which would enable manufacturers to make large steps in reducing CO_2 through new product offerings within intervals of more than one year. Such a credit system would also reflect the long product cycles and development time of heavy-duty vehicles in a meaningful manner. Applying the above-mentioned system to the various vehicle sub-groups in the portfolios of Europe's truck maufacturers would guarantee an equal distribution of efforts among all, as well as being the best way to meet CO_2 emission targets and therefore market demand at the same time.

GOAL THAT VEHICLES MANUFACTURER NEED TO COMPLY

European vehicle manufacturers' members believe that the following time frame and ambition need at certain levels for future emission green-house gas emitted from for heavy-duty vehicles are achievable at a high, but acceptable by standards. Nevertheless, the extremely short lead-time should be taken into account when setting the 2025 standard, especially given the product development of heavy-duty vehicles and that the selling will already be underway in 2025. A 2025 CO_2 reduction of 7% (i.e. -1.2% per year) for vehicle groups covered by the scope of the mandatory CO_2 declaration in 2019 (vehicle groups 4, 5, 9 and 10 – covering 80% of EU fleet emissions); based on a 2019 baseline calculated according to certified procedures and VECTO in order, 2030 emission of CO_2 the reduction target had been projected nearly 16% (i.e. -2% per year from 2025 to 2030), for all vehicle groups covered by the scope of the mandatory CO_2 EU declaration. This target would be based on the 2019 baseline and should be validated in 2022 [6].
As it were explained before, the baseline for future CO_2 standards should be based on VECTO-generated data. That is why it will be crucial that VECTO is updated regularly in the future, in order to install new technologies that will be introduced by truck makers to deliver to the CO_2 targets. Robust updates of VECTO will provide strong incentives for truck manufacturers to put cutting-edge technology in their vehicles – thereby stimulating further CO_2 reductions and encouraging customers to buy the most-efficient vehicles.

However, this would require a well-defined process with a clear timeline. ACEA recommends that VECTO is reviewed on an annual basis. Already now, technologies such as hybrid and electric drivetrains, dual-fuel engines, predictive cruise control, waste heat recovery and eco-roll are not accounted for. From year 2023 onwards, VECTO should be updated for all vehicle groups. These updates should go hand in hand with the 'ECO feature' process.

Low- and zero-emission vehicles (LEVs and ZEVs) could make an important contribution to the de carbonization of road freight transport, but they need to be incentivized in order to accelerate the market uptake of these innovative but very costly powertrains, and to enable customers to afford them. A system of 'super credits' (which give extra weighting to LEVs and ZEVs, i.e. these vehicles would count for more than one unit in reaching the targets) is the most effective approach to incentivize the market uptake of low-emission and zero-emission vehicles. This paper work complements the Impact Assessment accompanying the legislative proposal setting CO_2 standards for cars and vans from post-2021 year. It analyses the impacts of additional scenarios by using the same methodological approach as in the Impact Assessment. The assumptions made for the target levels and the incentive for zero-emission and low-emission vehicles (ZLEV) for cars and vans. The investments required for developing the necessary recharging and refueling infrastructure (electricity and hydrogen), both private and public charging points, are estimated in the table below for the different scenarios. Assuming that one public charging point is necessary per 10 electric cars (BEV and PHEV), the number of public charging points required in 2030 would range between 2.6 million under the 30% scenario and 8, 8 million for the most ambitious scenario. This represents an increase by a factor 20 to 75 compared to the 120,000 publically available charging points currently available in the EURO (7) VII! [7]. This estimation does not capture further developments in battery capacity and recharging speed, or scale effects as it assumes the constant ratio between the number of cars and the corresponding number of public charging points required. Both battery capacity and recharging speeds will reduce the number of necessary charging points. Nevertheless, it gives an indication of the additional effort needed with respect to the current situation.

