

## SHIFTING GEARS: THE EFFECTS OF A FUTURE DECLINE IN DIESEL MARKET SHARE ON TAILPIPE CO<sub>2</sub> AND NO<sub>x</sub> EMISSIONS IN EUROPE

The market share of fuel-efficient new diesel cars in the European Union has remained above 50% since 2010, greatly aiding the EU's efforts to reduce carbon emissions. But diesel market share is expected to fall significantly. A number of cities are threatening to ban diesel cars from their city centers as air-quality problems related to nitrogen oxide emissions mount, and consumers are turning against them. Meanwhile, improved exhaust aftertreatment technology is making diesel engines more expensive at the same time as some EU member states are cutting tax benefits diesel benefited from in the past, further weakening the competitive market position of diesel cars.

Yet despite the anticipated decline in diesel car sales future carbon dioxide (CO<sub>2</sub>) standards in the EU can still be met even if new-car diesel share falls as low as 15% by 2025, a new study by the International Council on Clean Transportation finds.

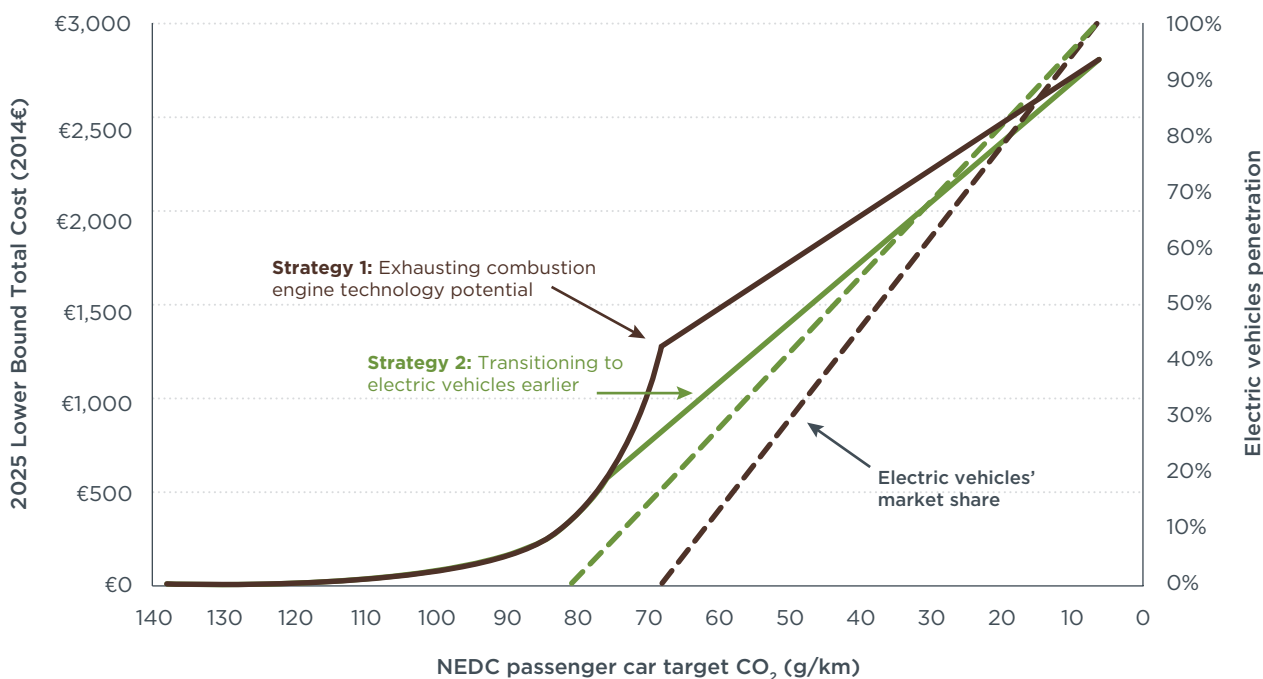
### BACKGROUND

- » Between 1990 and 2015, the average share of new diesel cars in Europe increased from about 14% to 52%, reaching a maximum of approximately 56% in 2011. Apart from Europe, the only major car markets worldwide with a significant share of diesel passenger cars are India and South Korea. In China, Japan, and the United States, diesel cars account for less than 5% of the market.
- » Despite the low diesel market shares in Japan and the United States, CO<sub>2</sub> emissions from new cars in those countries have decreased significantly in recent years. Japan's average

