Adjustment DE-A regarding NOx from Road Vehicles

PREFACE

When deriving proposals for national emission ceilings for negotiations of the 1999 Gothenburg Protocol, sector-specific emission estimates for the year 2010 were calculated at IIASA using a set of scenarios which assumed various technological abatement measures, policy incentives, and legislation available / in place or planned at that time. As a result, the 2010 emission by road transport in Germany was estimated at NO,,x,, (IIASA, 1999) [1)]. The over-all 2010 national emission ceiling (NEC) for NO,,x,, was set to 1,081 kt. When negotiating the EU NEC Directive two years later, Germany agreed to reduce its NO,,x,, emissions further, resulting in a NEC of 1,051 kt.

In its 2016 NEC emissions reporting, Germany provided a national total for NO,,x,, emissions of 1,337 kt for 2010. However, this total includes emissions from agricultural soils and other source categories not accounted for when setting the NEC. In addition, some assumptions made in 1999, including on emission factors from road traffic, turned out to be wrong in reality. Like in many other European countries, non-compliance with the 2010 NEC as set in 1999 was partly not caused by failed national mitigation policies, but by changes beyond the control of, and unforeseen by, the individual Party or Member State.

In order to differentiate such changes from policy failures in the responsibility of the individual Parties to the Gothenburg Protocol, a procedure (Inventory Adjustment) allowing the adjustment of emissions resulting from new emission categories, changes in estimation methodologies, emission factors etc. provided within the EMEP/EEA Guidebook, or other effects beyond national control with respect to complying to emission reduction obligations (EB, 2012a & c) [2)], [3)] was agreed. This procedure is applicable also for existing NECs (EB, 2012b) [4)].

With respect to road transport, such an unforeseeable effect was the partial failure of several so-called “Euro norms” set on the EU level to reduce emissions from road vehicles. In this report, Germany presents an estimate of the NO,,x,, emissions resulting from the partial failure of the mitigation policy reflected by the Euro norms, and lays out the calculations leading to these estimates.

REASONS FOR MISSING THE GOTHENBURG CEILINGS

The TREMOD methodology applied for estimating emissions from road transportation in Germany has changed over time. These changes include updates of emission factors (EF) for various pollutants and other changes such as an extension of vehicle classification (and thus inclusion of emission factors associated with these new vehicle sub-categories) to improve the estimation's accuracy.

The main changes occurred for the emission factors and for the Heavy Duty Vehicles (HDV) fleet structure. This last point led to changes in emissions because of the reallocation of activities (consumption/traffic) between the sub-categories of vehicles.

For the formalism of the adjustments, it is difficult to flag whether the modifications for road transport are due to “methodological changes” or due to “changes of emission factor”. Therefore, only the term “change of methodology” will be used (even if at the NFR reporting level this may seem like a simple change in EFs).

So far as road transport is concerned, the inability to attain the emission ceiling is most likely to have been affected by a combination of technological changes within the fleet (which of course made their way into the several versions of TREMOD) combined with greater than originally expected dieselisation of the fleet.

ANALYSING THE PROBLEM: THE EUROPEAN PERSPECTIVE BASED ON COPERT

Already in 2011, these effects were demonstrated by Ntziachristos and Papageorgiou (2011) [5)]. Here, the impacts of changing model versions and activity data in the context of meeting the EU NEC Directive ceiling commitments were examined for four European countries including Germany. Unfortunately, this comparison study was carried out within a COPERT environment. Therefore, the results gained cannot be transferred to the German TREMOD environment on a one-to-one level but nonetheless allow a highly illustrative insight in the reasons for not meeting the set ceiling. The study modeled fuel consumption and NO,,x,, emissions for four selected countries (Germany, France, Netherlands and Belgium) and found higher NO,,x,, emissions were estimated for the road transport sector than originally modelled by the RAINS model of IIASA (which underpinned the setting of 2010 ceilings). For Germany, this study shows that with the same activity data set (LIFE+

EC4MACS data from Amann et al. (2010)), NO,,x,, emissions estimated with COPERT II vs. COPERT 4 (v8.0) increase from 410 kt to 518 kt due to methodological changes, a difference of 282 kt. An additional consideration of changes in AD would lead to 620 kt of NO,,x,,. However, as changes in AD are no valid adjustment reason, the latter value is for information only.

This was mainly due to: * NO,,x,, emission factors updated in COPERT 4 that did not follow the reductions as set by the emission standards for diesel passenger cars; * important part of diesel fuel consumption in the total fuel consumption of the road traffic.

The results of this study showed that it is the combination of different parameters which might affect the ability (to different extents) of a Party to attain the emission ceilings. In other words, the exceeding of NO,,x,, ceilings for road transport is due to:

Changes in methodology and emission factors

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As these technologically driven changes (as reflected in the __evolution of the different so-
called Euro norms__) lie outside the country's responsibility, current methodology and EFs
have to be adjusted in a way to allow the comparison of the actual inventory and the
Gothenburg ceilings.
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Changes in the activity data

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As the development of mileage driven and fuels used within a country (__Germany: stronger
dieselisation__ then originally expected) is of the country's responsibility, this effect has
to be excluded from any adjustment estimation.
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IN-COUNTRY ANALYSIS: THE TREMOD PERSPECTIVE

INITIAL ASSUMPTION

In order to estimate the effect of NO,,x,, emissions resulting from the failure of the so-called Euro norms, the following procedure has been agreed by expert review teams in the last two years:

