

# Adjustment DE-A regarding NO<sub>x</sub> 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<sub>x</sub> (IIASA, 1999) <sup>1)</sup>. The over-all 2010 national emission ceiling (NEC) for NO<sub>x</sub> was set to 1,081 kt. When negotiating the EU NEC Directive two years later, Germany agreed to reduce its NO<sub>x</sub> emissions further, resulting in a NEC of 1,051 kt.

In its 2016 NEC emissions reporting, Germany provided a national total for NO<sub>x</sub> 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, 2012 a & c) <sup>2), 3)</sup> was agreed. This procedure is applicable also for existing NECs (EB, 2012b) <sup>4)</sup>.

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<sub>x</sub> 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) <sup>5)</sup>. 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<sub>x</sub> emissions for four selected countries (Germany, France, Netherlands and Belgium) and found higher NO<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub>. However, as changes in AD are no valid adjustment reason, the latter value is for information only.

This was mainly due to: \* NO<sub>x</sub> "artificial" current emissions = virtual current emissions assuming no changes in emission factors 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<sub>x</sub> ceilings for road transport is due to:

### Changes in methodology and emission factors

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.

### Changes in the activity data

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.

## IN-COUNTRY ANALYSIS: THE TREMOD PERSPECTIVE

### INITIAL ASSUMPTION

In order to estimate the effect of NO<sub>x</sub> 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<sup>1</sup>**

<sup>1</sup> "artificial" current emissions = virtual current emissions assuming no changes in emission factors



$$\begin{aligned} EM_{\text{adjustment}} &= AD_{\text{current}} * EF_{\text{current}} - AD_{\text{current}} * EF_{\text{original}} \\ &= AD_{\text{current}} * (EF_{\text{current}} - EF_{\text{original}}) \\ &= EM_{\text{current}} - EM_{\text{current "artificial"}} \end{aligned}$$

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<sub>x</sub> 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 then, 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 compiling 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 (2021).

Unfortunately, the oldest TREMOD version available for such comparison is TREMOD 3.1 from 2002 <sup>6)</sup>, including the following set of NO<sub>x</sub> 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 technological 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 therefore be considered conservative.

## THE COMPARISON

### Application of the original NO<sub>x</sub> 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<sub>x</sub> 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 6.12 (Knörr et al., 2020a) <sup>7)</sup>.

### 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<sub>x</sub> 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.

Table 1: Resulting adjustment proposal 2020

for year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>proposed adjustment</b>	<b>-296.1</b>	<b>-300.7</b>	<b>-300.4</b>	<b>-305.2</b>	<b>-294.9</b>	<b>-274.9</b>	<b>-250.9</b>	<b>-221.1</b>	<b>-179.6</b>	<b>-144.8</b>

