COPERT updates in v5.3

European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution

New elements in 2019

- Revision of emission factors for mopeds and motorcycles
- Calculation of the fossil fuel fraction in biodiesel
- Revision of Euro 6d evaporation emission factors
- Revision of Euro 6 LCVs emission factors

Emission factors update: Mopeds & Motorcycles

European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution

Test campaigns

- New tests in the framework of the ERMES-ACEM study (2018)
  - Sample: 3 mopeds and 15 motorcycles
  - Technology: Euro 4
  - Lab: JRC, TUG and FHB

- Tests in the framework of the L-category Euro 5 Effect Study (2017)
  - Sample: 41 vehicles
  - Technology: Euro 1 to Euro 4
  - Lab: JRC (mostly) and LAT

Test campaigns cont'd

- Tests on mopeds in the Netherlands (2017)
  - Sample: 15 mopeds
  - Technology: Euro 2 and Euro 3
  - The measurement programme was set up by TNO

- Tested driving cycles:
  - WMTC, ECE R40, ECE R47, WOT, IUC, AMA, SRC-LeCV, FHB1, FHB2, FHB3, FHB4, RCC, RDC1, RDC2, RDM

Methods: mopeds

- Euro 3
  - Based on the data from the TNO study *(data from the Euro 5 Effect study have been used only for verification)*
  - Based on the driving cycle: ECE R47

- Euro 4
  - Based on the data from the ERMES-ACEM study
  - Based on the driving cycles: ECE R47 and RDM

Methods: motorcycles

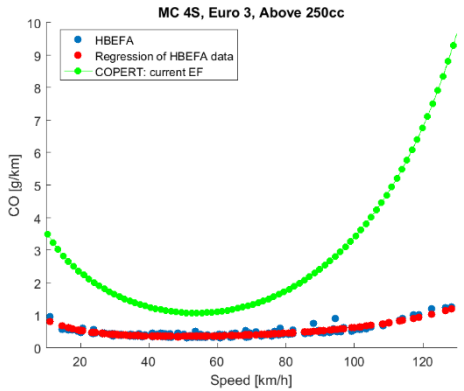
- Technology: Euro 3 to Euro 5
- Pollutants: CO, VOC, NO_x and energy consumption
- Motorcycle classes: 2-stroke, 4-stroke <250 cc, 4-stroke 250-750 cc, 4-stroke >750 cc
- Calculation steps
  - Step #1: the measurement data have been processed by TUG, providing the emission factors of HBEFA v4.1
  - Step #2: regression analysis: Levenberg-Marquardt (LM) algorithm for non-linear curve-fitting of data, using the robust least absolute residuals (LAR) fitting method

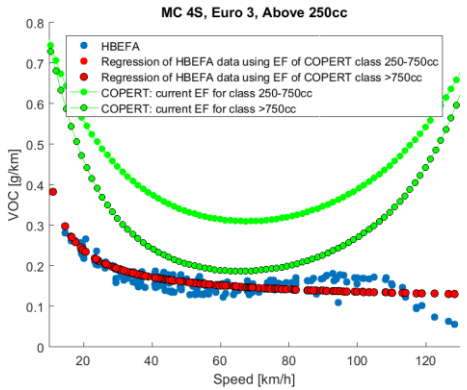
Emission factors

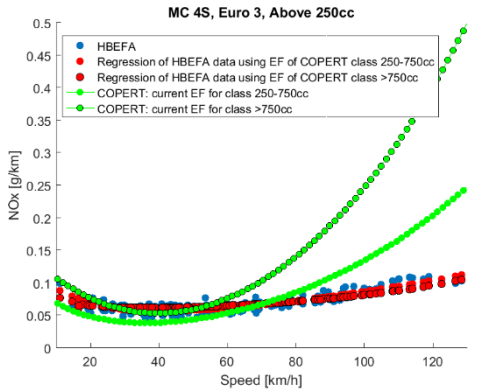
- Mopeds:

