

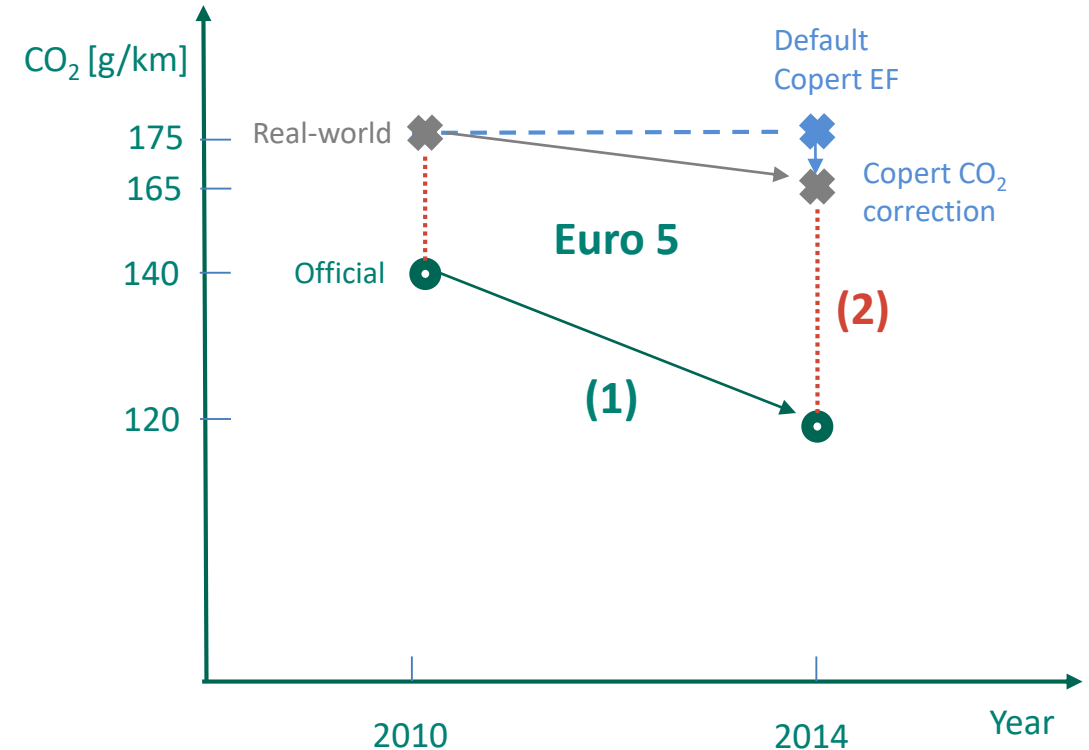
# COPERT Training

## 7. CO<sub>2</sub> correction methodology



# CO<sub>2</sub> correction description

- Without the CO<sub>2</sub> correction tool, Copert CO<sub>2</sub> emission factor would be steady over years.
- CO<sub>2</sub> correction models:
  1. The efficiency improvement of passenger cars over the years.
  2. By taking into consideration the increasing gap between official and in-use CO<sub>2</sub> emissions / fuel consumption.



# CO<sub>2</sub> correction methodology (1/3)

- CO<sub>2</sub> correction use functions based on the regression model developed by Uwe Tietge et al., 2017\* which considers an increase in the gap over time

Regression coefficients for Petrol and Diesel vehicles

Year	Petrol	Diesel
2002	0.06109	0.01423
2003	0.07502	0.09597
2004	0.21420	0.14220
2005	0.27260	0.20380
2006	0.30680	0.21990
2007	0.37350	0.21190
2008	0.47190	0.23600

Year	Petrol	Diesel
2009	0.49580	0.21270
2010	0.53240	0.24680
2011	0.65210	0.35810
2012	0.67840	0.43610
2013	0.81580	0.53210
2014 and on	1.00100	0.77140

- The user has to provide:
  - Reference mass
  - Engine capacity
  - Type approval CO<sub>2</sub> EF

\*Uwe Tietge et al., 2017 Uwe Tietge, Peter Mock, Vicente Franco, Nikiforos Zacharof  
From laboratory to road: Modeling the divergence between official and real-world fuel consumption and CO<sub>2</sub> emission values in the German passenger car market for the years 2001–2014, Energy Policy



# CO<sub>2</sub> correction methodology (2/3)

- The equations for petrol and diesel vehicles are the following:

Petrol:  $FC_{InUse} \left[ \frac{l}{100km} \right] = 0.06056 + 0.0004079 \times CC + 0.001214 \times m + 0.7551 \times FC_{TA} + Y_{RC}$

Diesel:  $FC_{InUse} \left[ \frac{l}{100km} \right] = -0.5682 + 0.0003539 \times CC + 0.001708 \times m + 0.6279 \times FC_{TA} + Y_{RC}$

$FC_{TA}$  stands for type-approval fuel consumption (in l/100km)

$m$  stands for the vehicle reference mass (empty weight + 75 kg for driver and 20 kg for fuel)

$CC$  stands for the engine capacity in cm<sup>3</sup>

$Y_{RC}$  stands for the Year regression coefficient



# CO<sub>2</sub> correction methodology (3/3)

A correction then is applied to the fuel consumption and CO<sub>2</sub> emission factors based on the following equation:

$$\textit{Correction} = \frac{FC_{InUse}}{FC_{Sample}}$$

where  $FC_{Sample}$  is calculated as the average fuel consumption of the vehicle sample used in developing COPERT emission factors over the three parts (Urban, Road and Motorway) of the Common Artemis Driving Cycles (CADC).



# An example of CO<sub>2</sub> correction

Before CO<sub>2</sub> correction

Category	Fuel	Segment	Euro Standard	Total g/km Total
Passenger Cars	Petrol	Small	Euro 5	201.1064

Category	Fuel	Segment	Euro Standard	Total [MJ/km] Total
Passenger Cars	Petrol	Small	Euro 5	2.7901

User input

Category	Fuel	Segment	Euro Standard	Year	Share of Registration [%]	Capacity [cc]	Mass [kg]	CO2 T/A [g/km]	Result [g/km]
Passenger Cars	Petrol	Small	Euro 5	2012					
Passenger Cars	Petrol	Small	Euro 5	2013					
Passenger Cars	Petrol	Small	Euro 5	2014	100%	1,100	1,200	140	178.99

After CO<sub>2</sub> correction

Category	Fuel	Segment	Euro Standard	Total g/km Total
Passenger Cars	Petrol	Small	Euro 5	190.9301

Category	Fuel	Segment	Euro Standard	Total [MJ/km] Total
Passenger Cars	Petrol	Small	Euro 5	2.6492



**Thank you for your attention!**

