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THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

IMPACT OF IMPROVED REGULATION OF REAL-WORLD NO_X EMISSIONS FROM DIESEL PASSENGER CARS IN THE EU, 2015–2030

New analysis by the International Council on Clean Transportation finds that the real-driving emissions (RDE) test, to be introduced in the European Union in 2017, will likely reduce real-world nitrogen oxide (NO_X) emissions from new diesel cars from 5–7 times the Euro 6 limit to 4 times that limit (equivalent to a 20%–40% reduction). But future changes to the RDE test and European type-approval and enforcement practices recommended by the ICCT could reduce new diesel car NO_X emissions even further, to only 1.2 times the Euro 6 limit.

KEY FINDINGS AND POLICY IMPLICATIONS

- Under a Baseline RDE scenario, which reflects the RDE program as currently formulated (first and second packages), real-world NO_X emissions of new Euro 6 diesel cars will be reduced from 5–7 times the Euro 6 limit of 80 mg/km to 4 times that limit. This multiplier is higher than the regulated conformity factor of 2.1 since it includes real-world emissions resulting from defeat devices, poor calibrations, and driving conditions not covered by the RDE test. Total NO_X emissions from passenger cars in the EU-28 are projected to decrease through 2030 as a result of the RDE program and Euro 6 standards.
- Under a Conservative RDE+ scenario, in which cold-start provisions are added to the RDE test procedure in 2020 and market surveillance and tightened conformity factors are added in 2023 (the expected content of the third and fourth RDE packages), real-world NO_X emissions of new Euro 6 diesel cars would be reduced to 2.1 times the Euro 6 limit. If diesel cars retain their current market share, the Conservative RDE+ scenario would reduce NO_X emissions from cars in the EU-28 by 210,000 metric tons per year in 2030 compared to the Baseline RDE scenario.
- In an Accelerated RDE+ scenario, under which the provisions in the Conservative RDE+ scenario are introduced earlier—in 2018 and 2020—followed by a more stringent step in 2022, real-world NO_X emissions of new Euro 6 diesel cars would be reduced to 1.2 times the Euro 6 limit. The last, more stringent, step in 2022 would go beyond the current expectations for the RDE, including real-world emissions monitoring via remote sensing, expanded boundaries of the RDE test procedure, and publication of RDE test results to enable independent verification.
- Compared to the Baseline RDE scenario, the Accelerated RDE+ scenario would achieve a 360,000-ton annual NO_X reduction in 2030, assuming diesel cars retain their market share. And even if the market share of diesel cars were to decline from its current 50%-plus to less than 20% of new car sales, such a strengthened RDE program would still avoid hundreds of thousands of tons of NO_X emissions each year.
- At the local level, reductions in passenger car NO_X emissions could be accelerated via introduction of a low-emission zone (LEZ) that progressively phases out Euro 4 and Euro 5 diesel passenger cars. An LEZ implemented in conjunction with the Accelerated RDE+ scenario could achieve a 50% local reduction in passenger car NO_X emissions 8 years earlier than a Baseline RDE scenario without an LEZ.

