

1.A.4.a ii - Commercial / Institutional: Mobile

Short description

In *NFR 1.A.4.a ii - Commercial/institutional: Mobile* fuel combustion activities and emissions from commercially and institutionally used mobile sources should be reported.

Within the German inventory, non-road diesel and LPG-driven (forklifters) vehicles used in the commercial and institutional sector are taken into account here.

~ Method	~ AD	~ EF	~ Key Category Analysis
= T1, T2	= NS, M	= CS, D, M	= no key category

Methodology

Activity data

Sector-specific **diesel** consumption data are included in the primary fuel-delivery data available from NEB line 67: 'Commercial, trade, services and other consumers' (AGEB, 2019) ¹⁾.

Table 1: Sources for primary fuel-deliveries data

through 1994	NEB line 79: 'Households and small consumers'
as of 1995	NEB line 67: 'Commercial, trade, services and other consumers'

Following the deduction of diesel oil inputs for military vehicles as provided in (BAFA, 2019) ²⁾, the remaining amounts of diesel oil are apportioned onto off-road construction vehicles (NFR 1.A.2.g vii) and off-road vehicles in commercial/institutional use (1.A.4.a ii) as well as agriculture and forestry (1.A.4.c ii) based upon annual shares derived from (Knörr et al. (2019b)) ³⁾ (cf. [NFR 1.A.4 - mobile](#)).

Table 2: Annual contribution of NFR 1.A.4.a ii to the over-all amounts of diesel oil provided in NEB line 67

	= 1990	= 1995	= 2000	= 2005	= 2006	= 2007	= 2008	= 2009	= 2010	= 2011	= 2012	= 2013	= 2014	= 2015	= 2016	= 2017	= 2018
~ Diesel fuels	> 6.948%	> 6.557%	> 6.644%	> 7.142%	> 6.924%	> 6.975%	> 6.915%	> 6.993%	> 7.018%	> 6.958%	> 6.913%	> 6.848%	> 6.784%	> 6.794%	> 6.792%	> 6.777%	> 6.751%

source: (Knörr et al. (2019b)) ⁴⁾

As the NEB does not distinguish into specific biofuels, consumption data for biodiesel are calculated by applying Germany's official annual shares of biodiesel blended to fossil diesel oil.

In contrast, for **LPG**-driven forklifters, specific consumption data is modelled in TREMOD-MM. These amounts are then subtracted from the over-all amount available from NEB line 67 to estimate the amount of LPG used in stationary combustion.

Table 3: Annual fuel consumption, in terajoules

	= 1990	= 1995	= 2000	= 2004	= 2005	= 2006	= 2007	= 2008	= 2009	= 2010	= 2011	= 2012	= 2013	= 2014	= 2015	= 2016	= 2017	= 2018
~ Diesel Oil	> 7,774	> 6,413	> 6,316	> 6,028	> 5,851	> 5,733	> 5,795	> 5,853	> 6,266	> 6,213	> 6,314	> 6,158	> 6,348	> 6,562	> 6,885	> 7,153	> 7,343	> 6,816
~ Biodiesel	> 0	> 0	> 0	> 52	> 128	> 167	> 259	> 289	> 432	> 403	> 414	> 402	> 368	> 398	> 372	> 376	> 389	> 372
~ LPG	> 2,787	> 3,450	> 4,261	> 4,778	> 4,894	> 5,007	> 5,117	> 5,224	> 5,328	> 5,431	> 5,441	> 5,449	> 5,456	> 5,462	> 5,467	> 5,471	> 5,474	> 5,477
Σ 1.A.4.a ii	~ 10,561	~ 9,863	~ 10,577	~ 10,858	~ 10,873	~ 10,907	~ 11,171	~ 11,366	~ 12,025	~ 12,047	~ 12,169	~ 12,009	~ 12,172	~ 12,422	~ 12,724	~ 13,000	~ 13,206	~ 12,665

gallery size="medium" : 1A4aii AD.png : 1A4aii AD bio.png gallery

Emission factors

The emission factors used here are of rather different quality: Basically, for all **main pollutants**, **carbon monoxide** and **particulate matter**, annual IEF modelled within ⁵⁾ are used, representing the sector's vehicle-fleet composition, the development of mitigation technologies and the effect of fuel-quality legislation.

As no such specific EF are available for biofuels, the values used for diesel oil are applied to biodiesel, too.

Table 4: Annual country-specific emission factors from TREMOD MM, in kg/TJ

[illegible]

the moment.

-]

Discussion of emission trends

NFR 1.A.4.a ii is no key source.

++ Unregulated pollutants (NH₃, HMs, POPs, ...)

[gallery size="medium" : 1A4a_ii_EM_NH3.PNG : 1A4a_ii_EM_Cd.PNG gallery](#)

For all unregulated pollutants, emission trends directly follow the trend in fuel consumption.

++ Regulated pollutants

+++ Nitrogen oxides (NO_x), Sulphur dioxide (SO₂)

For all regulated pollutants, emission trends follow not only the trend in fuel consumption but also reflect the impact of fuel-quality and exhaust-emission legislation.

[gallery size="medium" : 1A4a_ii_EM_NOx.PNG : 1A4a_ii_EM_SOx.PNG gallery](#)

+++ Particulate matter (BC, PM_{2.5}, PM₁₀, and TSP)

Over-all PM emissions are by far dominated by emissions from diesel oil combustion with the falling trend basically following the decline in fuel consumption between 2000 and 2005. Nonetheless, the decrease of the over-all emission trend was and still is amplified by the expanding use of particle filters especially to eliminate soot emissions.