CO<sub>2</sub> emissions from new cars decreased from 182 grams per kilometer (g/km) in 2001 to 115 g/km in 2014—lower than the average CO<sub>2</sub> emissions from new cars in the EU (123 g/km in 2014). The CO<sub>2</sub> reduction in Japan was achieved partly due to an increasing share of hybrid electric vehicles. Approximately 20% of new cars in Japan are hybrids, whereas in the EU, the market share is only 1.4% of new cars. Similarly, within the EU, the Netherlands was most successful in reducing new cars' CO<sub>2</sub> levels, to a level of 102 g/km by 2015, despite the fact that diesel cars make up only 25% of the market. At the same time, sales of hybrid and plug-in hybrid electric vehicles in the Netherlands increased dramatically in recent years, to a level of 15.6% by 2015 (compared to 2.1% for the EU average).

### KEY FINDINGS

- » Within a vehicle segment, diesel cars emit less CO<sub>2</sub> than non-hybrid gasoline cars. For the lower medium segment in the EU, the average diesel car emits about 17% less CO<sub>2</sub> than the average non-hybrid gasoline car. However, the average hybrid car emits 18% less CO<sub>2</sub> than the average diesel car. At the fleet level, across all vehicle segments, average CO<sub>2</sub> emissions of new diesel and gasoline cars are nearly identical (119 g/km vs. 123 g/km, respectively), indicating that efficiency gains from the diesel engine often are counterbalanced by a higher engine power and higher weight for diesel cars.
- » Focusing on a comparison within a specific vehicle segment and EU member state, the ICCT study found that the average sale price



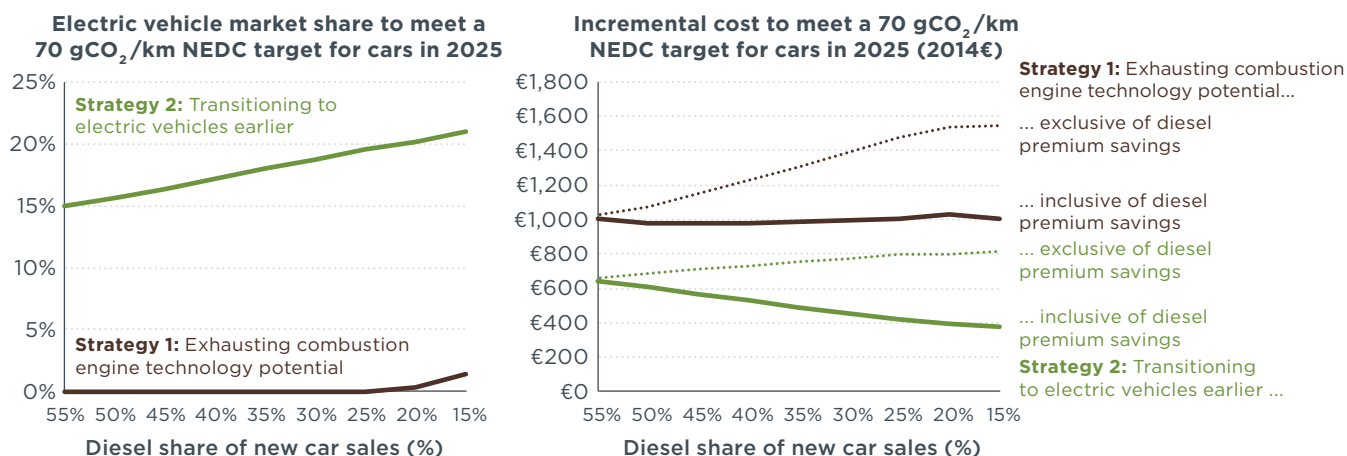
**Figure 1.** Total incremental cost (including indirect costs but excluding taxes) of reducing CO<sub>2</sub> emissions of the average passenger car in the EU by 2025 in a lower-bound scenario, comparing full deployment of combustion-engine technologies before transitioning to electric vehicles to a least-cost strategy of transitioning to electric vehicles earlier.

of new hybrid cars has decreased significantly in recent years, whereas prices for gasoline and diesel cars have remained constant or have increased slightly. In 2015, the average hybrid car within the lower medium segment in Germany sold for €26,700, whereas the average diesel car cost €1,700 more. Given that the average hybrid car emits less CO<sub>2</sub> and is now cheaper than the average diesel car within a specific vehicle segment, switching from a gasoline to a hybrid car is a more cost-efficient way of reducing CO<sub>2</sub> than switching from a gasoline to a diesel car.