AN AMBITION LEVEL FOR 2025 YEAR

The proposed review of the CO2 Regulation for cars and vans is foreseen for June 2021, which implies that inter-institutional agreement could be reached until late annual year 2022 or even later. Considering the long technological development and production cycles of the auto industry, it is simply not possible to change any technical parameters of vehicles this late if those vehicles have to be ready for the market in 2025. In principle, vehicles entering the market now will also be sold in 2025 and their production facilities are installed years in advance, especially those for major components like batteries. For this reason, the 2025 ambition level must remain the same as that fixed in the current CO_2 Regulation. This is necessary with a view to respecting the principles of better regulation and guaranteeing the reliability and robustness of the system. Next step will be the 2030 ambition level according to which auto industry is firmly committed to reach climate neutrality by 2050 and in general supports the objectives of the European Green Deal [8].

However, the CO2 ambition level for 2030 must reflect the environment in which our industry operates, especially with respect to the: significant drop in sales in 2020 and similar results expected for 2021 due to the COVID-19 pandemic, which has limited the investment possibilities of automobile manufacturers and also harmed consumer confidence and purchasing power, but also missing public and private charging and refueling infrastructure for electrified vehicles (50% share of electrically-chargeable vehicles by 2030 would require around 60 million private and public charging points to be available) as well as the required 1,000 public hydrogen refueling stations. In this context, ACEA considers the current targets already to be very challenging. Nevertheless, ACEA is open to the further development of the current regulation, as all of its members are equally committed to sustainably reaching a carbon-neutral transport sector by the middle of the 21st century. Nevertheless, any CO_2 reduction beyond the current targets must be directly and through legislation linked to key enabling conditions that must be met (the so-called 'conditionality principle'): A strong and ambitious AFID review in line with the agreed ACEA position (especially with regard to mandatory targets for member states and the Directive becoming a Regulation), according to previously

mentioned authorities should deliver a sharp increase in the number of publicly-available charging points by implementation of legislations.