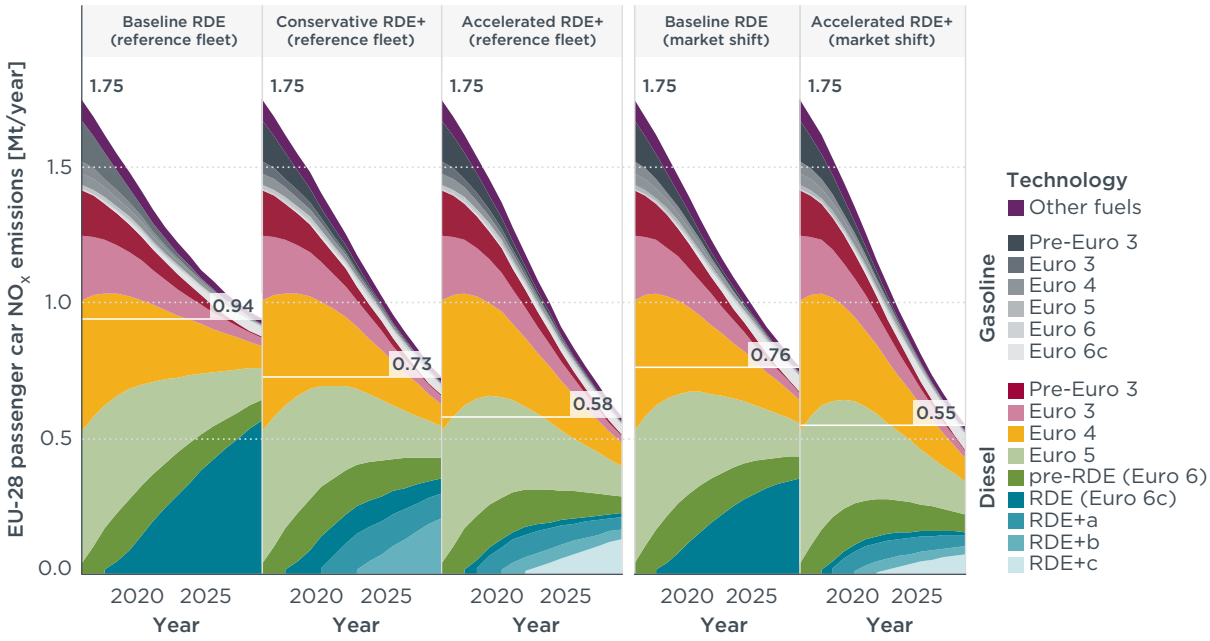

Figure 1. Projections of real-world NO_x emissions for passenger cars in the EU-28

BACKGROUND AND METHODOLOGY

- Transport is the largest contributor to emissions of NO_x in the EU (46% in 2013), and 80% of NO_x emissions in the transport sector come from diesel vehicles.
- Euro 4 and Euro 5 standards failed to reduce real-world NO_x from diesel cars. Real-world NO_x emission factors for Euro 4 and Euro 5 diesel cars average 800 mg/km—3.2 times the Euro 4 limit of 250 mg/km and 4.4 times the Euro 5 limit of 180 mg/km. In contrast, gasoline-powered cars have met regulated NO_x emission limits under real-world conditions, including the 60 mg/km limit for Euro 6 gasoline cars.
- Since September 2015, all new diesel passenger cars registered in the EU must meet the Euro 6 standard, which lowered the NO_x emission limit to 80 mg/km. But studies conducted with portable emissions measurement systems (PEMS) estimate a real-world NO_x emission factor of 450–600 mg/km (5 to 7 times the limit) for early Euro 6 models.
- Recent investigations by German, French, British, and Dutch national authorities point to a failure of the Euro 5 and Euro 6 regulatory compliance and enforcement mechanisms to ensure that manufacturers properly calibrate engine and aftertreatment devices to achieve low real-world NO_x emissions from diesel cars.
- The EU emissions type-approval procedure for passenger cars will soon include a new RDE test conducted using PEMS. RDE is being developed in four progressive regulatory packages, the first two of which were adopted earlier in 2016:

  1. New diesel car types are tested using PEMS for monitoring in 2016 (adopted)
  2. Beginning in January 2017, conformity factors will limit the gap between RDE test results and NO_x emission limits (adopted)
  3. Cold-start emissions and particulate emissions will become part of the RDE test (proposed)
  4. RDE testing will be extended to in-use vehicles rather than only prototypes (proposed)

- The ICCT has previously outlined five specific recommendations to strengthen the RDE regulation. Some of these modifications are in line with the European Commission's proposal for an overhauled light-duty type-approval framework and the expected content of the third and fourth RDE packages, but others go beyond them. The newly released white paper examines the potential impact of the RDE regulation and

ICCT's proposed modifications on real-world emission factors of new diesel cars and projected passenger car fleet NO_x emissions in the EU through 2030.

» Real-world emission factors were modeled for the Baseline RDE scenario and each progressive RDE+ step using ICCT's PEMS database of Euro 6 diesel cars combined with expert assumptions on the emissions behavior associated with four types of driving conditions (normal, cold-start, extended driving, and defeat devices/poor calibrations). Monte Carlo analysis was performed to assess the sensitivity of the modeled emission factors to variations in these input assumptions.

» Modeled real-world emission factors were combined with EU passenger car stock and activity data and projections up to the year 2030 to forecast the trends in passenger car NO_x emissions under various assumptions for RDE and diesel market share. Reference scenarios model a relatively constant new diesel car market share, whereas market-shift scenarios examine the sensitivity of results to a decline in diesel market share. The additional local-level impacts of an LEZ on average passenger car NO_x emissions were investigated for a hypothetical city with EU-average technology mix.

PUBLICATION INFORMATION

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DOWNLOAD
www.theicct.org/rde-passenger-car-nox-impacts-eu

ADDITIONAL RELATED INFORMATION
For a collection of ICCT research and analysis related to this topic, go to http://www.theicct.org/spotlight/eu-type-approval-test-procedures

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