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<sub>x</sub> 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 <sub>x</sub> Emissions			
			current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference
			in [TJ]	in [TJ]	in [%]	in [kg/TJ]	in [%]	in [%]	in [kg]	in [kg]	in [%]	in [%]
1.A.3.b.i	gasoline		795.957	795.957	0%	97.55	84.99	-13%	77.64.842	67.690.906	9.993.935	-13%
1.A.3.b.i	diesel oil		629.380	629.380	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		48.844	48.844	0%	823.00	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		47.355	47.355	0%	592.65	448.99	-24%	28.071.221	21.268.323	6.804.898	-24%
1.A.3.b.iii	diesel oil		563.891	563.891	0%	410.38	244.97	-40%	231.410.271	138.135.342	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	-8%	64.379.994	58.677.229	5.802.765	-8%
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	128.17	-75%	55.106.362	13.741.354	41.365.008	-75%
1.A.3.b.iii	diesel oil		50.902	50.902	0%	533.22	384.33	-28%	27.141.913	19.563.200	7.578.704	-28%
1.A.3.b.iii	diesel oil		589.585	589.585	0%	381.33	224.00	-41%	234.829.180	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	316.391.343	300.420.094	-49%
1.A.3.b.i	gasoline		749.114	749.114	0%	89.35	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%	257.633.728	93.499.010	164.134.718	-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	13.690.488	43.433.045	-76%
1.A.3.b.iii	diesel oil		51.716	51.716	0%	509.64	260.06	-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	287.93	-41%	211.887.531	124.788.469	87.099.062	-41%
1.A.3.b.iv	gasoline		18.229	18.229	0%	104.34	175.30	68%	1.902.068	3.197.038	-1.294.951	68%
1.A.3.b TOTAL	2013		2.132.683	2.132.683	0%			0%	616.079.063	316.854.371	300.224.692	-50%
1.A.3.b.i	gasoline		752.526	752.526	0%	76.03	73.09	-4%	57.215.533	54.988.921	2.216.612	-4%
1.A.3.b.i	diesel oil		626.845	626.845	0%	435.87	159.12	-63%	272.876.061	95.613.892	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%	74.30	71.73	-4%	53.190.787	51.300.983	1.889.805	-4%
1.A.3.b.i	diesel oil		645.555	645.555	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		135.386	135.386	0%	489.35	187.96	-77%	63.605.443	14.607.490	48.997.953	-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	110.620.703	46.568.973	-30%
1.A.3.b.iv	gasoline		18.459	18.459	0%	99.32	180.65	82%	1.833.362	3.334.472	-1.501.090	82%
1.A.3.b TOTAL	2015		2.161.976	2.161.976	0%			0%	575.931.265	301.877.596	274.053.670	-48%
1.A.3.b.i	gasoline		715.272	715.272	0%	79.93	76.65	-4%	50.736.367	50.535.049	201.318	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	171.05	-5%	1.068.292	1.013.678	54.614	-5%
1.A.3.b.ii	diesel oil		144.068	144.068	0%	456.12	185.62	-77%	65.712.732	15.216.007	50.496.725	-77%
1.A.3.b.iii	diesel oil		54.157	54.157	0%	424.73	388.24	-27%	23.002.109	16.683.117	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%	95.14	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%	553.790.558	302.901.820	250.897.738	-45%
1.A.3.b.i	gasoline		724.571	724.571	0%	67.66	69.88	3%	49.026.074	50.634.714	-1.607.640	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	183.89	-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		596.263	596.263	0%	195.02	175.92	-10%	116.671.141	106.246.508	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	182.69	-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%	180.173.337	180.710.869	-537.532	1%
1.A.3.b.iv	gasoline		18.497	18.497	0%	89.66	184.61	106%	1.658.568	3.414.767	-1.756.209	106%
1.A.3.b TOTAL	2018		2.180.993	2.180.993	0%			0%	478.758.206	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	1.034.150	-57.931	5%
1.A.3.b.ii	diesel oil		159.183	159.183	0%	347.42	181.90	-71%	55.303.535	16.221.445	39.082.090	-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%	91.380.760	106.809.376	-15.428.616	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		2.202.890	2.202.890	0%			0%	437.268.744	292.497.697	144.771.048	-33%