> **proposed amount of adjustable emissions = current AD x current EF - current AD x original EF = current AD x (current EF - original EF) = current EM - “artificial” current EM^^1^^**
> ^^1^^ “artificial” current emissions = virtual current emissions assuming no changes in emission factors

math EM_\text{ adjustment} = AD_\text{ current} * EF_\text{ current} - AD_\text{ current} * EF_\text{ original} = AD_\text{ current} * (EF_\text{ current} - EF_\text{ original}) = EM_\text{ current} - EM_\text{ current-“artificial”} math

with * ***EM* ,,adjustment,,** = amount of emissions to be subtracted from National Totals * ***AD* ,,current,,** = AD from latest TREMOD version as used for current submission * ***EF* ,,current,,** = EF from latest TREMOD version as used for current submission * ***EF* ,,original,,** = EF from TREMOD version used at the time NEC ceilings were set (here: TREMOD 3.1) * ***EM* ,,current,,** = EM estimated from AD and EF from latest TREMOD version = EM reported for NFR 1.A.3.b with latest submission * ***EM* ,,current-“artificial”,,** = EM estimated from AD from latest TREMOD version and EF from TREMOD version used at the time NEC ceilings were set (here: TREMOD 3.1)

APPLYING THE ORIGINAL METHODOLOGY

FRAMEWORK INFORMATION

The methodology used for estimating Germany's exhaust emissions from road transport when determining emissions ceilings of the Gothenburg Protocol (1999), was the second version of the EMEP/CORINAIR guidebook corresponding to COPERT II software. This method proposed NO,,x,, emission factors for

- passenger cars (PC): up to Euro 1
- light commercial vehicles (LCV2): up to Euro 1
- heavy duty vehicles (HDV): pre-EURO I only (conventional)

Back than, without better knowledge, the emission factors for the most recent standards were derived by directly applying

the expected reductions in emission standards.

However, as Germany does not use COPERT for compliling its road transport emissions inventory but a national model called TREMOD, the following comparison has to be carried out between the oldest version of TREMOD still available and the version as applied for the current inventory submission (2020).

Unfortunately, the oldest TREMOD version available for such comparison is TREMOD 3.1 from 2002 [6)], including the following set of NO,,x,, emission factors:

- passenger cars (PC): up to Euro 4
- light commercial vehicles (LCV): up to Euro 4
- heavy duty vehicles (HDV) only up to EURO V

However, as this version includes the technocological development since 1999 (when the ceilings were set based on COPERT II), the results from this analysis and the adjustment proposal based upon these results are likely to slightly underestimate the effect of technological changes since 1999 and must tehrefore be considered conservative.

THE COMPARISON

Application of the original NO,,x,, methodology to the current road transport background activity data

The *basic activity data* (such as over-all fuel sold and traffic mileages by vehicle type, by fuel or by Euro regulation) implemented in TREMOD 3.1 differ significantly from those of the current TREMOD version especially for the more recent years as of 2005. In addition, *specific activity data* (such as fuel consumptions per vehicle type, per fuel or per Euro regulation) strongly depend on the TREMOD version.

Within this report, Germany re-estimates the NO,,x,, emission within the TREMOD 3.1 model. To isolate the requested information, the original TREMOD 3.1 activity data was combined with emission factors from both TREMOD 3.1 and the currently used TREMOD 6.02 (Knörr et al., 2019a) [7)].

Description of the updated methodology used

The updated methodology, used in 2019 (for NFR submission 2021) and implemented in version 6.12 of the TREMOD software, considers emission factors of

- passenger cars (PC) up to Euro 6d
- light commercial vehicles (LCV) up to Euro 6d
- heavy duty vehicles (HDV) up to EURO VI

and

- motorized two-wheelers (M2W) up to Euro 4

Comparison of emission estimates made using the original and updated methodologies

The values of NO,,x,, emissions presented in the table below are estimated with:

- TREMOD 3.1 model equations as initial methodology

and ,

- TREMOD 6.12 equations as methodology applied for NEC submission 2021.

The activity data applied to initial (here: oldest available) and most recent methodology, are those of the latest inventory provided with NEC submission 2021.

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cf. Also related columns in the Excel table “Annex_VII_Adjustments_summary_template_extended2_V2_Aprill15.xlsx” for road transport).

Table: Aggregated impact of adjustments on NO,,x,, emissions from NFR 1.A.3.b

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Table 1: Resulting adjustment proposal 2020

> ||> for year ||= **2010** ||= **2011** ||= **2012** ||= **2013** ||= **2014** ||= **2015** ||= **2016** ||= **2017** ||= **2018** ||=
> ||~ proposed adjustment ||~ ##red| -297.8## ||~ ##red| -302.3## ||~ ##red| -301.3## ||~ ##red| -306.1## ||~ ##red| -294.5## ||~ ##red| -269.0## ||~ ##red| -244.3## ||~ ##red| -214.9## ||~ ##red | -174.6## ||>

The following screenshots show the TREMOD 3.1 / TREMOD 6.12 implementation comparisons per vehicle type/fuel/Euro regulation.

