1.A.3.b iv - Road Transport: Mopeds & Motorcycles

Short description

In sub-categories *1.A.3.b iv - Road Transport: Mopeds & Motorcycles* emissions from fuel combustion in motorised two-wheelers are reported.

Category Code	**Method**					**AD**				**EF**					
1.A.3.b iv	T1, T3					NS, M				CS, M, D					
	NO_x	**NMVOC**	**SO_2**	**NH_3**	**$PM_{2.5}$**	**PM_{10}**	**TSP**	**BC**	**CO**	**PB**	**Cd**	**Hg**	**Diox**	**PAH**	**HCB**
Key Category:	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-

Methodology

Activity data

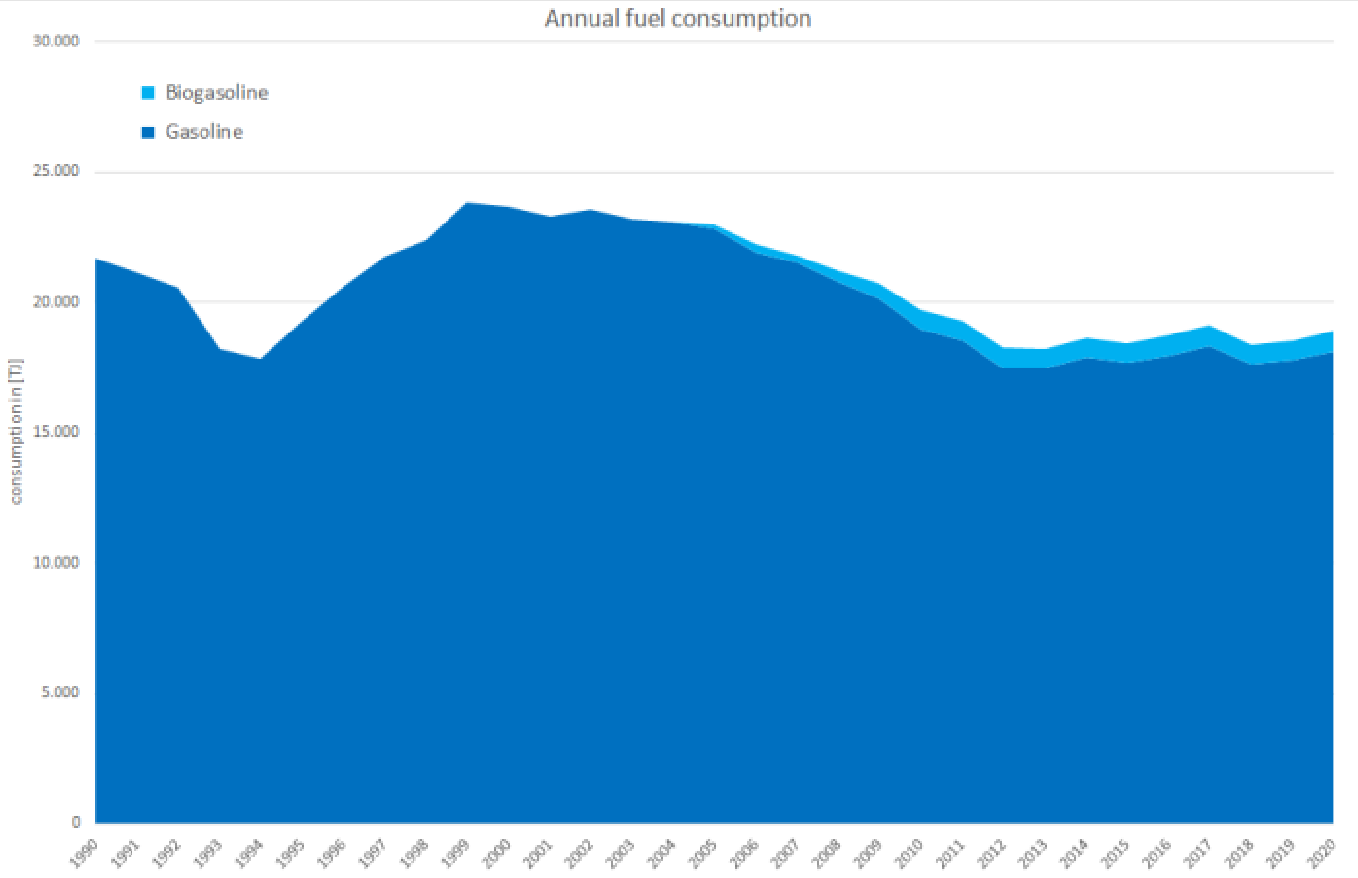
Specific consumption data for mopeds and motorcycles is generated within the TREMOD model (Knörr, 2021a) [1].

The following table provides an overview of annual amounts of gasoline fuels consumed by motorized two-wheelers in Germany.

Table 1: Annual fuel consumption of mopeds and motorcycles, in terajoules

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
MOPEDS																			
Gasoline	4,953	3,102	3,133	3,056	3,021	3,169	3,240	3,517	3,298	3,235	3,067	3,152	3,155	3,173	3,186	3,181	3,119	3,160	3,230
Biogasoline	0	0	0	21	44	43	62	100	127	133	136	135	137	138	138	134	140	136	147
Σ Mopeds	**4,953**	**3,102**	**3,133**	**3,077**	**3,065**	**3,212**	**3,302**	**3,617**	**3,426**	**3,368**	**3,203**	**3,287**	**3,293**	**3,310**	**3,324**	**3,315**	**3,259**	**3,296**	**3,377**
MOTORCYCLES																			
Gasoline	16,747	16,206	20,514	19,740	18,888	18,352	17,563	16,613	15,680	15,294	14,426	14,326	14,731	14,502	14,786	15,152	14,483	14,618	14,875
Biogasoline	0	0	0	21	44	43	62	100	127	133	136	135	137	138	138	134	140	136	147
Σ Motorcycles	**16,747**	**16,206**	**20,514**	**19,761**	**18,932**	**18,395**	**17,625**	**16,714**	**15,807**	**15,427**	**14,562**	**14,461**	**14,868**	**14,640**	**14,925**	**15,287**	**14,623**	**14,754**	**15,022**
MOTORIZED 2-WHEELERS: Mopeds & Motorcycles																			
Gasoline	21,700	19,308	23,648	22,796	21,909	21,521	20,803	20,130	18,978	18,530	17,493	17,478	17,887	17,675	17,972	18,333	17,601	17,777	18,104
Biogasoline	0	0	0	157	316	291	398	575	733	760	775	749	778	767	781	773	791	767	827
Σ 1.A.3.b iv	**21,700**	**19,308**	**23,648**	**22,953**	**22,225**	**21,812**	**21,201**	**20,705**	**19,712**	**19,289**	**18,268**	**18,227**	**18,665**	**18,441**	**18,753**	**19,106**	**18,393**	**18,544**	**18,931**

source: TREMOD [2]



For information on mileage, please refer to sub-chapters on emissions from tyre & brake wear and road abrasion.

Emission factors

The majority of emission factors for exhaust emissions from road transport are taken from the 'Handbook Emission Factors for Road Transport' (HBEFA, version 4.1) [3] where they are provided on a tier3 level mostly and processed within TREMOD [4].

However, it is not possible to present these highly specific tier3 values in a comprehendible way here.

With respect to the country-specific emission factors applied for particulate matter, given the circumstances during test-bench measurements, condensables are most likely included at least partly. [1]

For heavy-metal (other then lead from leaded gasoline) and PAH exhaust-emissions, default emission factors from the 2019 EMEP Guidebook (EMEP/EEA, 2019) [5] have been applied. Regarding PCDD/F, tier1 EF from (Rentz et al., 2008) [6] are used instead.

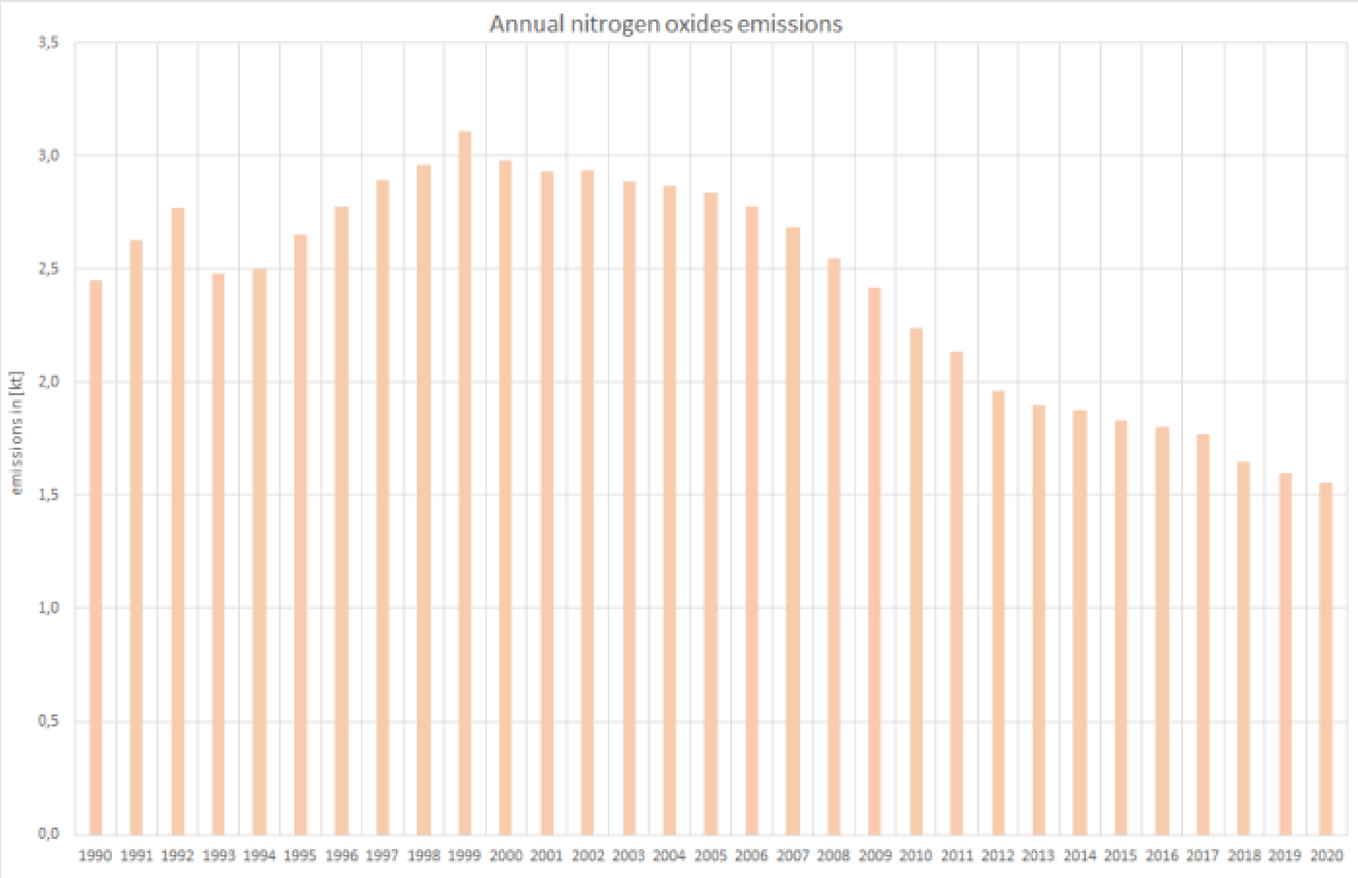
Table 3: Overview of applied EMEP/EEA defaults and other tier1 EF

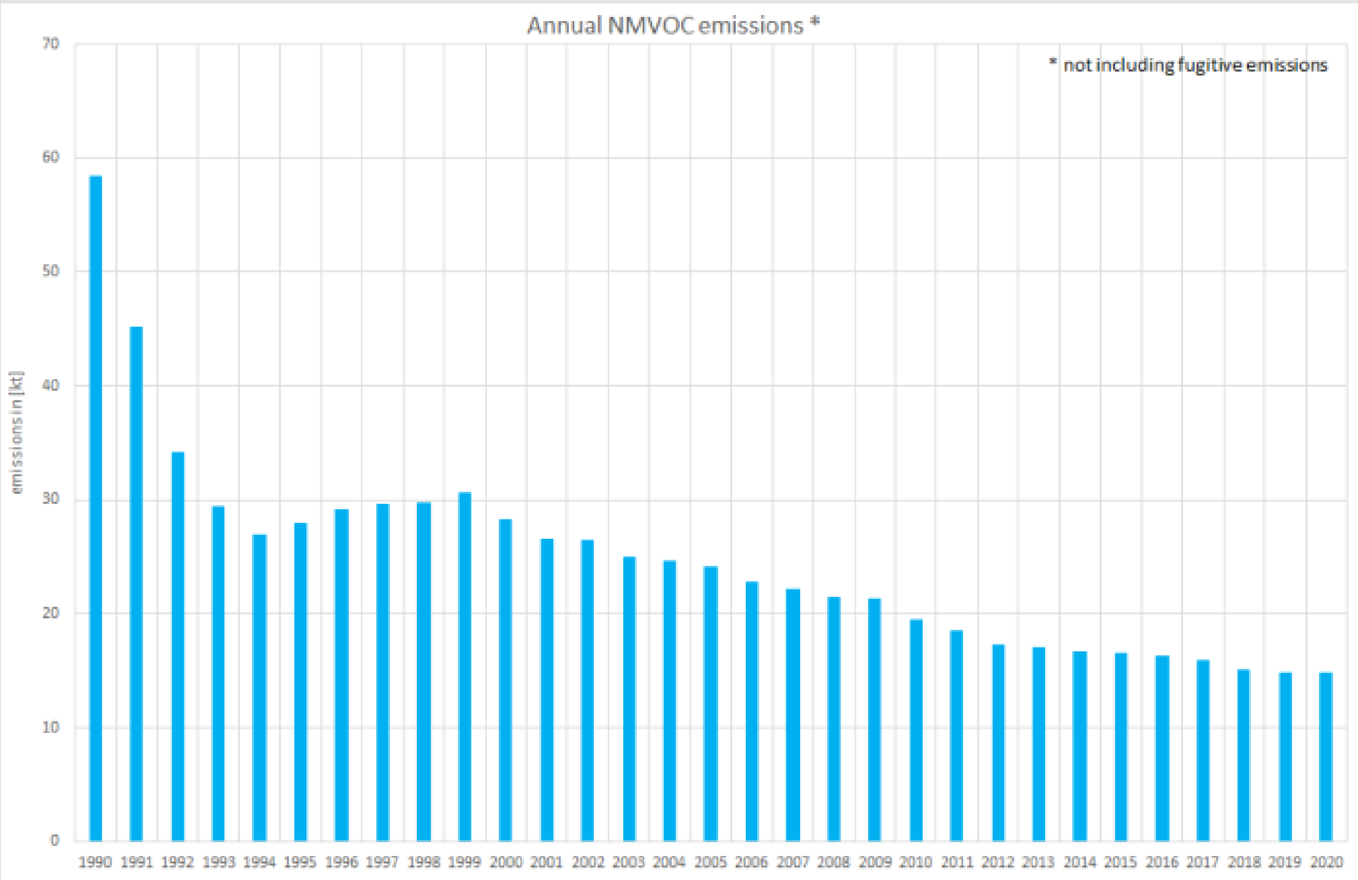
As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	PCDD/F	B[a]P	B[b]F	B[k]F	I[...]P	PAH 1-4
[g/TJ]									[µg/km]	[mg/TJ]				
0.007	0.005	0.145	0.103	0.200	0.053	0.037	0.005	0.758	0.0000027	192.91	215.88	156.17	234.25	799.21

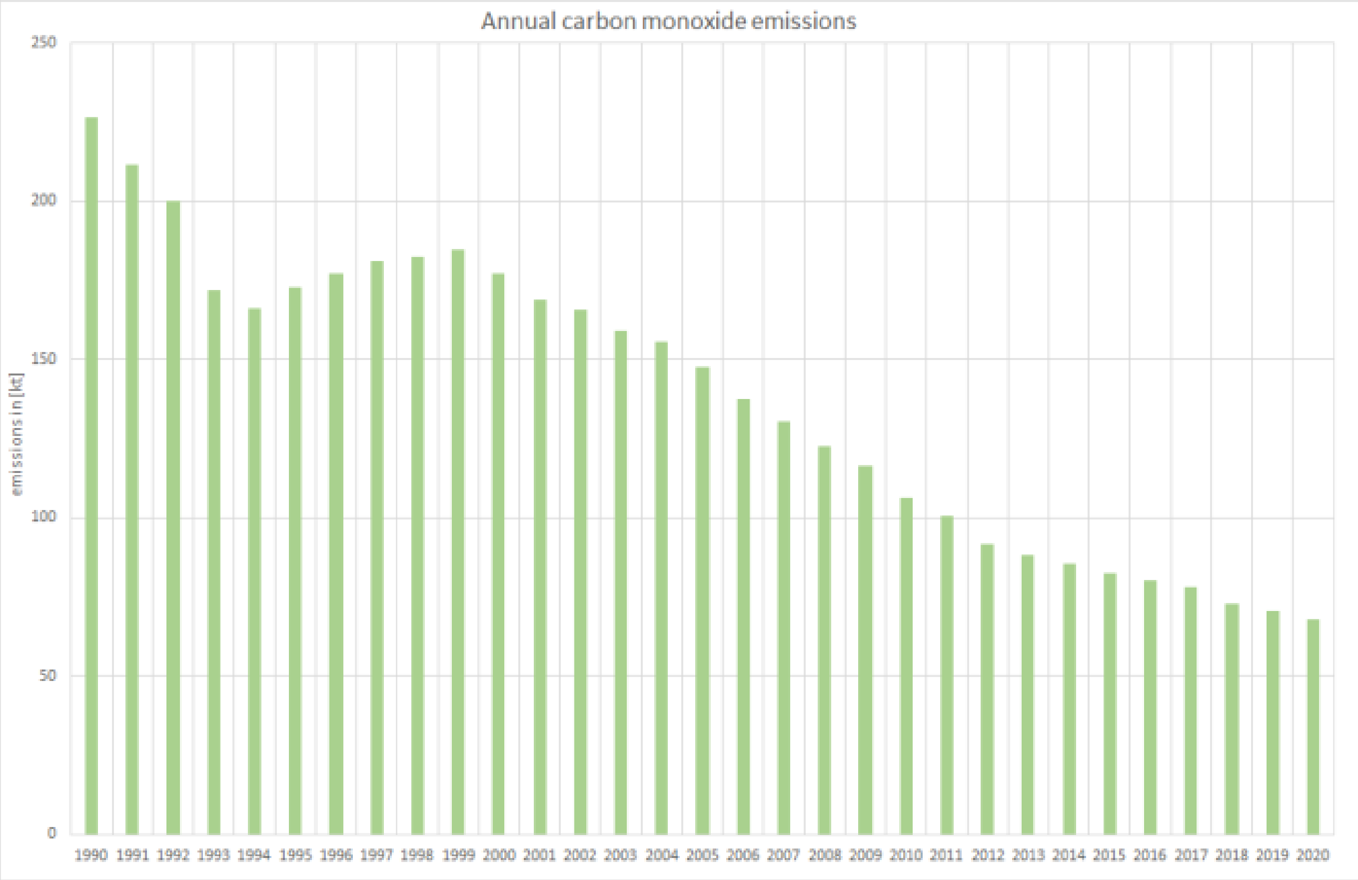
Discussion of emission trends

NFR 1.A.3.b iv is no key category.

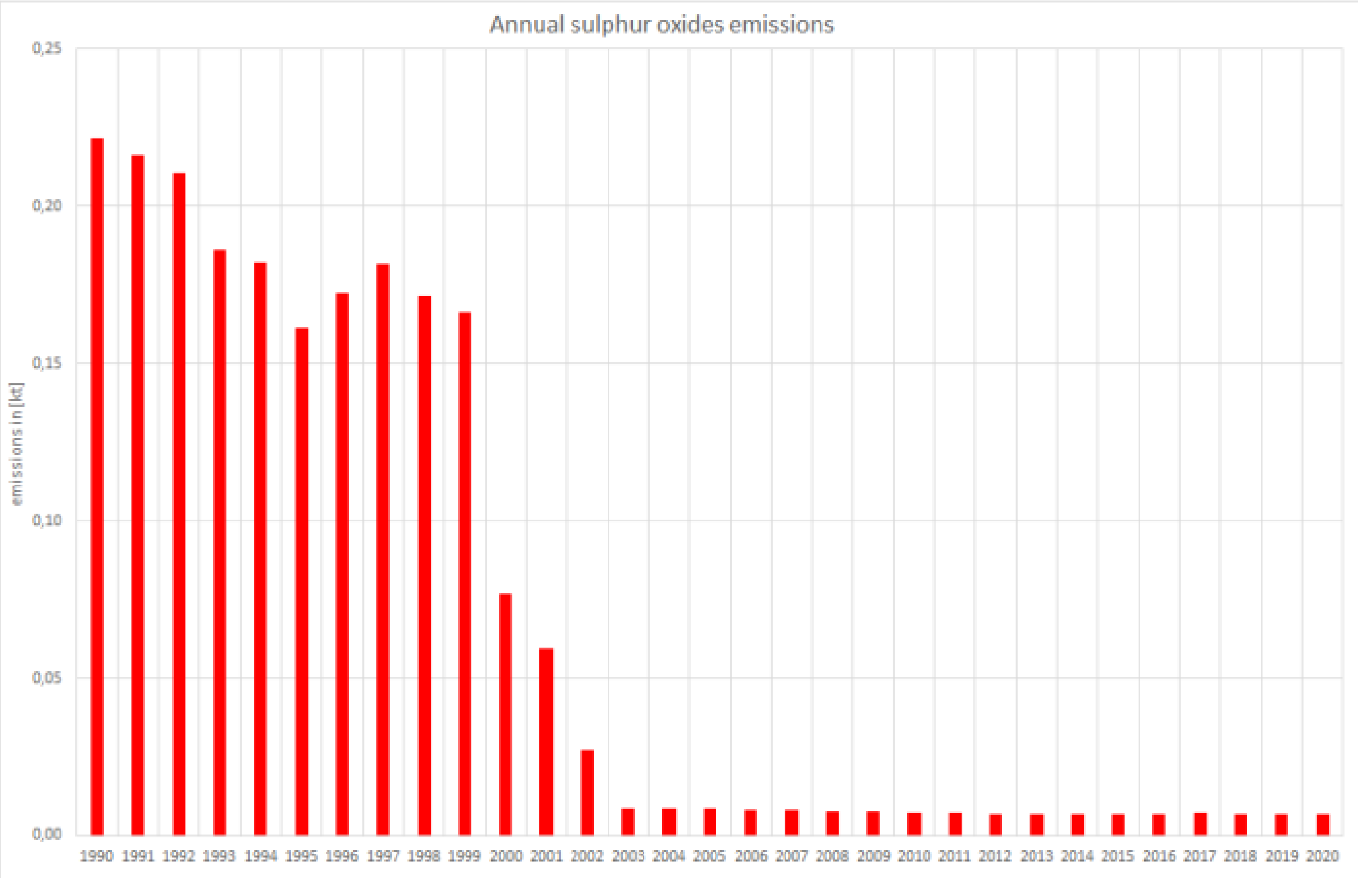
Since 1990, exhaust emissions of NO_x, NMVOC, and CO have decreased due to technical improvements.



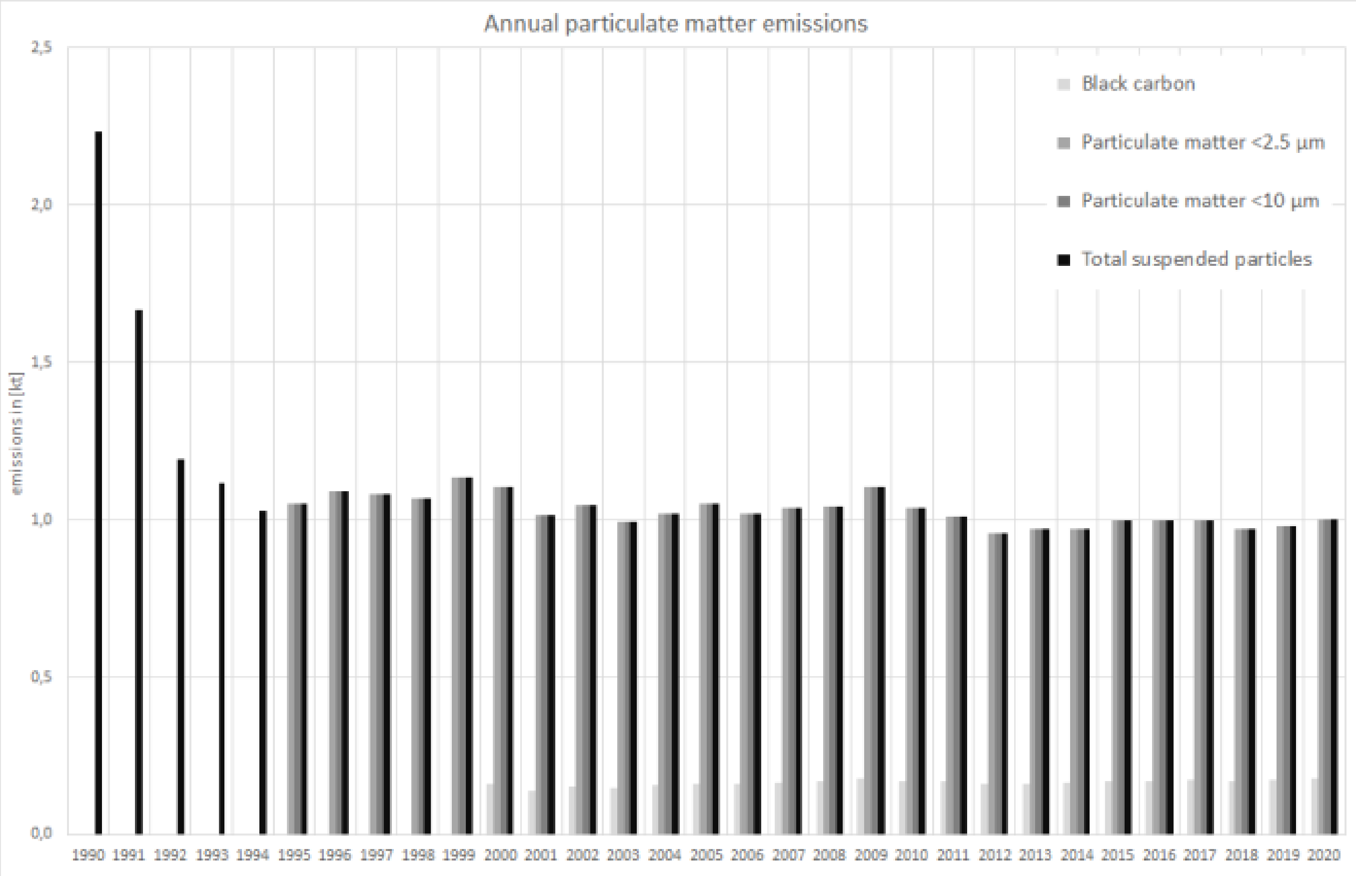




As for the entire road transport sector, the trends for **sulphur dioxide** exhaust emissions from two-wheelers shows charcteristics very different from those shown above: Here, the strong dependence on increasing fuel qualities (sulphur content) leads to an cascaded downward trend of emissions , influenced only slightly by increases in fuel consumption and mileage.



Particle emissions result from the comusbtion of gasoline and bioethanol. Here, due to the assumption that nearly all TSP emitted is formed by particles in the $PM_{2.5}$ range, similar estimates are provided for all three fractions. (Exception: Until 1997, additional TSP emissions from use of leaded gasoline are included.)



Recalculations

Compared to submission 2020, recalculations were carried out due to a routine revision of the TREMOD software and the revision of several National Energy Balances (NEB).

Here, **activity data** were revised within TREMOD.

Table 4: Revised fuel consumption data, in terajoules

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
GASOLINE																		
current submission	21.700	19.308	23.648	22.796	21.909	21.521	20.803	20.130	18.978	18.530	17.493	17.478	17.887	17.675	17.972	18.333	17.601	17.777
previous submission	21.700	19.308	23.648	22.796	21.909	21.521	20.803	20.130	18.978	18.530	17.492	17.480	17.894	17.691	18.003	18.385	17.702	17.974
absolute change	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,29	-1,58	-7,59	-16,6	-30,7	-51,9	-100	-197
relative change	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	-0,01%	-0,04%	-0,09%	-0,17%	-0,28%	-0,57%	-1,10%
BIOGASOLINE																		
current submission				157	316	291	398	575	733	760	775	749	778	767	781	773	791	767
previous submission				157	316	291	398	575	733	760	775	749	778	767	782	775	796	775
absolute change				0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	-0,07	-0,33	-0,72	-1,33	-2,19	-4,50	-8,49
relative change				0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	-0,01%	-0,04%	-0,09%	-0,17%	-0,28%	-0,57%	-1,10%
TOTAL FUEL CONSUMPTION																		
current submission	21.700	19.308	23.648	22.953	22.225	21.812	21.201	20.705	19.712	19.289	18.271	18.231	18.669	18.447	18.759	19.113	18.401	18.553

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
previous submission	21.700	19.308	23.648	22.953	22.225	21.812	21.201	20.705	19.712	19.289	18.270	18.233	18.677	18.464	18.791	19.167	18.505	18.758
absolute change	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,30	-1,65	-7,92	-17,3	-32,0	-54,1	-105	-205
relative change	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	-0,01%	-0,04%	-0,09%	-0,17%	-0,28%	-0,57%	-1,10%

Due to the variety of tier3 **emission factors** applied, it is not possible to display any changes in these data sets in a comprehendible way.

For more information on recalculated emission estimates reported for Base Year and 2019, please see the pollutant-specific recalculation tables following chapter 8.1 - Recalculations.

Planned improvements

Besides a routine revision of the underlying model, no specific improvements are planned.

FAQs

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[1], [2], [4] Knörr et al. (2021a): Knörr, W., Heidt, C., Gores, S., & Bergk, F.: ifeu Institute for Energy and Environmental Research (Institut für Energie- und Umweltforschung Heidelberg gGmbH, ifeu): Fortschreibung des Daten- und Rechenmodells: Energieverbrauch und Schadstoffemissionen des motorisierten Verkehrs in Deutschland 1960-2035, sowie TREMOD, im Auftrag des Umweltbundesamtes, Heidelberg & Berlin, 2021.
[3] Keller et al. (2017): Keller, M., Hausberger, S., Matzer, C., Wüthrich, P., & Notter, B.: Handbook Emission Factors for Road Transport, version 4.1 (Handbuch Emissionsfaktoren des Straßenverkehrs 4.1) URL: http://www.hbefa.net/e/index.html - Dokumentation, Bern, 2017.
[5] EMEP/EEA, 2019: EMEP/EEA air pollutant emission inventory guidebook 2019; https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-3-b-i/view; Copenhagen, 2019.
[6] Rentz et al., 2008: Nationaler Durchführungsplan unter dem Stockholmer Abkommen zu persistenten organischen Schadstoffen (POPs), im Auftrag des Umweltbundesamtes, FKZ 205 67 444, UBA Texte | 01/2008, January 2008 - URL: http://www.umweltbundesamt.de/en/publikationen/nationaler-durchfuehrungsplan-unter-stockholmer

[1]
During test-bench measurements, temperatures are likely to be significantly higher than under real-world conditions, thus reducing condensation. On the contrary, smaller dillution (higher number of primary particles acting as condensation germs) together with higher pressures increase the likeliness of condensation. So over-all condensables are very likely to occur but different to real-world conditions.