Adjustment details for 2020													
NFR Code	Fuel	Activity Data			Implied Emission Factor			NO <sub>x</sub> Emissions					
		current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference		
		in [t]	in [t]	in [%]	in [g/t]	in [g/t]	in [%]	in [kg]	in [kg]	in [kg]	in [%]		
1.A.3.a.i. Passenger Cars	Gasoline	pre-Euro	13.685	13.685	0%	584.75	514.25	-12%	7.955.060	6.986.917	-958.143	-12%	
		Euro 1	36.541	36.541	0%	338.50	297.71	-12%	25.915.925	19.189.262	-7.716.663	-30%	
		Euro 2	96.425	96.425	0%	172.95	135.63	-22%	16.580.020	13.020.026	-3.559.995	-22%	
		Euro 3	133.139	133.139	0%	58.51	70.18	20%	7.790.384	9.343.433	1.553.129	20%	
		Euro 4	444.991	444.991	0%	42.27	42.19	0%	18.911.389	18.773.529	-137.859	0%	
		Euro 5	31.234	31.234	0%	18.61	42.19	127%	581.142	1.317.737	736.595	127%	
	Gasoline total	795.057	795.057	0%	59.25	84.99	43%	37.644.842	67.650.986	30.006.145	13%		
	Diesel Oil	pre-Euro	1.915	1.915	0%	318.13	264.95	-17%	583.760	527.256	-56.504	-10%	
		Euro 1	10.338	10.338	0%	294.62	246.17	-17%	3.046.428	2.741.387	-305.041	-10%	
		Euro 2	50.088	50.088	0%	406.90	279.19	-32%	29.372.795	19.974.210	-9.398.584	-32%	
		Euro 3	134.025	134.025	0%	542.94	176.54	-67%	72.645.173	23.929.276	-48.715.897	-67%	
		Euro 4	279.154	279.154	0%	304.37	140.58	-53%	187.299.180	39.243.811	-148.055.369	-53%	
		Euro 5	53.547	53.547	0%	434.70	140.58	-68%	23.276.735	7.527.796	-15.748.939	-68%	
	Diesel oil total	529.380	529.380	0%	429.45	160.55	-63%	227.347.096	84.970.461	-142.376.635	-63%		
	Pkx Total	1.325.337	1.325.337	0%	238.12	115.16	-51%	364.985.938	152.627.367	-212.358.570	-58%		
	1.A.3.b.i. Light Duty Vehicles (LDVs)	Gasoline	pre-Euro	1.249	1.249	0%	627.99	545.95	-13%	783.320	686.871	-96.449	-12%
			Euro 1	367	367	0%	361.95	297.39	-18%	368.969	186.620	-182.349	-50%
Euro 2			1.393	1.393	0%	264.75	184.41	-30%	368.840	256.917	-111.923	-30%	
Euro 3			856	856	0%	82.47	90.83	10%	70.631	77.625	6.994	10%	
Euro 4			2.420	2.420	0%	36.32	44.90	24%	87.987	188.679	100.692	24%	
Euro 5			49	49	0%	15.34	44.90	193%	750	2.218	1.468	193%	
Gasoline total		6.345	6.345	0%	255.87	254.75	-0%	1.478.832	1.596.126	117.294	8%		
Diesel Oil		pre-Euro	4.876	4.876	0%	425.99	386.79	-9%	2.077.142	1.436.983	-640.159	-31%	
		Euro 1	9.989	9.989	0%	398.59	276.24	-31%	2.389.080	1.289.636	-1.099.444	-46%	
		Euro 2	13.126	13.126	0%	336.76	153.18	-54%	4.420.380	2.534.731	-1.885.649	-43%	
		Euro 3	33.249	33.249	0%	531.91	150.58	-72%	17.655.883	5.085.760	-12.570.123	-72%	
		Euro 4	54.581	54.581	0%	491.42	80.69	-84%	26.021.036	4.940.722	-21.080.314	-80%	
		Euro 5	1.629	1.629	0%	427.50	80.69	-81%	696.296	144.434	-551.862	-80%	
Diesel oil total		113.450	113.450	0%	416.34	134.96	-68%	54.043.533	15.351.584	-38.691.949	-72%		
LDVs Total		179.775	179.775	0%	464.70	139.18	-70%	55.658.966	16.648.913	-39.010.053	-70%		
1.A.3.b.ii. Heavy Duty Vehicles (HDVs)		Gasoline	pre-Euro	3.382	3.382	0%	1096.25	1028.78	-6%	3.674.087	3.432.644	-241.443	-7%
			Euro 1	2.826	2.826	0%	749.41	732.14	-2%	2.117.871	2.125.595	7.723	0%
	Euro 2		10.152	10.152	0%	801.96	643.47	-20%	8.140.119	6.532.213	-1.607.906	-20%	
	Euro 3		15.890	15.890	0%	633.22	437.25	-31%	10.865.776	7.289.299	-3.576.477	-33%	
	Euro 4		5.461	5.461	0%	448.63	351.65	-21%	2.650.016	1.921.527	-728.489	-28%	
	Euro 5		10.326	10.326	0%	337.28	182.33	-46%	3.882.417	1.882.544	-1.999.873	-51%	
	Euro 6		0	0	0%	0	0	0%	0	0	0	0%	
	Buses Total		48.044	48.044	0%	623.80	482.55	-23%	29.931.266	23.183.732	-6.747.534	-23%	
	Diesel Oil	pre-Euro	10.185	10.185	0%	1040.16	787.37	-25%	10.510.623	7.754.136	-2.756.487	-26%	
		Euro 1	5.677	5.677	0%	758.59	575.55	-24%	4.261.383	3.287.681	-973.702	-23%	
		Euro 2	38.558	38.558	0%	817.62	524.79	-35%	31.525.526	20.234.619	-11.290.907	-36%	
		Euro 3	169.023	169.023	0%	636.28	374.48	-41%	161.136.182	99.617.271	-61.518.911	-38%	
		Euro 4	69.636	69.636	0%	368.34	280.62	-24%	27.183.867	20.146.636	-7.037.231	-26%	
		Euro 5	283.934	283.934	0%	276.42	151.65	-45%	78.643.643	43.115.897	-35.527.746	-45%	
		Euro 6	0	0	0%	0	0	0%	0	0	0	0%	
		Trucks Total	566.741	566.741	0%	446.67	271.83	-39%	293.148.243	154.696.160	-138.452.083	-39%	
	Motorised Two-Wheelers (MOWs)	pre-Euro	7.973	7.973	0%	122.80	149.18	22%	372.721	1.189.393	216.502	23%	
Euro 1		5.231	5.231	0%	123.77	165.74	34%	647.479	887.039	239.560	34%		
Euro 2		3.587	3.587	0%	141.16	184.21	31%	585.362	686.681	101.319	30%		
Euro 3		2.950	2.950	0%	38.11	184.21	381%	116.188	657.032	540.844	381%		
Euro 4		0	0	0%	0	0	0%	0	0	0	0%		
Euro 5		0	0	0%	0	0	0%	0	0	0	0%		
MOWs Total		19.712	19.712	0%	113.68	168.43	48%	2.243.149	3.326.034	1.082.885	48%		
1.A.3.b. Road Transport	Total	2,879,688	2,879,688	0%	219,62	168,23	-23%	645,965,162	349,851,296	-296,113,866	-46%		