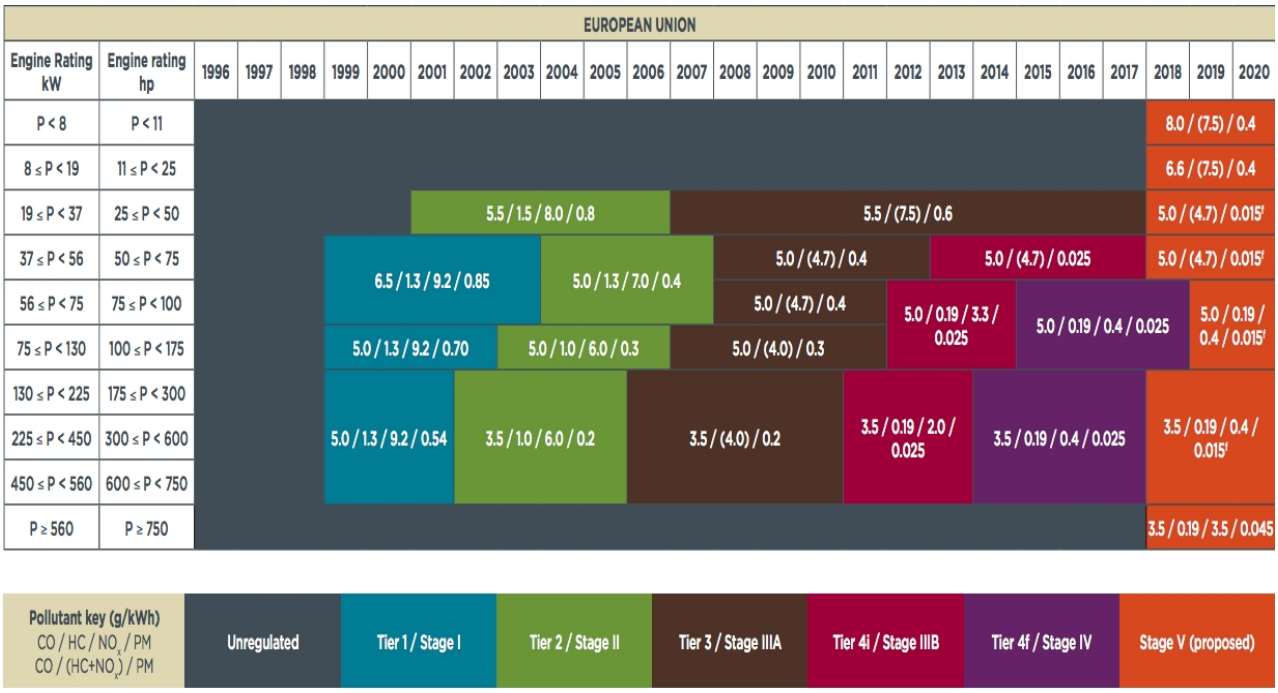

Figure 2. Figure 2. European Union Non-Road Diesel Engine Emission Standards [8].

The EU citizens should have the 'right to charge' in facilities accommodated for that purpose - both at public and private locations.

CONCLUSION

Potential fines for non-compliance with CO_2 targets should also be implemented for supporting the transition of the industry towards zero-emission mobility, and especially for building the needed charging and refueling infrastructure. EU state aid rules should be revised to allow restructuring and financing the further development of the sector across the EU. The interest for conditionality will get higher in connection with the AFID review. The review of the CO_2 Regulation must go hand-in-hand with an equally ambitious review of the Alternative Fuels Infrastructure Directive (AFID). As stressed in the recent non-paperwork (informal-joint letter) from ACEA, Transport & Environment (T&E) and the European Consumer Organization (BEUC), the Commision should show political commitment to deliver one million charging points in 2025, three million charging points by 2030, as well as a minimum of 1,000 hydrogen refueling stations. It should be reiterated that these numbers are necessary to reach the current ambition level of the CO_2 targets.
Therefore, any target level above the current levels must be accompanied by a conditionality mechanism. If the Commission wants to go beyond the current CO_2 targets it should consequently present an own more ambitious AFID proposal as unique and equal to the proposed CO_2 reduction target. Moreover, the AFID review must be also concluded before the CO_2 review. After all, the number of charging points and refueling stations member states agree to deploy also determines what would be an achievable CO_2 ambition level. Strong enforcement measures also have to be introduced to ensure that the AFID targets are met in reality and to ensure coherence between the CO_2 targets and the number of charging points and refueling stations needed. In other words, there needs to be a direct link between reduction targets set for vehicle manufacturers and the deployment level of charging and refueling infrastructure throughout the EU incomplete. ACEA wants to reiterate the fact that the Commission has made an explicit link between the deployment of alternative fuels infrastructure and attaining the 2030 CO_2 targets for passenger cars, light commercial vehicles and heavy - duty vehicles (HDVs). In this context, it must be stressed that high - power

charging points and hydrogen re‑fuelling stations are lacking in particular today. Indeed, making the necessary infrastructure available is critical to improving consumer convenience in the case of passenger cars and to allowing for smooth operational use of HDVs by freight operators. Reaching any CO_2 target beyond 2020 will greatly depend on the availability of infrastructure for alternatively‑powered vehicles.

The analysis of emissions performed in this article is in accordance with the rules of the NTE procedure. Performed on the basis of RDE, measurements have shown that the NTE procedure under typical operating conditions of agricultural vehicles does not meet its target. Especially important in this method is to determine a test cycle that takes into account operation on asphalt roads and work in the field. As a result, the share of valid measurement windows in the NTE method is expected to increase. If it does not exceed 50% of the work time, then the engine work performed in the measurements should be determined. If it is larger than the work generated in the NRTC test, the calculations should be carried out according to the initial proposal the European method dedicated for NRMM vehicles, proposed by the European Commission. However, it can be said that the introduction of increasingly strict legal regulations on permitted emissions dictates the application of certain improvements and technological solutions.

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