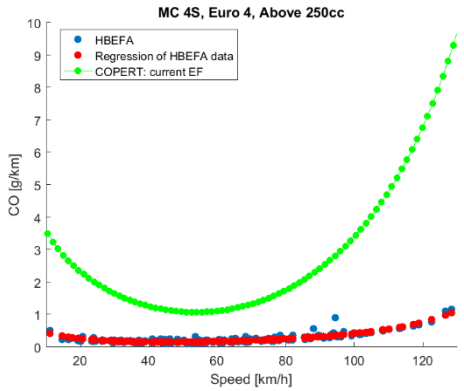
Euro	Driving Mode	CO [g/km]	VOC [g/km]	NO_x [g/km]	PM (exhaust) [mg/km]	PN [#/km]	CO_2 [g/km]	FC [l/100km]
Euro 3	Urban	3.9	1.8	0.39	8.4	2.3E+12	41.3	2.3
	Rural	2.0	1.0	0.36	6.5	2.3E+12	44.1	2.1
Euro 4	Urban	2.4	0.5	0.05	2.1	-	46.5	2.2
	Rural	2.0	0.4	0.04	1.5	-	46.4	2.2

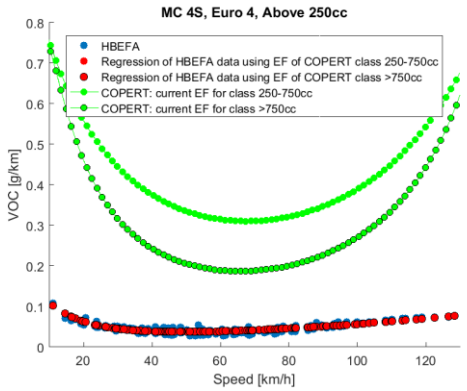
- Motorcycles:

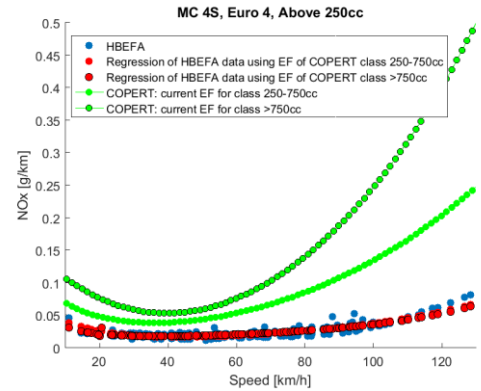










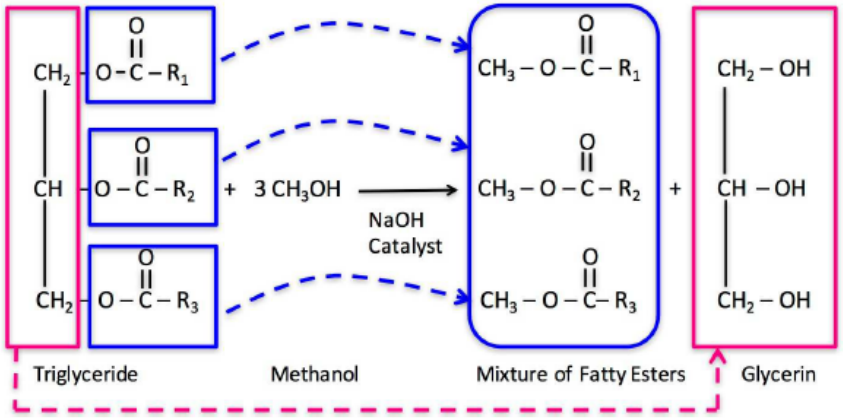


Calculation of the fossil fuel fraction in biodiesel

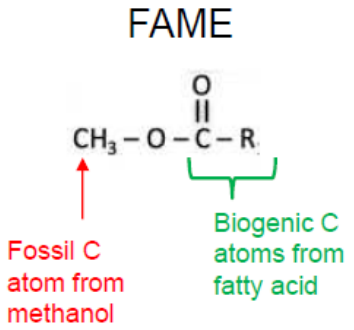
European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution

Why this update?