Adjustment details for 2021												
NFR Code	Fuel	Activity Data			Implied Emission Factor			NO <sub>x</sub> Emissions				
		current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference	
		in [t]	in [t]	in [%]	in [g/t]	in [g/t]	in [%]	in [kg]	in [kg]	in [kg]	in [kg]	
1.A.3.a.i. Passenger Cars	Gasoline	pre-Euro	13.063	13.063	0%	592.96	534.68	-10%	7.728.235	6.979.435	-748.801	-10%
		Euro 1	61.979	61.979	0%	347.96	340.16	-2%	11.040.430	10.884.961	-155.469	-1%
		Euro 2	87.083	87.083	0%	178.38	136.58	-24%	15.620.983	11.883.782	-3.737.191	-24%
		Euro 3	124.330	124.330	0%	61.94	71.52	16%	7.683.891	8.891.671	1.207.780	16%
		Euro 4	442.185	442.185	0%	43.94	43.68	0%	19.384.914	19.376.439	-8.475	0%
		Euro 5	66.057	66.057	0%	18.58	43.68	135%	1.227.381	2.085.636	1.658.255	135%
		Euro 6	1	1	0%	25.05	43.68	69%	17	20	3	15%
		Gasoline total	794.688	794.688	0%	52.69	81.65	55%	73.165.851	64,851,551	-8,314,300	-11%
	Diesel Oil	pre-Euro	1.711	1.711	0%	519.80	443.16	-15%	682.214	590.373	-91.841	-13%
		Euro 1	8.426	8.426	0%	297.32	246.85	-17%	2.585.115	2.239.987	-345.128	-13%
		Euro 2	42.514	42.514	0%	407.93	279.27	-32%	17.384.549	9.321.916	-8.062.633	-46%
		Euro 3	121.429	121.429	0%	555.36	176.55	-68%	67.437.053	21.681.386	-45.755.667	-68%
		Euro 4	264.943	264.943	0%	388.88	143.48	-63%	182.817.881	30.889.755	-151.928.126	-63%
		Euro 5	113.047	113.047	0%	435.12	143.48	-67%	49.536.960	16.332.974	-33.203.986	-67%
		Euro 6	685	685	0%	259.59	143.48	-45%	180.582	99.754	-80.828	-45%
		Diesel oil total	553.564	553.564	0%	434.12	159.92	-63%	249.713.791	80.138.959	-169.574.832	-63%
		Pkx Total	1,348,252	1,348,252	0%	232,52	113,47	-51%	313,899,642	152,990,510	-160,909,132	-51%
1.A.3.b.i. Light Duty Vehicles (LDVs)	Gasoline	pre-Euro	1.084	1.084	0%	626.75	545.95	-13%	1.482.011	1.254.176	-227.835	-15%
		Euro 1	283	283	0%	818.74	584.47	-29%	243.289	86.158	-157.132	-65%
		Euro 2	1.184	1.184	0%	268.66	191.68	-29%	310.529	223.189	-87.340	-28%
		Euro 3	783	783	0%	85.97	95.39	11%	67.320	74.782	7.462	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	189%	3.882	11.190	7.308	189%
		Euro 6	0	0	0%	15.33	46.51	203%	1	2	1	203%
		Gasoline total	6.118	6.118	0%	229.35	186.52	-23%	1,483,081	1,254,176	-228,905	-15%
	Diesel Oil	pre-Euro	3.995	3.995	0%	425.99	386.79	-9%	1.988.280	1.225.682	-762.598	-38%
		Euro 1	4.787	4.787	0%	398.71	276.24	-31%	1.984.260	1.030.426	-953.835	-48%
		Euro 2	10.816	10.816	0%	336.90	153.18	-54%	3.644.582	2.091.063	-1.553.519	-43%
		Euro 3	28.876	28.876	0%	541.53	150.54	-72%	15.037.249	4.346.870	-10.690.379	-



