THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

BRIEFING

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Reducing CO_2 and fuel consumption: A summary of the technology potential for new cars in the EU

1. EFFECT OF THE EU-CO_2 REGULATION

The official average CO_2 emissions level of new cars in the EU decreased from 170 grams per kilometer (g/km) in 2001 to 136 g/km in 2011—a 20 percent reduction in 10 years. This corresponds to a reduction in fuel consumption from roughly 7.0 liters per 100 kilometer (l/100km) to 5.6 l/100km.

When looking closer, two distinct periods can be identified. Up until about 2007, the annual reduction rate was about one percent per year. From 2008 to 2011, the rate of reduction increased significantly, to about four percent per year. A similar trend can also be found for the individual vehicle segments, indicating that the EU-wide mandatory CO_2 regulation—that was agreed in 2008—is a key driver behind these developments and is proving to be an effective instrument to increase vehicle efficiency.

The 2015 industry-wide target of 130 g/km was already nearly met in 2011, and indeed some vehicle manufacturers met their specific 2015 targets that year. Others, who are lagging behind, have announced that they will catch up and likely exceed their 2015 targets to some extent[1]. If the improvement rate since the introduction of the mandatory EU-CO_2 regulation for new cars continues into the future, the proposed 95 g/km target for 2020 would be met on time.

1 http://www.theicct.org/blogs/staff/eu-car-manufacturers-likely-meet-2015-co2-target-early

2. TECHNOLOGY POTENTIAL ASSESSMENT

In recent years we have seen a leap forward in assessing the future CO_2 emission reduction potential of vehicle technologies, and with assessing the costs associated with these new technologies. In the US, the Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and the ICCT teamed up to commission a detailed assessment involving extensive computer siumulations along with *tear-down* cost studies on real vehicles.

For the cost assessment, established vehicle technologies are compared to innovative technologies and both are broken down to the individual parts level. For the additional or revised components, a detailed physical and chemical analysis is then carried out to determine any necessary changes to materials and production processes. This approach allows for a thorough and transparent assessment of the cost of a technology when being produced in high volume and mirrors a similar approach generally used by manufacturers and suppliers in the automotive industry.

Building on the results of the US analysis, ICCT commissioned an additional study specifically for the European vehicle market, carried out by Ricardo Inc., FEV Inc. and the University of Aachen. This study used European baseline vehicles and labor costs and material prices in Germany[2].

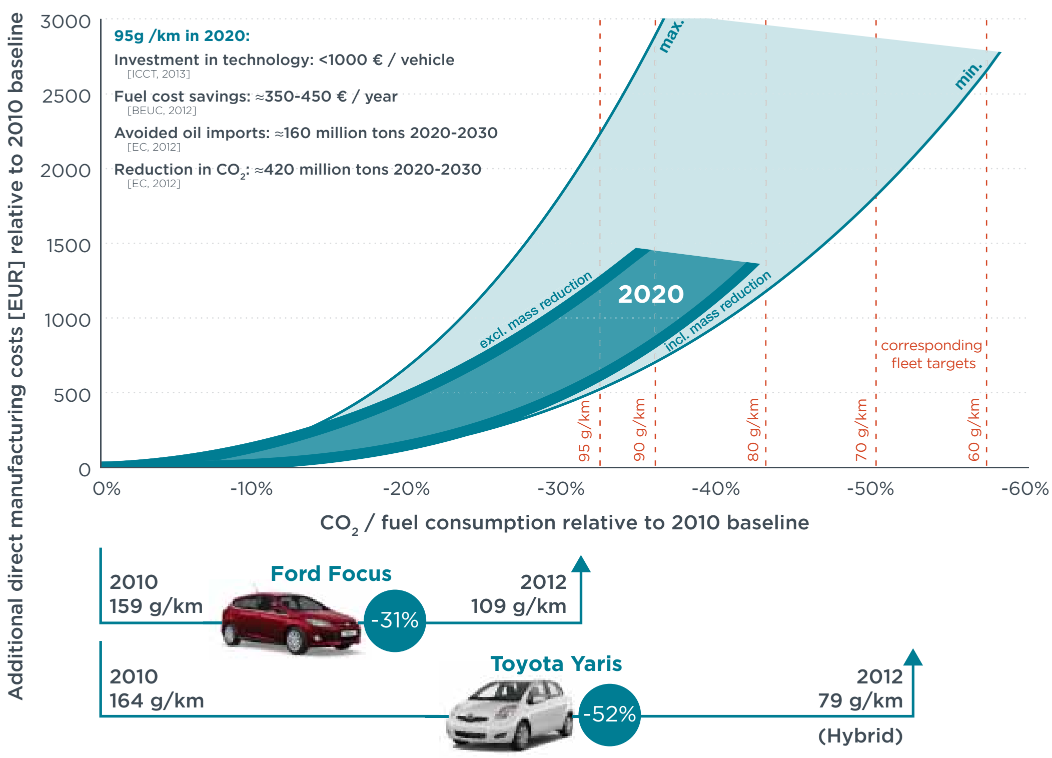

Fig. 1: CO_2 reduction cost curve for the European passenger cars market, based on vehicle computer simulation and tear-down cost assessments. Reference year is 2010—costs for reference year 2015 (130 g/km) are lower[3].