- Assessment of biodiesel origin: Identify & separate biogenic and fossil feedstock involved in the production process. E.g. biodiesel from coal methanol with vegetable oil has a non-zero fossil fuel fraction, thus not entirely carbon neutral fuel
- Depending on the production pathway, fossil fuel carbon content is about 5.5%
- Aim: Calculation of fossil fuel carbon content of biodiesel deriving from the most widely used production pathways



Source: https://www.e-education.psu.edu/egee439/node/684



European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution

Fossil and biogenic CO_2 emissions to FAME

- Fossil origin g CO_2 / g FAME = (carbon content of FAME) * (fossil part of C of FAME) * 44/12
- Bio origin g CO_2 / g FAME = (carbon content of FAME) * [100% - (fossil part of C of FAME)] * 44/12

	C fossil part	Carbon content	g fossil CO_2 / g FAME
Sunflower	5.3 %	77.2 %	0.150
Rapeseed	5.3 %	75.5 %	0.147
Palm oil	5.5 %	71.8 %	0.145
Cottonseed	5.4 %	77.0 %	0.152
Tallow	5.5 %	73.6 %	0.148
Lard	5.4 %	74.4 %	0.147

New Euro 6d evaporation emission factors

European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution

Why this update?

- Regulation (EU) 2017/1221 introduced a new procedure for evaporative emissions, applicable to Euro 6d-temp and Euro 6d vehicles
- Whereas the emission limit remains at 2.0 g of NMVOC per test, the procedure becomes more severe, specifically targeting the aging of the carbon canister and the permeability of the fuel system

Methodology

- Modelling work carried out in the framework of the “Review of the European test procedure for evaporative emissions | Cost/Benefit analysis” (JRC)
- A number of scenarios developed to assess different policy options
- COPERT model adjusted to simulate the developed scenarios

Scenario 1	Scenario 2	Scenario 3
• More aggressive purging	• More aggressive purging • Bigger canister (size x 2)	• More aggressive purging • Bigger canister (size x 2) • Improved durability (lower carbon degradation) • Multi-layer tanks for all cars

Results

- Stricter procedure in Regulation (EU) 2017/1221:
  - Longer (48 h) diurnal test --> Bigger activated carbon canister
  - Shorter preconditioning time --> More intense purging strategy
  - Stricter aging procedure of the carbon canister --> Low degradation carbon

		Canister size (liters)		Degradation / purging strategy	
		Current (GB 2018)	Suggested (GB 2019)	Current (GB 2018)	Suggested (GB 2019)
Mini & small Passenger Cars (petrol only)	**Euro 3 – Euro 6c**	0.8	0.8	High degr. / low purge rate	High degr. / low purge rate
	Euro 6d-temp / 6d		1.6		Low degr. / high purge rate
Medium Passenger Cars N1-I, N1-II LCVs (petrol only)	**Euro 3 – Euro 6c**	1.0	1.0	Low degr. / high purge rate	Low degr. / high purge rate
	Euro 6d-temp / 6d		2.0		
Large Passenger Cars N1-III LCVs (petrol only)	**Euro 3 – Euro 6c**	1.5	1.5	Low degr. / high purge rate	Low degr. / high purge rate
	Euro 6d-temp / 6d		3.0		