Adjustment details for 2023												
NFR Code	Fuel	Activity Data			Implied Emission Factor			NO <sub>x</sub> Emissions				
		current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference	
		in [t]	in [t]	in [%]	in [g/t]	in [g/t]	in [%]	in [kg]	in [kg]	in [kg]	in [%]	
1.A.3.a.i. Passenger Cars	Gasoline	pre-Euro	11,581	11,581	0%	607.72	635.38	-5%	7,035,041	6,189,785	-836,256	-12%
		Euro 1	47,487	47,487	0%	348.56	341.62	-2%	16,571,746	11,426,129	-5,145,617	-31%
		Euro 2	72,781	72,781	0%	194.27	137.82	-29%	13,487,749	10,035,380	-3,372,369	-25%
		Euro 3	189,443	189,443	0%	63.89	72.62	14%	6,927,963	7,875,172	947,209	14%
		Euro 4	489,541	489,541	0%	45.39	45.13	-1%	18,541,881	18,436,736	-105,145	-1%
		Euro 5	181,961	181,961	0%	18.61	45.13	142%	1,887,355	4,681,311	2,793,956	142%
		Euro 6	282	282	0%	25.06	45.13	74%	7,339	12,736	5,399	74%
		Gasoline total	794,267	794,267	0%	85.73	78.88	-8%	64,379,964	58,577,229	-5,802,735	-9%
	Diesel Oil	pre-Euro	1,487	1,487	0%	311.98	284.56	-9%	463,963	383,872	-80,091	-17%
		Euro 1	6,660	6,660	0%	267.79	246.44	-11%	1,980,364	1,771,787	-208,577	-11%
		Euro 2	33,967	33,967	0%	406.82	279.27	-40%	13,987,432	7,445,646	-6,541,787	-40%
		Euro 3	183,539	183,539	0%	564.82	176.63	-69%	58,389,037	18,434,837	-39,954,200	-69%
		Euro 4	234,943	234,943	0%	398.41	146.46	-62%	91,724,190	34,488,997	-57,235,193	-62%
		Euro 5	173,112	173,112	0%	434.89	146.46	-66%	75,284,364	25,353,375	-49,930,989	-66%
		Euro 6	1,557	1,557	0%	259.84	146.46	-44%	484,664	220,086	-264,578	-44%
		Diesel oil total	555,245	555,245	0%	415.96	158.66	-64%	242,962,982	88,096,639	-154,866,343	-64%
		FCs Total	1,349,512	1,349,512	0%	234.61	115.29	-50%	386,442,896	146,673,867	-239,769,029	-50%
	Gasoline	pre-Euro	962	962	0%	632.36	645.95	2%	607,179	621,160	13,981	2%
		Euro 1	232	232	0%	803.24	383.22	-52%	199,985	70,295	-129,690	-61%
		Euro 2	989	989	0%	271.16	195.74	-28%	269,134	133,538	-135,596	-50%
		Euro 3	835	835	0%	89.38	98.33	10%	34,623	82,092	47,469	10%
		Euro 4	2,030	2,030	0%	38.49	47.58	24%	78,155	96,691	18,536	24%
		Euro 5	610	610	0%	16.36	47.58	182%	9,941	29,011	19,069	182%
		Euro 6	0	0	0%	15.37	47.58	210%	2	6	4	210%
		Gasoline total	5,657	5,657	0%	218.93	193.15	-12%	1,238,520	1,692,662	454,142	37%
	Diesel Oil	pre-Euro	3,281	3,281	0%	424.46	386.79	-9%	1,368,754	982,093	-386,661	-28%
		Euro 1	3,666	3,666	0%	398.34	276.24	-30%	1,445,980	787,634	-658,346	-46%
		Euro 2	8,479	8,479	0%	336.40	133.39	-40%	2,852,325	1,639,772	-1,212,553	-43%
		Euro 3	23,785	23,785	0%	558.53	150.44	-73%	13,050,281	3,546,082	-9,504,199	-73%
		Euro 4	59,485	59,485	0%	494.22	89.85	-82%	29,369,070	5,337,395	-24,031,675	-82%
		Euro 5	15,964	15,964	0%	442.70	89.85	-80%	7,040,461	1,420,906	-5,619,555	-80%
		Euro 6	1	1	0%	15.14	89.85	-81%	122	72	-50	-41%
		Diesel oil total	114,550	114,550	0%	485.91	126.17	-74%	55,186,382	13,741,354	-41,445,028	-74%
		LDVs Total	129,088	129,088	0%	489.51	123.61	-74%	56,344,903	14,834,656	-41,510,247	-74%
1.A.3.b.ii. Heavy Duty Vehicles Buses	Gasoline	pre-Euro	1,326	1,326	0%	1091.46	1918.46	4%	1,410,640	1,352,283	-58,357	-4%
		Euro 1	1,245	1,245	0%	727.34	731.15	1%	1,017,476	1,017,184	-292	-0%
		Euro 2	7,789	7,789	0%	703.46	643.34	-9%	5,085,091	4,597,478	-487,613	-9%
		Euro 3	14,483	14,483	0%	629.94	457.61	-27%	9,073,137	6,689,744	-2,383,393	-27%
		Euro 4	5,331	5,331	0%	468.10	361.86	-23%	2,642,179	1,675,777	-966,402	-37%
		Euro 5	20,752	20,752	0%	347.84	182.99	-47%	7,219,563	2,787,467	-4,432,096	-61%
		Euro 6	73	73	0%	64.52	182.99	284%	3,961	13,296	9,334	236%
		Buses Total	50,962	50,962	0%	533.22	384.33	-28%	27,141,913	19,965,288	-7,176,625	-26%
	Diesel Oil	pre-Euro	6,922	6,922	0%	1036.95	758.82	-27%	7,107,543	5,252,345	-1,855,198	-27%
		Euro 1	3,630	3,630	0%	743.70	570.57	-24%	2,721,326	2,071,111	-650,215	-24%
		Euro 2	23,577	23,577	0%	818.27	516.43	-37%	19,262,253	12,175,855	-7,086,398	-37%
		Euro 3	96,736	96,736	0%	634.65	370.21	-42%	61,387,137	35,888,665	-25,498,472	-42%
		Euro 4	69,550	69,550	0%	366.50	288.44	-21%	19,982,680	14,680,877	-5,301,723	-27%
		Euro 5	485,981	485,981	0%	261.24	152.32	-42%	116,149,955	61,626,577	-54,523,378	-47%
		Euro 6	2,380	2,380	0%	188.487	360.323	191%	188,487	360,323	171,836	91%
		Trucks Total	589,585	589,585	0%	385.33	224.69	-41%	224,829,180	132,064,153	-92,765,027	-41%
	Gasoline	pre-Euro	6,780	6,780	0%	122.76	151.03	23%	822,539	1,011,520	188,981	23%
		Euro 1	4,386	4,386	0%	134.61	171.39	28%	536,615	738,050	201,435	38%
		Euro 2	3,267	3,267	0%	136.22	184.56	35%	445,087	636,853	191,766	43%
		Euro 3	3,984	3,984	0%	38.66	184.56	382%	18,386	778,616	760,230	382%
		Euro 4	0	0	0%	0	0	0%	0	0	0	0%
		Euro 5	0	0	0%	0	0	0%	0	0	0	0%
		MDVs Total	18,268	18,268	0%	107.43	175.28	61%	1,982,546	3,165,438	1,182,891	61%
		1.A.3.b. Road Transport	2,084,964	2,084,964	0%	295.79	151.71	-49%	616,721,438	396,381,343	-220,340,094	-49%

Adjustment details for 2023												
NFR Code	Fuel	Activity Data			Implied Emission Factor			NO <sub>x</sub> Emissions				
		current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference	
		in [t]	in [t]	in [%]	in [g/t]	in [g/t]	in [%]	in [kg]	in [kg]	in [kg]	in [%]	
1.A.3.a.i. Passenger Cars	Gasoline	pre-Euro	11,680	11,680	0%	618.27	649.35	-5%	7,011,541	6,967,452	-1,044,089	-15%
		Euro 1	37,743	37,743	0%	353.78	341.68	-3%	13,362,986	9,129,436	-4,233,550	-32%
		Euro 2	62,680	62,680	0%	188.93	139.33	-27%	11,889,922	8,722,244	-3,167,678	-27%
		Euro 3	97,782	97,782	0%	66.38	73.19	10%	6,481,618	7,156,920	675,302	10%
		Euro 4	397,911	397,911	0%	47.22	46.52	-1%	18,790,345	18,589,937	-200,407	-1%
		Euro 5	138,063	138,063	0%	18.60	46.52	150%	2,583,150	6,439,691	3,856,541	150%
	Euro 6	2,714	2,714	0%	25.99	46.52	79%	70,526	126,237	55,711	79%	
	Gasoline total	748,114	748,114	0%	88.35	74.85	-16%	68,090,687	56,671,737	-11,418,950	-17%	
	Diesel Oil	pre-Euro	1,389	1,389	0%	312.32	284.56	-9%	433,081	368,136	-64,945	-15%
		Euro 1	5,426	5,426	0%	298.42	246.79	-17%	1,678,472	1,640,688	-37,784	-2%
		Euro 2	28,437	28,437	0%	406.84	279.91	-40%	11,563,522	6,253,531	-5,309,991	-40%
		Euro 3	92,795	92,795	0%	574.33	176.67	-69%	53,284,956	16,579,373	-36,705,583	-69%
		Euro 4	222,583	222,583	0%	393.55	149.27	-62%	87,598,471	33,225,566	-54,372,905	-62%
		Euro 5	233,786	233,786	0%	435.42	149.27	-66%	101,787,275	34,884,788	-66,902,487	-66%
	Euro 6	4,536	4,536	0%	259.53	149.27	-42%	5,177,151	677,045	-4,500,106	-42%	
	Diesel oil total	589,131	589,131	0%	437.14	158.71	-64%	257,533,128	83,899,619	-173,633,509	-64%	
FCs Total	1,337,245	1,337,245	0%	237.49	111.77	-53%	317,723,735	146,576,886	-171,146,849	-53%		
Gasoline	pre-Euro	981	981	0%	633.81	645.95	2%	568,320	575,293	6,973	1%	
	Euro 1	184	184	0%	803.50	383.22	-52%	187,281	59,328	-127,953	-68%	
	Euro 2	836	836	0%	274.42	291.18	11%	229,520	188,285	-41,235	-18%	
	Euro 3	784	784	0%	52.66	191.79	10%	72,691	79,780	7,089	10%	
	Euro 4	1,089	1,089	0%	43.70	48.89	10%	77,284	82,833	5,549	7%	
	Euro 5	965	965	0%	16.37	48.89	183%	15,187	47,268	32,081	183%	
	Euro 6	1	1	0%	17.66	48.89	170%	26	72	46	170%	
	Gasoline total	5,578	5,578	0%	262.86	184.67	-30%	1,137,299	1,696,727	559,428	49%	
Diesel Oil	pre-Euro	2,744	2,744	0%	424.37	386.79	-9%	1,168,757	944,928	-223,829	-19%	
	Euro 1	2,945	2,945	0%	398.34	276.24	-30%	1,166,782	634,566	-532,216	-46%	
	Euro 2	6,982	6,982	0%	336.92	133.39	-40%	2,340,147	1,350,614	-989,533	-42%	
	Euro 3	20,421	20,421	0%	568.12	150.38	-73%	11,437,989	3,670,823	-7,767,166	-73%	