> **Activity Data**
> * **current**: from TREMOD 6.12, as reported with the latest inventory submission
> * **adjusted**: has to be similar to **current** AD!
> * **difference**: as only recent AD are to be used for adjustment estimations, this value must be zero!
> **Implied Emission Factor**
> * **current**: representing the ratio of current emissions and current AD
> * **adjusted**: representing the ratio of adjusted emissions and current AD
> * **difference**: shows percentual difference
> **NO,,x,, Emissions**
> * **current**: from TREMOD 6.12, as reported with the latest inventory submission
> * **adjusted**: estimated based on TREMOD 3.1 methodology and TREMOD 6.12 AD
> * **adjustment**: adjusted emissions minus current emissions
> * **difference**: percentual difference between current and adjusted emissions

Adjustment overview for years 2010 to 2019

NFR Code	Fuel	Year	Activity Data			Implied Emission Factor			NO_x Emissions			
			current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference
			in [TJ]		in [%]	in [kg/TJ]		in [%]		in [kg]		in [%]
1.A.3.b i	gasoline		795.957	795.957	0%	97,55	84,99	-13%	77.644.842	67.650.906	9.993.935	-13%
1.A.3.b i	diesel oil		529.380	529.380	0%	429,45	160,51	-63%	227.341.096	84.970.461	142.370.635	-63%
1.A.3.b ii	gasoline		6.325	6.325	0%	255,87	214,75	-16%	1.618.432	1.358.328	260.104	-16%
1.A.3.b ii	diesel oil		113.450	113.450	0%	476,34	134,96	-72%	54.040.533	15.311.584	38.728.949	-72%
1.A.3.b iii	diesel oil		48.044	48.044	0%	623,00	482,55	-23%	29.931.266	23.183.732	6.747.534	-23%
1.A.3.b iii	diesel oil		566.741	566.741	0%	446,67	271,83	-39%	253.148.243	154.056.160	99.092.083	-39%
1.A.3.b iv	gasoline		19.712	19.712	0%	113,68	168,43	48%	2.240.749	3.320.034	-1.079.285	48%
1.A.3.b TOTAL		**2010**	**2.079.608**	**2.079.608**	**0%**			0%	**645.965.162**	**349.851.206**	**296.113.956**	**-46%**
1.A.3.b i	gasoline		794.688	794.688	0%	92,09	81,61	-11%	73.185.851	64.851.951	8.333.900	-11%
1.A.3.b i	diesel oil		553.564	553.564	0%	434,12	159,22	-63%	240.313.791	88.138.959	152.174.832	-63%
1.A.3.b ii	gasoline		6.118	6.118	0%	229,35	198,57	-13%	1.403.081	1.214.776	188.305	-13%
1.A.3.b ii	diesel oil		115.967	115.967	0%	481,55	126,92	-74%	55.844.518	14.718.142	41.126.376	-74%
1.A.3.b iii	diesel oil		47.365	47.365	0%	592,65	448,99	-24%	28.071.221	21.266.323	6.804.898	-24%
1.A.3.b iii	diesel oil		563.891	563.891	0%	410,38	244,97	-40%	231.410.271	138.136.342	93.273.929	-40%
1.A.3.b iv	gasoline		19.289	19.289	0%	110,79	171,60	54%	2.137.002	3.299.162	-1.162.160	54%
1.A.3.b TOTAL		**2011**	**2.100.883**	**2.100.883**	**0%**			0%	**632.365.736**	**331.625.655**	**300.740.081**	**-48%**
1.A.3.b i	gasoline		750.957	750.957	0%	85,73	78,00	-9%	64.379.994	58.577.229	5.802.765	-9%
1.A.3.b i	diesel oil		555.245	555.245	0%	435,96	158,66	-64%	242.062.902	88.096.699	153.966.203	-64%
1.A.3.b ii	gasoline		5.657	5.657	0%	218,93	193,15	-12%	1.238.520	1.092.662	145.859	-12%
1.A.3.b ii	diesel oil		114.350	114.350	0%	481,91	120,17	-75%	55.106.382	13.741.354	41.365.028	-75%
1.A.3.b iii	diesel oil		50.902	50.902	0%	533,22	384,33	-28%	27.141.913	19.563.208	7.578.704	-28%
1.A.3.b iii	diesel oil		589.585	589.585	0%	381,33	224,00	-41%	224.829.180	132.064.753	92.764.428	-41%
1.A.3.b iv	gasoline		18.268	18.268	0%	107,43	173,28	61%	1.962.546	3.165.439	-1.202.893	61%
1.A.3.b TOTAL		**2012**	**2.084.964**	**2.084.964**	**0%**			0%	**616.721.438**	**316.301.343**	**300.420.094**	**-49%**
1.A.3.b i	gasoline		749.114	749.114	0%	80,35	74,85	-7%	60.190.007	56.071.797	4.118.211	-7%
1.A.3.b i	diesel oil		589.131	589.131	0%	437,14	158,71	-64%	257.533.728	93.499.010	164.034.718	-64%
1.A.3.b ii	gasoline		5.578	5.578	0%	202,80	184,07	-9%	1.131.209	1.026.727	104.482	-9%
1.A.3.b ii	diesel oil		118.777	118.777	0%	480,60	114,93	-76%	57.083.533	13.650.488	43.433.045	-76%
1.A.3.b iii	diesel oil		51.716	51.716	0%	509,54	360,06	-29%	26.350.969	18.620.843	7.730.126	-29%
1.A.3.b iii	diesel oil		600.139	600.139	0%	353,06	207,93	-41%	211.887.531	124.788.469	87.099.062	-41%
1.A.3.b iv	gasoline		18.229	18.229	0%	104,34	175,38	68%	1.902.088	3.197.038	-1.294.951	68%
1.A.3.b TOTAL		**2013**	**2.132.683**	**2.132.683**	**0%**			0%	**616.079.063**	**310.854.371**	**305.224.692**	**-50%**
1.A.3.b i	gasoline		752.526	752.526	0%	76,03	73,09	-4%	57.215.533	54.998.921	2.216.612	-4%
1.A.3.b i	diesel oil		626.045	626.045	0%	435,87	159,12	-63%	272.876.061	99.613.892	173.262.169	-63%