Revision of Euro 6 LCVs emission factors

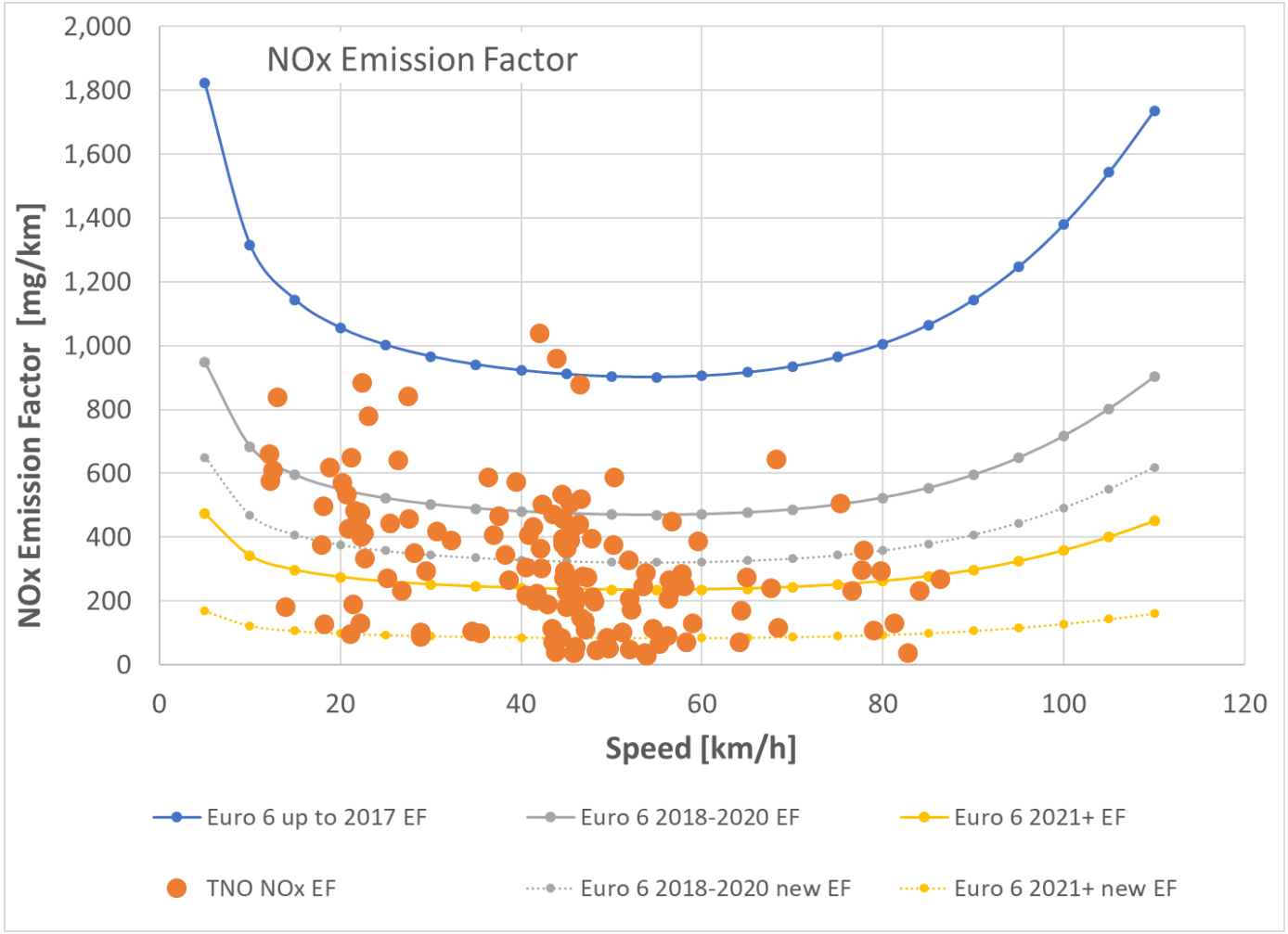
European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution

Why this update?

- Previous EFs based on assumed developments over previous standards, in line with passenger cars
- New experimental data has become available

- 3 TNO reports:
  - Investigations and real world emission performance of Euro 6 light-duty vehicles (2013 R11891)
  - NOx emissions of Euro 5 diesel vans – test results in the lab and on the road (2016 R10356)
  - NOx emissions of eighteen diesel Light Commercial Vehicles: Results of the Dutch Light-Duty road vehicle emission testing programme 2017 (2017 R11473)

Results (N1 II-III)



European Environment Agency
European Topic Centre on Air pollution, transport, noise and industrial pollution

Thank you for your attention!

European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution