The 2025 CO$_2$ standard for new cars: A look at technology penetration, CO$_2$ reduction potential and cost

“Road to efficiency” workshop
Brussels, June 9, 2016
Looking back: Technology penetration and cost estimates in the past
CO\textsubscript{2} regulations are driving new technologies into the market, both in the EU and U.S.
For some technologies the uptake is similar in both markets, for others there are striking differences.

still work in progress!
The CO₂ reduction effect for start-stop is high in NEDC but much lower for US-FTP and real-world

Start-stop

still work in progress!
The market for hybrid cars is still mostly driven by one manufacturer, both in the EU and U.S.

Forthcoming ICCT Working Paper

still work in progress!
Share of diesel is much smaller outside the EU, requiring more reductions from other technologies

Diesel

still work in progress!
The original penetration and cost estimates for the 130 g/km target for 2015 turned out to be too high.

To reach the level of 120 g/km\(^1\) the OEMs will have to force an increased market penetration of different technologies, which lead to extensive additional cost.

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<th>Needed additional market penetration of technologies</th>
<th>Additional cost</th>
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<tr>
<td>- Maximize market penetration of conventional powertrain technologies(^2)</td>
<td>- 3 250 Euro/car on small segment</td>
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<td>- Further reduce vehicle mass (^3)</td>
<td>- 3 900 Euro/car in medium segment</td>
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<td>- By an additional(^3) 15% on small segment</td>
<td>- 5 400 Euro/car on large segment</td>
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<td>- By an additional(^3) 18% on medium segment</td>
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<td>- By an additional(^3) 30% on large segment</td>
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<td>- Increase market penetration of mild-hybrids</td>
<td><strong>4 000 Euro/car on average, which equals an annual extra cost for society of about 50bn €</strong></td>
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<td>- To 20% on small segment</td>
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<td>- To 20% on medium segment</td>
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<td>- To 20% on large segment</td>
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<td>- Increase market penetration of full-hybrids to 2,5% on all segments</td>
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Note:  
1) Taken into account the negative impact from legal requirements and customer preferences of about 5.5 g/km.  
2) Excluding cylinder deactivation, which will only be applicable for engines with a number of cylinders of 8 and above.  
3) Starting point: vehicle weight when reaching average of 140 gCO\(_2\)/km in 2008 plus the additional weight from legal and customer preferences which is set equally to -145 kg on average for all segments. This equal 900+145=1045 kg for the small segment, 1200+145=1345 kg for the medium segment and 1450+145=1595 kg on the large segment.

\(130 \text{ g/km by 2015}\)

\([\text{TNO, 2006}]\)

\([\text{AEA, 2015}]\)

\(\text{g/km CO}_2\) reduction in NEDC compared to 2010 baseline

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http://www.theicct.org/blogs/staff/vehicle-technology-costs-estimates-vs-reality
For determining feasible CO\textsubscript{2} reduction rates and the associated cost there are different approaches

**Industry survey**
Industry representatives share data on CO\textsubscript{2} reduction potential and costs for technologies / technology packages

**In-depth bottom-up analysis**
Computer simulation of CO\textsubscript{2} reduction potential for technology packages + tear-down cost estimates
The assessment for meeting 95 g/km by 2020/21 was more thorough but still likely overly pessimistic.
Looking forward: What are the technologies to reach a 2025 target?
There is a variety of technical options to reduce CO₂ emissions of new vehicles, already today.
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- **Improving the gasoline engine**
  (still large potential for evolutionary development)
- **Improving the diesel engine**
  (less potential than for gasoline? exhaust aftertreatment? cost-benefit?)
- **Improving the transmission system**
  (more gears, moving to dual-clutch transmission)
- **Moving towards increased electrification**
  (mild hybrid $\rightarrow$ full hybrid $\rightarrow$ plug-in hybrid $\rightarrow$ range extender $\rightarrow$ fully electric)
- **Improving the vehicle road-load**
  (light-weighting aerodynamics, tires)

- **Technology is always evolving!**
The gap between official and real-world CO$_2$ data is expected to continue to increase, even with WLTP.

RDE* = comprehensive in-use conformity and on-road testing scheme
Results so far suggest that a 2025 target of ~70 g/km is reachable without a large share of electric vehicles still work in progress!

Based on: http://www.theicct.org/blogs/staff/vehicle-technology-costs-estimates-vs-reality
Payback for post-2020 target(s) is most likely still well within holding period of first hand owner.

[ICCT, 2016]
plug-in hybrid / electric vehicles
not yet incorporated

still work in progress!

15,000 km/year; 1.5 EUR/l
The bigger picture: What do we have to achieve in the mid and long term?
Globally, there is a competition to introduce more efficient vehicles and to reduce CO₂ emission levels.
For reaching the CO$_2$ reduction targets for 2030, we need a combination of all available measures.
Agreed long-term targets will require essentially the de-carbonization of our vehicle fleet

Pathway for CO₂ emission levels of new cars in the EU
For more information, please visit our website and/or get in touch with our team at ICCT

http://www.theicct.org/future-of-vehicle-testing
http://www.theicct.org/wltp-how-new-test-procedure-cars-will-affect-fuel-consumption-value-s-eu
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