1.A.3.b ii	gasoline		5.845	5.845	0%	190,34	176,49	-7%	1.112.584	1.031.612	80.972	-7%
1.A.3.b ii	diesel oil		128.578	128.578	0%	475,56	110,96	-77%	61.146.575	14.267.237	46.879.338	-77%
1.A.3.b iii	diesel oil		49.143	49.143	0%	468,37	339,99	-27%	23.017.115	16.708.234	6.308.881	-27%
1.A.3.b iii	diesel oil		572.754	572.754	0%	314,05	196,05	-38%	179.874.133	112.285.582	67.588.551	-38%
1.A.3.b iv	gasoline		18.673	18.673	0%	100,59	179,24	78%	1.878.294	3.346.794	-1.468.499	78%
1.A.3.b TOTAL		**2014**	**2.153.563**	**2.153.563**	**0%**			0%	**597.120.297**	**302.252.271**	**294.868.025**	**-49%**
1.A.3.b i	gasoline		715.156	715.156	0%	74,38	71,73	-4%	53.190.787	51.300.983	1.889.805	-4%
1.A.3.b i	diesel oil		645.565	645.565	0%	426,19	159,80	-63%	275.130.233	103.163.501	171.966.732	-63%
1.A.3.b ii	gasoline		5.793	5.793	0%	187,12	172,80	-8%	1.083.927	1.000.999	82.928	-8%
1.A.3.b ii	diesel oil		135.306	135.306	0%	469,35	107,96	-77%	63.505.443	14.607.490	48.897.953	-77%
1.A.3.b iii	diesel oil		52.287	52.287	0%	458,96	327,99	-29%	23.997.817	17.149.448	6.848.370	-29%
1.A.3.b iii	diesel oil		589.411	589.411	0%	266,69	187,51	-30%	157.189.675	110.520.703	46.668.973	-30%
1.A.3.b iv	gasoline		18.459	18.459	0%	99,32	180,65	82%	1.833.382	3.334.472	-1.501.090	82%
1.A.3.b TOTAL		**2015**	**2.161.976**	**2.161.976**	**0%**			0%	**575.931.265**	**301.077.596**	**274.853.670**	**-48%**
1.A.3.b i	gasoline		715.272	715.272	0%	70,93	70,65	0%	50.736.967	50.535.049	201.918	0%
1.A.3.b i	diesel oil		675.119	675.119	0%	410,36	160,76	-61%	277.041.660	108.535.230	168.506.430	-61%
1.A.3.b ii	gasoline		5.926	5.926	0%	180,27	171,06	-5%	1.068.292	1.013.678	54.614	-5%
1.A.3.b ii	diesel oil		144.068	144.068	0%	456,12	105,62	-77%	65.712.732	15.216.007	50.496.726	-77%
1.A.3.b iii	diesel oil		54.157	54.157	0%	424,73	308,24	-27%	23.002.109	16.693.117	6.308.992	-27%
1.A.3.b iii	diesel oil		594.013	594.013	0%	226,31	180,97	-20%	134.431.899	107.496.262	26.935.637	-20%
1.A.3.b iv	gasoline		18.785	18.785	0%	96,14	181,66	89%	1.805.897	3.412.476	-1.606.579	89%
1.A.3.b TOTAL		**2016**	**2.207.339**	**2.207.339**	**0%**			0%	**553.799.558**	**302.901.820**	**250.897.738**	**-45%**
1.A.3.b i	gasoline		724.571	724.571	0%	67,66	69,88	3%	49.026.874	50.634.714	-1.607.840	3%
1.A.3.b i	diesel oil		696.592	696.592	0%	390,65	161,95	-59%	272.126.091	112.810.721	159.315.370	-59%
1.A.3.b ii	gasoline		6.186	6.186	0%	171,15	167,18	-2%	1.058.799	1.034.211	24.588	-2%
1.A.3.b ii	diesel oil		153.284	153.284	0%	424,66	103,89	-76%	65.093.930	15.925.216	49.168.714	-76%
1.A.3.b iii	diesel oil		53.382	53.382	0%	370,80	286,71	-23%	19.793.901	15.304.828	4.489.073	-23%
1.A.3.b iii	diesel oil		598.263	598.263	0%	195,02	175,92	-10%	116.671.141	105.246.508	11.424.633	-10%
1.A.3.b iv	gasoline		19.160	19.160	0%	92,83	183,39	98%	1.778.674	3.513.787	-1.735.114	98%
1.A.3.b TOTAL		**2017**	**2.251.437**	**2.251.437**	**0%**			0%	**525.549.410**	**304.469.986**	**221.079.424**	**-42%**
1.A.3.b i	gasoline		699.027	699.027	0%	64,42	68,36	6%	45.032.996	47.786.817	-2.753.820	6%
1.A.3.b i	diesel oil		666.074	666.074	0%	371,66	163,30	-56%	247.556.063	108.768.604	138.787.459	-56%
1.A.3.b ii	gasoline		6.315	6.315	0%	158,22	160,11	1%	999.199	1.011.138	-11.939	1%
1.A.3.b ii	diesel oil		154.259	154.259	0%	384,71	102,69	-73%	59.344.525	15.840.310	43.504.215	-73%
1.A.3.b iii	diesel oil		51.634	51.634	0%	309,75	263,53	-15%	15.993.526	13.607.106	2.386.420	-15%
1.A.3.b iii	diesel oil		585.186	585.186	0%	171,18	172,10	1%	100.173.337	100.710.869	-537.532	1%
1.A.3.b iv	gasoline		18.497	18.497	0%	89,66	184,61	106%	1.658.558	3.414.767	-1.756.209	106%
1.A.3.b TOTAL		**2018**	**2.180.993**	**2.180.993**	**0%**			0%	**470.758.206**	**291.139.612**	**179.618.593**	**-38%**
1.A.3.b i	gasoline		704.691	704.691	0%	62,30	68,45	10%	43.901.941	48.238.025	-4.336.084	10%
1.A.3.b i	diesel oil		663.841	663.841	0%	345,81	165,07	-52%	229.566.088	109.582.982	119.983.106	-52%
1.A.3.b ii	gasoline		6.683	6.683	0%	146,08	153,25	5%	976.219	1.024.150	-47.931	5%
1.A.3.b ii	diesel oil		159.183	159.183	0%	347,42	101,90	-71%	55.303.335	16.221.445	39.081.890	-71%
1.A.3.b iii	diesel oil		52.939	52.939	0%	274,41	247,81	-10%	14.527.012	13.118.578	1.408.434	-10%
1.A.3.b iii	diesel oil		595.913	595.913	0%	153,35	169,17	10%	91.380.700	100.809.376	-9.428.676	10%
1.A.3.b iv	gasoline		18.750	18.750	0%	86,05	186,83	117%	1.613.450	3.502.941	-1.889.491	117%
1.A.3.b TOTAL		**2019**	**2.202.000**	**2.202.000**	**0%**			0%	**437.268.744**	**292.497.497**	**144.771.248**	**-33%**

Adjustment details for 2010

NFR Code	Fuel		Activity Data current in [TJ]	Activity Data adjusted in [TJ]	Activity Data difference in [%]	Implied Emission Factor current in [kg/TJ]	Implied Emission Factor adjusted in [kg/TJ]	Implied Emission Factor difference in [%]	NO_x Emissions current	NO_x Emissions adjusted in [kg]	NO_x Emissions adjustment	NO_x Emissions difference in [%]
1.A.3.b i - Passenger Cars	Gasoline	pre-Euro	13.606	13.606	0%	584,75	514,25	-12%	7.956.060	6.996.917	-959.143	-12%
		Euro 1	76.561	76.561	0%	338,50	237,71	-30%	25.915.925	18.199.262	-7.716.663	-30%
		Euro 2	96.425	96.425	0%	172,05	135,03	-22%	16.590.020	13.020.026	-3.569.995	-22%
		Euro 3	133.139	133.139	0%	58,51	70,18	20%	7.790.304	9.343.433	1.553.129	20%
		Euro 4	444.991	444.991	0%	42,27	42,19	0%	18.811.389	18.773.529	-37.859	0%
		Euro 5	31.234	31.234	0%	18,61	42,19	127%	581.142	1.317.737	736.595	127%
		Euro 6	0	0	0%	26,08	42,19	62%	2	3	1	62%
		Gasoline total	**795.957**	**795.957**	**0%**	**97,55**	**84,99**	**-13%**	**77.644.842**	**67.650.906**	**-9.993.935**	**-13%**
	Diesel Oil	pre-Euro	1.915	1.915	0%	310,13	264,95	-15%	593.760	507.256	-86.505	-15%
		Euro 1	10.338	10.338	0%	296,62	265,17	-11%	3.066.428	2.741.307	-325.121	-11%
		Euro 2	50.068	50.068	0%	406,90	219,19	-46%	20.372.795	10.974.210	-9.398.584	-46%
		Euro 3	134.025	134.025	0%	542,04	178,54	-67%	72.646.173	23.929.216	-48.716.957	-67%
		Euro 4	279.154	279.154	0%	384,37	140,58	-63%	107.299.160	39.243.811	-68.055.349	-63%
		Euro 5	53.547	53.547	0%	434,70	140,58	-68%	23.276.735	7.527.706	-15.749.029	-68%
		Euro 6	334	334	0%	257,62	140,58	-45%	86.044	46.953	-39.091	-45%
		Diesel oil total	**529.380**	**529.380**	**0%**	**429,45**	**160,51**	**-63%**	**227.341.096**	**84.970.461**	**-142.370.635**	**-63%**
		PCs Total	**1.325.337**	**1.325.337**	**0%**	**230,12**	**115,16**	**-50%**	**304.985.938**	**152.621.367**	**-152.364.570**	**-50%**
1.A.3.b ii - Light Duty Vehicles (LDVs)	Gasoline	pre-Euro	1.249	1.249	0%	627,09	645,95	3%	783.320	806.871	23.551	3%
		Euro 1	357	357	0%	861,05	297,39	-65%	306.969	106.020	-200.950	-65%
		Euro 2	1.393	1.393	0%	264,75	184,41	-30%	368.848	256.917	-111.931	-30%
		Euro 3	856	856	0%	82,47	90,63	10%	70.631	77.625	6.994	10%
		Euro 4	2.420	2.420	0%	36,32	44,90	24%	87.907	108.679	20.772	24%
		Euro 5	49	49	0%	15,34	44,90	193%	758	2.218	1.460	193%
		Euro 6	0	0	0%			0%	0	0	0	0%
		Gasoline total	**6.325**	**6.325**	**0%**	**255,87**	**214,75**	**-16%**	**1.618.432**	**1.358.328**	**-260.104**	**-16%**
	Diesel Oil	pre-Euro	4.876	4.876	0%	425,99	306,79	-28%	2.077.142	1.495.903	-581.239	-28%
		Euro 1	5.989	5.989	0%	395,59	215,24	-46%	2.369.098	1.289.030	-1.080.069	-46%
		Euro 2	13.126	13.126	0%	336,76	193,10	-43%	4.420.360	2.534.731	-1.885.629	-43%
		Euro 3	33.249	33.249	0%	531,01	150,58	-72%	17.655.883	5.006.760	-12.649.123	-72%
		Euro 4	54.581	54.581	0%	491,42	88,69	-82%	26.821.836	4.840.722	-21.981.114	-82%
		Euro 5	1.629	1.629	0%	427,50	88,69	-79%	696.206	144.434	-551.772	-79%
		Euro 6	0	0	0%	151,73	88,69	-42%	7	4	-3	-42%
		Diesel oil total	**113.450**	**113.450**	**0%**	**476,34**	**134,96**	**-72%**	**54.040.533**	**15.311.584**	**-38.728.949**	**-72%**
		LDVs Total	**119.775**	**119.775**	**0%**	**464,70**	**139,18**	**-70%**	**55.658.966**	**16.669.913**	**-38.989.053**	**-70%**
1.A.3.b iii - Heavy Duty Vehicle: Buses	Diesel Oil	pre-Euro	3.382	3.382	0%	1086,25	1020,78	-6%	3.674.067	3.452.644	-221.423	-6%
		Euro I	2.826	2.826	0%	749,41	752,14	0%	2.117.871	2.125.595	7.723	0%
		Euro II	10.152	10.152	0%	801,86	643,47	-20%	8.140.119	6.532.213	-1.607.906	-20%
		Euro III	15.898	15.898	0%	633,22	457,25	-28%	10.066.776	7.269.209	-2.797.567	-28%
		Euro IV	5.461	5.461	0%	448,63	351,85	-22%	2.450.016	1.921.527	-528.489	-22%
		Euro V	10.325	10.325	0%	337,28	182,33	-46%	3.482.417	1.882.544	-1.599.873	-46%
		Euro VI	0	0	0%			0%	0	0	0	0%
		Buses Total	**48.044**	**48.044**	**0%**	**623,00**	**482,55**	**-23%**	**29.931.266**	**23.183.732**	**-6.747.534**	**-23%**
1.A.3.b iii - Heavy Duty Vehicle: Trucks & Lorries	Diesel Oil	pre-Euro	10.105	10.105	0%	1040,16	767,37	-26%	10.510.623	7.754.138	-2.756.485	-26%
		Euro I	5.677	5.677	0%	750,59	575,55	-23%	4.261.393	3.267.601	-993.792	-23%
		Euro II	38.558	38.558	0%	817,62	524,79	-36%	31.525.526	20.234.619	-11.290.907	-36%
		Euro III	158.933	158.933	0%	636,28	374,48	-41%	101.126.192	59.517.271	-41.608.921	-41%
		Euro IV	69.535	69.535	0%	390,94	290,02	-26%	27.183.867	20.166.635	-7.017.232	-26%
		Euro V	283.934	283.934	0%	276,62	151,85	-45%	78.540.643	43.115.897	-35.424.746	-45%
		Euro VI	0	0	0%			0%	0	0	0	0%
		Trucks Total	**566.741**	**566.741**	**0%**	**446,67**	**271,83**	**-39%**	**253.148.243**	**154.056.160**	**-99.092.083**	**-39%**
1.A.3.b iv - Motorised Two-Wheelers (M2Ws)	Gasoline	pre-Euro	7.973	7.973	0%	122,00	149,16	22%	972.721	1.189.303	216.582	22%
		Euro 1	5.231	5.231	0%	123,77	165,74	34%	647.479	867.039	219.560	34%
		Euro 2	3.587	3.587	0%	141,16	194,21	38%	506.352	696.661	190.309	38%
		Euro 3	2.920	2.920	0%	39,11	194,21	397%	114.198	567.032	452.834	397%
		Euro 4	0	0	0%			0%	0	0	0	0%
		Euro 5	0	0	0%			0%	0	0	0	0%
		M2Ws Total	**19.712**	**19.712**	**0%**	**113,68**	**168,43**	**48%**	**2.240.749**	**3.320.034**	**1.079.285**	**48%**
1.A.3.b - Road Transport		**Total**	**2.079.608**	**2.079.608**	**0%**	**310,62**	**168,23**	**-46%**	**645.965.162**	**349.851.206**	**-296.113.956**	**-46%**

Adjustment details for 2011

NFR Code	Fuel		Activity Data current in [TJ]	Activity Data adjusted in [TJ]	Activity Data difference in [%]	Implied Emission Factor current in [kg/TJ]	Implied Emission Factor adjusted in [kg/TJ]	Implied Emission Factor difference in [%]	NO_x Emissions current	NO_x Emissions adjusted in [kg]	NO_x Emissions adjustment	NO_x Emissions difference in [%]
1.A.3.b i - Passenger Cars	Gasoline	pre-Euro	13.053	13.053	0%	592,06	534,69	-10%	7.728.235	6.979.435	-748.801	-10%
		Euro 1	61.979	61.979	0%	347,86	240,16	-31%	21.560.430	14.884.951	-6.675.479	-31%
		Euro 2	87.083	87.083	0%	179,38	136,58	-24%	15.620.983	11.893.792	-3.727.191	-24%
		Euro 3	124.330	124.330	0%	61,64	71,52	16%	7.663.891	8.891.671	1.227.780	16%
		Euro 4	442.185	442.185	0%	43,84	43,68	0%	19.384.914	19.316.439	-68.476	0%
		Euro 5	66.057	66.057	0%	18,58	43,68	135%	1.227.381	2.885.636	1.658.255	135%
		Euro 6	1	1	0%	26,00	43,68	68%	17	28	11	68%
		Gasoline total	**794.688**	**794.688**	**0%**	**92,09**	**81,61**	**-11%**	**73.185.851**	**64.851.951**	**-8.333.900**	**-11%**
	Diesel Oil	pre-Euro	1.711	1.711	0%	310,90	264,95	-15%	531.803	453.197	-78.606	-15%
		Euro 1	8.426	8.426	0%	297,32	265,85	-11%	2.505.115	2.239.997	-265.119	-11%
		Euro 2	42.514	42.514	0%	407,03	219,27	-46%	17.304.549	9.321.916	-7.982.634	-46%
		Euro 3	121.429	121.429	0%	555,36	178,55	-68%	67.437.053	21.681.366	-45.755.687	-68%
		Euro 4	264.943	264.943	0%	388,08	143,46	-63%	102.817.801	38.009.755	-64.808.046	-63%
		Euro 5	113.847	113.847	0%	435,12	143,46	-67%	49.536.968	16.332.974	-33.203.994	-67%
		Euro 6	695	695	0%	259,59	143,46	-45%	180.502	99.754	-80.748	-45%
		Diesel oil total	**553.564**	**553.564**	**0%**	**434,12**	**159,22**	**-63%**	**240.313.791**	**88.138.959**	**-152.174.832**	**-63%**
		PCs Total	**1.348.252**	**1.348.252**	**0%**	**232,52**	**113,47**	**-51%**	**313.499.642**	**152.990.910**	**-160.508.732**	**-51%**
1.A.3.b ii - Light Duty Vehicles (LDVs)	Gasoline	pre-Euro	1.084	1.084	0%	629,25	645,95	3%	682.274	700.373	18.099	3%
		Euro 1	283	283	0%	859,74	304,47	-65%	243.289	86.158	-157.132	-65%
		Euro 2	1.164	1.164	0%	266,66	191,66	-28%	310.529	223.189	-87.340	-28%
		Euro 3	783	783	0%	85,97	95,39	11%	67.320	74.702	7.381	11%
		Euro 4	2.562	2.562	0%	37,38	46,51	24%	95.786	119.162	23.376	24%
		Euro 5	241	241	0%	16,13	46,51	188%	3.882	11.190	7.308	188%
		Euro 6	0	0	0%	15,33	46,51	203%	1	3	2	203%
		Gasoline total	**6.118**	**6.118**	**0%**	**229,35**	**198,57**	**-13%**	**1.403.081**	**1.214.776**	**-188.305**	**-13%**
	Diesel Oil	pre-Euro	3.995	3.995	0%	425,09	306,79	-28%	1.698.200	1.225.602	-472.598	-28%
		Euro 1	4.787	4.787	0%	395,71	215,24	-46%	1.894.350	1.030.425	-863.925	-46%