2 http://www.theicct.org/eu-cost-curve-development-methodology

3 The curve "excl. mass reduction" shows the expected compliance costs in a regulatory system that *fully* discounts mass reduction, the curve "incl. mass reduction" the costs in a technology-neutral system.

The results show that for meeting the proposed 95 g/km target in 2020, an investment in new technologies of less than 1,000 EUR per vehicle is needed (Fig. 1). Current cost estimates are expected to be conservative, as they assume German labor cost rates and do not incorporate any further technology improvements beyond what is known today.

Taking today's fuel prices and annual driving ranges, the expected fuel cost savings from the proposed 95 g/km target are in the order of 350-450 EUR per year per vehicle[4]. For the consumer, as well as for society as a whole, significant savings over the lifetime of a vehicle can therefore be expected—even taking into account indirect technology costs and vehicle taxes.

The Ford Focus, one of the top-5 most popular cars in Europe, is a real-world example for some of the technologies that will likely be used to meet the 95 g/km target by 2020. The 2012 vehicle has a smaller, turbocharged engine, makes use of Gasoline Direct Injection, and applies a Start-Stop system. The result is a vehicle that has about 30 percent lower CO_2 emissions in 2012 than it had in 2010, without any reduction in vehicle weight and while maintaining all vehicle performance characteristics. The 2012 version of the Audi A3—having the same vehicle platform as the VW Golf—emits 29 percent less CO_2 emissions than the 2010 version of the vehicle, using similar technologies plus a dual-clutch automated manual transmission. In order to reach the 95 g/km target in 2020, a 32 percent reduction compared to 2010 (27 percent compared to the 2015 target value) is required for the total vehicle fleet. This reduction has been met by both vehicles—the Ford Focus and Audi A3—already in 2012.

Another example is the Toyota Yaris: the 2012 hybrid version of the vehicle emits about 50 percent less CO_2 than the 2010 non-hybrid version, thereby demonstrating the reduction potential of this more advanced technology. For the average fleet, however, it is expected that few hybrid vehicles are needed to meet the 95 g/km target. This may be different for individual vehicle manufacturers, depending on their fleet mix.

3. CHOICE OF THE INDEX PARAMETER

Reducing the weight of a vehicle is an important measure for reducing its CO_2 emissions. Yet, the current CO_2 target system dis-incentivizes weight reduction: the heavier a car, the more CO_2 emission it is allowed to emit. Equally, if a manufacturer reduces the weight of its vehicles, it now faces a more stringent target. In comparison, a target system based on vehicle size, such as the footprint of a vehicle, is technology neutral. Calculations show that meeting the 95 g/km target under a footprint-based target system can be up to 40 percent cheaper than under a weight-based target system.

Given the development of advanced computer simulations (capable of simultaneously optimizing the material and design of every part on the vehicle), and the desire to maximize the driving range of electric vehicles, weight reduction is likely to become a much more important compliance option in the future. When switching to a footprint-based target system, it is important to allow sufficient lead-time to manufacturers, so that they can adapt their product plans accordingly. A dual-compliance approach for the 2020 standards could help in this respect: It would allow manufacturers to choose

4 http://www.beuc.org/custom/2012-00461-01-E.pdf

between a weight- or a footprint-based target for 2020, but would at the same time set the path to a mandatory footprint-based system for beyond 2020.

In a similar way, manufacturers should be given sufficient time to prepare for future CO_2 targets. Studies such as the ICCT EU cost curve work already allow the estimation of technical and economically sensible CO_2 targets for 2025 based on current knowledge. These can be re-evaluated at a later point in time in the form of a *review* based upon the latest technical knowledge and economic developments.

CONTACT Dr. Peter Mock, peter@theicct.org, +49 30 847129-102, http://www.theicct.org

ICCT is an independent nonprofit organisation founded to provide first-rate, unbiased research and technical and scientific analysis to environmental regulators. The ICCT participants' council comprises two dozen high-level civil servants, academic researchers, and independent transportation and environmental policy experts, who come together at regular intervals to collaborate as individuals on setting a global agenda for clean transportation. ICCT was founded in 2005, and since 2012 is present in Europe with offices in Berlin and Brussels. Principal funding for the ICCT comes from private foundations, such as the ClimateWorks Foundation in the US, and Stiftung Mercator in Europe.