Additional contributors such as the impact of TSP emissions from the use of leaded gasoline (until 1997) have no significant effect onto over-all emission estimates.

Here, as the EF(BC) are estimated via fractions provided in ¹⁰⁾, black carbon emissions follow the corresponding emissions of PM_{2.5}.

[gallery size="medium" : 1A4a_ii_EM_PM.PNG gallery](#)

Recalculations

Activity data have been revised according to the finalized data from the National Energy Balance 2017.

Table 7: Revised fuel consumption data for 2017, in terajoules

=	= Diesel oil	= Biodiesel	= LPG	= Σ
~ Submission 2020	> 7,343	> 389	> 5,474	> 13,206
~ Submission 2019	> 7,300	> 387	> 5,474	> 13,161
~ absolute change	> 42,8	> 2,25	> 0,00	> 45

~ relative change	> 0,59%	> 0,58%	> 0,00%	> 0,34%
-------------------	---------	---------	---------	---------

source: own estimates based on ¹¹⁾ and ¹²⁾

With all **emission factors** remaining unrevised, emission values have only been recalculated for 2017 as shown in the following table for the main pollutants.

Table 8: Recalculated emission estimates 2017, in kilotonnes

=	= NH ₃	= NMVOC	= NO _x	= PM	= BC	= CO
~ Submission 2020	> 0.00203	> 1.195	> 10.3	> 0.286	> 0.217	> 3.099
~ Submission 2019	> 0.00202	> 1.193	> 10.3	> 0.284	> 0.216	> 3.084
~ absolute change	> 0.00001	> 0.002	> 0.02	> 0.002	> 0.001	> 0.014
~ relative change	> 0.37%	> 0.19%	> 0.17%	> 0.58%	> 0.58%	> 0.47%



For pollutant-specific information on recalculated emission estimates for Base Year and 2018, please see the pollutant specific recalculation tables following [chapter 8.1 - Recalculations](#).

Uncertainties

Uncertainty estimates for **activity data** of mobile sources derive from research project FKZ 360 16 023: "Ermittlung der Unsicherheiten der mit den Modellen TREMOD und TREMOD-MM berechneten Luftschadstoffemissionen des landgebundenen Verkehrs in Deutschland" by (Knörr et al. (2009)) ¹³⁾.

Uncertainty estimates for **emission factors** were compiled during the PAREST research project. Here, the final report has not yet been published.

Planned improvements

Besides the annual **routine revision** of **TREMOD MM**, no specific improvements are planned.

FAQs

Why are similar EF applied for estimating exhaust heavy metal emissions from both fossil and biofuels?

The EF provided in ¹⁴⁾ represent summatory values for (i) the fuel's and (ii) the lubricant's heavy-metal content as well as (iii) engine wear. Here, there might be no heavy metal contained in biofuels. But since the specific shares of (i), (ii) and (iii) cannot be separated, and since the contributions of lubricant and engine wear might be dominant, the same emission factors are applied to biodiesel and bioethanol.

bibliography

: 1 : AGEb (2019): Working Group on Energy Balances (Arbeitsgemeinschaft Energiebilanzen (Hrsg.), AGEb): Energiebilanz für die Bundesrepublik Deutschland; URL: <https://ag-energiebilanzen.de/7-0-Bilanzen-1990-2017.html>, (Aufruf: 29.11.2019), Köln & Berlin, 2019.

: 2 : BAFA (2019): Federal Office of Economics and Export Control (Bundesamt für Wirtschaft und Ausfuhrkontrolle, BAFA): Amtliche Mineralöl-daten für die Bundesrepublik Deutschland; URL: https://www.bafa.de/SharedDocs/Downloads/DE/Energie/Mineraloel/moel_amtliche_daten_2017_dezember.html, Eschborn, 2019

: 3 : Knörr et al. (2019b): Knörr, W., Heidt, C., Gores, S., & Bergk, F. (2019b): ifeu Institute for Energy and Environmental Research (Institut für Energie- und Umweltforschung Heidelberg gGmbH, ifeu): Aktualisierung des Modells TREMOD-Mobile Machinery (TREMOD MM) 2018, Heidelberg, 2019.

: 4 : EMEP/EEA, 2019: EMEP/EEA air pollutant emission inventory guidebook 2019, Copenhagen, 2019.

: 5 : 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>

: 6 : Knörr et al. (2009): Knörr, W., Heldstab, J., & Kasser, F.: Ermittlung der Unsicherheiten der mit den Modellen TREMOD und TREMOD-MM berechneten Luftschadstoffemissionen des landgebundenen Verkehrs in Deutschland; final report; URL: <https://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/3937.pdf>, FKZ 360 16 023, Heidelberg & Zürich, 2009. **bibliography**

¹⁾ (bibcite 1)

²⁾ (bibcite 2)

³⁾ (bibcite 3)

⁴⁾ (bibcite 3)

⁵⁾ (bibcite 3)

⁶⁾ (bibcite 3)

⁷⁾ (bibcite 3)

⁸⁾ (bibcite 4)

⁹⁾ (bibcite 5)

¹⁰⁾ (bibcite 4)

¹¹⁾ (bibcite 1)

¹²⁾ (bibcite 3)

¹³⁾ (bibcite 6)

¹⁴⁾ (bibcite 4)