		Euro 2	10.818	10.818	0%	336,90	193,29	-43%	3.644.592	2.091.063	-1.553.530	-43%
		Euro 3	28.876	28.876	0%	541,53	150,54	-72%	15.637.249	4.346.870	-11.290.379	-72%
		Euro 4	60.832	60.832	0%	493,82	89,26	-82%	30.039.914	5.429.811	-24.610.104	-82%
		Euro 5	6.659	6.659	0%	440,05	89,26	-80%	2.930.198	594.364	-2.335.835	-80%
		Euro 6	0	0	0%	156,21	89,26	-43%	14	8	-6	-43%
		Diesel oil total	**115.967**	**115.967**	**0%**	**481,55**	**126,92**	**-74%**	**55.844.518**	**14.718.142**	**-41.126.376**	**-74%**
		LDVs Total	**122.085**	**122.085**	**0%**	**468,92**	**130,51**	**-72%**	**57.247.599**	**15.932.918**	**-41.314.681**	**-72%**
1.A.3.b iii - Heavy Duty Vehicle: Buses	Diesel Oil	pre-Euro	2.620	2.620	0%	1082,69	1019,78	-6%	2.836.109	2.671.331	-164.778	-6%
		Euro I	2.258	2.258	0%	752,91	751,40	0%	1.699.707	1.696.297	-3.410	0%
		Euro II	9.074	9.074	0%	804,17	643,36	-20%	7.297.125	5.837.959	-1.459.166	-20%
		Euro III	14.887	14.887	0%	633,16	457,38	-28%	9.425.890	6.809.064	-2.616.827	-28%
		Euro IV	5.131	5.131	0%	448,88	351,81	-22%	2.303.338	1.805.274	-498.064	-22%
		Euro V	13.396	13.396	0%	336,60	182,62	-46%	4.509.052	2.446.399	-2.062.653	-46%
		Euro VI	0	0	0%			0%	0	0	0	0%
		Buses Total	**47.365**	**47.365**	**0%**	**592,65**	**448,99**	**-24%**	**28.071.221**	**21.266.323**	**-6.804.898**	**-24%**
1.A.3.b iii - Heavy Duty Vehicle: Trucks & Lorries	Diesel Oil	pre-Euro	8.044	8.044	0%	1038,67	763,88	-26%	8.355.423	6.144.933	-2.210.491	-26%
		Euro I	4.384	4.384	0%	750,16	574,04	-23%	3.288.422	2.516.377	-772.044	-23%
		Euro II	29.277	29.277	0%	817,97	520,31	-36%	23.947.723	15.233.223	-8.714.499	-36%
		Euro III	121.581	121.581	0%	635,56	372,69	-41%	77.271.520	45.312.437	-31.959.084	-41%
		Euro IV	58.430	58.430	0%	393,25	289,40	-26%	22.977.704	16.909.685	-6.068.019	-26%
		Euro V	342.175	342.175	0%	279,30	152,03	-46%	95.569.479	52.019.687	-43.549.793	-46%
		Euro VI	0	0	0%			0%	0	0	0	0%
		Trucks Total	**563.891**	**563.891**	**0%**	**410,38**	**244,97**	**-40%**	**231.410.271**	**138.136.342**	**-93.273.929**	**-40%**
1.A.3.b iv - Motorised Two-Wheelers (M2Ws)	Gasoline	pre-Euro	7.389	7.389	0%	122,96	150,24	22%	908.598	1.110.178	201.580	22%
		Euro 1	4.805	4.805	0%	124,72	168,26	35%	599.299	808.547	209.248	35%
		Euro 2	3.544	3.544	0%	137,85	194,58	41%	488.552	689.603	201.051	41%
		Euro 3	3.550	3.550	0%	39,59	194,58	392%	140.553	690.834	550.280	392%
		Euro 4	0	0	0%			0%	0	0	0	0%
		Euro 5	0	0	0%			0%	0	0	0	0%
		M2Ws Total	**19.289**	**19.289**	**0%**	**110,79**	**171,04**	**54%**	**2.137.002**	**3.299.162**	**1.162.160**	**54%**
1.A.3.b - Road Transport		**Total**	**2.100.883**	**2.100.883**	**0%**	**301,00**	**157,85**	**-48%**	**632.365.736**	**331.625.655**	**-300.740.081**	**-48%**

REVISION OF ADJUSTMENT PROPOSAL COMPARED TO SUBMISSIONS 2014 to 2019

Table 2: annual NO,,x,, adjustment proposals, in kilotonnes

=	= 2010	= 2011	= 2012	= 2013	= 2014	= 2015	= 2016	= 2017	> 2018	
< Adjustment 2014 (accepted)	> -105.6	> -101.3	> -95.7	> -91.7	~	~	~	~	>	
< Adjustment 2015 (accepted)	> -100.3	> -95.5	> -89.9	> -85.1	~	~	~	~	>	
< Adjustment 2016 (accepted)	> -151.3	> -146.9	> -145.1	> -142.5	> -128.1	~	~	~	>	

< Adjustment 2017 (accepted)	> -151.3	> -146.8	> -145.0	> -142.4	> -127.2	> -100.9	~	~	>
< Adjustment 2018 (accepted)	> -172.3	> -174.5	> -177.4	> -180.4	> -171.5	> -148.9	> -123.2	~	>
< Adjustment 2019 (accepted)	> -172.3	> -174.5	> -177.4	> -180.3	> -171.4	> -148.8	> -123.3	> 93.7	>
>									
~ Adjustment 2020 (proposal)	~ -297.8	~ -302.3	~ -301.3	~ -306.1	~ -294.5	~ -269.0	~ -244.3	~ -214.9	~ -174.6
> Change against Adjustment 2019	> -125.5	> -127.8	> -123.9	> -125.8	> -123.1	> -120.2	> -121.0	> -121.2	>

> The noticeable differences between the 2017 and 2018 adjustment proposals resulted from an ad-hoc revision of the *Handbook Emission Factors for Road Transport* (HBEFA, version 3.3) in the aftermath of the so-called “Diesel-gate”. [8)]
>
> The even bigger changes between adjustment 2019 and adjustment proposal 2020 result from an additional rather fundamental revision of of the *Handbook Emission Factors for Road Transport* now available in version 4.1 > [9)] strongly effecting the TREMOD model underlying Germany's emission reporting for road transpprt and hence any adjustments of NO,,x,, emissions.
>
> **With such major model revision between submissions 2019 and 2020, the current adjustment proposal differs *significantly* from the adjustment applied for and accepted in 2019.**

Adjustment description as provided in IIRs 2014 and 2015:

image Description%20Adjustment%20DE-A%20-%20NOx%20from%201.A.3.b%20Road%20transport%20-%20IIRs%202014%20%26%202015.pdf

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