- » A 2016 ICCT analysis of 2020–2030 CO<sub>2</sub> standards for new cars and light-commercial vehicles, assuming a constant diesel car market share of 55%, showed that a passenger car CO<sub>2</sub> standard of 70 g/km (measured on the New European Driving Cycle [NEDC]) would require few or possibly no electric vehicle sales. The range of combustion engine technologies, including 48-volt belt starter-generator and full parallel P2 hybrid electric vehicles, is sufficient to reduce the fleet average CO<sub>2</sub> emissions to that level. The average per-vehicle cost increment to reach that target, including indirect costs but excluding taxes, would fall between €1,000 and €2,150 in 2025, compared to a 2014

baseline. Switching to electric vehicles earlier and following a least-cost technology strategy, rather than exhausting the full potential of combustion-engine technologies, would reduce the cost of meeting a 70 g/km (NEDC) CO<sub>2</sub> target by €300–€400 per vehicle in 2025.

- » Assuming the same 70 g/km (NEDC) CO<sub>2</sub> standard for 2025, the diesel market share is now gradually reduced from 55% to a minimum of 15%. In the “exhausting combustion engine technology” scenario, diesel vehicles are replaced by advanced gasoline vehicles (including hybrid vehicles) and (when the diesel share falls below 25%) also partly by electric vehicles. In the “transitioning to electric vehicles earlier” scenario, manufacturers comply with the target by offering more electric, hybrid, and advanced gasoline vehicles in place of diesels. In both cases, the required investment in vehicle efficiency technologies increases but is counterbalanced if taking into account the cost savings when moving away from diesel engines. This is because the production costs of diesel engines are generally greater than their gasoline counterparts, considering the higher temperatures and pressures for the diesel combustion process as well as more complex exhaust aftertreatment systems. As a



**Figure 2.** Change in electric vehicle market shares (left) and compliance costs (right) for meeting a 70 g/km NEDC target for cars in 2025 with different diesel market shares.

result, the net compliance cost for reaching a 70 g/km (NEDC) target by 2025 would decline by €10–€280 per vehicle, if the diesel market share were to drop to a level as low as 15%.

- » As a co-benefit, nitrogen oxide (NO<sub>x</sub>) emissions from diesel cars are estimated to

be 60,000–260,000 tons lower by 2030 if the new car diesel market share in the EU drops to 15% by 2025. This would equal a reduction of 10%–28% compared to a baseline scenario and is equivalent to the sum of all NO<sub>x</sub> emissions in a country the size of the Netherlands.

## FURTHER READING

- » **Shifting gears: The effects of a future decline in diesel market share on tailpipe CO<sub>2</sub> and NO<sub>x</sub> emissions in Europe**  
<http://theicct.org/effects-of-future-EU-diesel-mkt-share-decline>
- » **2020–2030 CO<sub>2</sub> standards for new cars and light-commercial vehicles in the European Union**  
<http://www.theicct.org/2020-2030-co2-standards-cars-lcvs-eu-briefing-nov2016>
- » **Impact of improved regulation of real-world NO<sub>x</sub> emissions from diesel passenger cars in the EU, 2015–2030**  
<http://www.theicct.org/rde-passenger-car-nox-impacts-eu>
- » **Cities driving diesel out of the European car market**  
<http://theicct.org/blogs/staff/cities-driving-diesel-out-european-car-market>

## FURTHER INFORMATION

**Title:** Shifting gears: The effects of a future decline in diesel market share on tailpipe CO<sub>2</sub> and NO<sub>x</sub> emissions in Europe

**Download:** <http://theicct.org/effects-of-future-EU-diesel-mkt-share-decline>

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