	Euro 4	55,087	55,087	0%	407.72	90.45	-42%	27,776,440	5,040,454	-22,735,986	-42%	
	Euro 5	29,024	29,024	0%	441.97	90.45	-40%	13,181,325	2,687,954	-10,493,371	-40%	
	Euro 6	41	41	0%	951.20	90.45	-40%	6,160	3,688	-2,472	-40%	
	Diesel oil total	118,777	118,777	0%	488.86	154.83	-76%	57,083,533	13,656,488	-43,427,045	-76%	
LDWs Total	124,354	124,354	0%	488.84	158.63	-69%	58,214,142	14,677,215	-43,537,927	-69%		
1.A.3.a.ii. Heavy Duty Vehicles (LDVs)	pre-Euro	1,172	1,172	0%	1098.69	1110.23	4%	1,249,028	1,134,143	-114,885	-9%	
	Euro I	1,054	1,054	0%	727.68	759.39	2%	786,020	791,181	24,961	3%	
	Euro II	6,684	6,684	0%	764.87	643.48	-16%	3,324,968	4,379,371	1,054,403	31%	
	Euro III	13,187	13,187	0%	638.43	473.65	-27%	6,262,880	5,998,226	-2,654,575	-27%	
	Euro IV	4,946	4,946	0%	460.55	351.71	-24%	2,278,051	1,739,736	-542,354	-24%	
	Euro V	26,096	26,096	0%	368.98	183.48	-40%	8,435,583	4,240,743	-4,194,761	-40%	
	Euro VI	537	537	0%	44.76	183.48	310%	24,047	86,672	74,625	310%	
	Buses Total	31,716	31,716	0%	508.54	340.06	-29%	25,369,989	16,620,843	-7,738,126	-29%	
1.A.3.a.iii. Heavy Duty Vehicle: Trucks & Lorries	pre-Euro	5,983	5,983	0%	1030.72	737.35	-29%	6,072,170	4,322,888	-1,749,303	-29%	
	Euro I	2,945	2,945	0%	748.27	583.47	-24%	2,176,946	1,650,980	-525,877	-24%	
	Euro II	16,884	16,884	0%	818.17	510.25	-37%	10,080,881	6,949,975	-3,130,886	-37%	
	Euro III	45,517	45,517	0%	633.52	487.73	-24%	47,587,448	27,081,147	-19,998,688	-24%	
	Euro IV	42,781	42,781	0%	356.90	287.27	-27%	16,936,867	12,289,770	-4,647,837	-27%	
	Euro V	436,980	436,980	0%	261.70	152.65	-40%	123,181,324	66,796,436	-56,384,897	-40%	
	Euro VI	18,020	18,020	0%	93.87	152.65	281%	913,082	2,750,630	1,837,548	281%	
	Trucks Total	680,139	680,139	0%	353.96	287.33	-41%	218,587,531	124,188,469	-97,899,062	-41%	
1.A.3.b.iv. Motorised Two-Wheelers (MOWs)	pre-Euro	6,352	6,352	0%	123.97	151.79	23%	781,730	964,170	182,443	23%	
	Euro I	4,013	4,013	0%	125.91	173.15	39%	582,073	634,880	52,807	39%	
	Euro 2	3,362	3,362	0%	132.24	158.58	40%	436,688	648,894	209,136	40%	
	Euro 3	4,562	4,562	0%	39.81	158.58	281%	181,610	882,175	716,565	281%	
	Euro 4	0	0	0%	0	0	0%	0	0	0	0%	
	Euro 5	0	0	0%	0	0	0%	0	0	0	0%	
	Euro 6	0	0	0%	0	0	0%	0	0	0	0%	
	MOWs Total	18,229	18,229	0%	104.34	175.38	68%	1,962,088	3,197,038	1,234,951	68%	
1.A.3.b. Road Transport	Total	2,132,083	2,132,083	0%	268.88	186.27	-56%	616,073,963	310,854,371	-305,224,592	-56%	





Adjustment details for 2026												
NFR Code	Fuel	Activity Data			Implied Emission Factor			NO <sub>x</sub> Emissions				
		current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference	
		in [t]	in [t]	in [%]	in [g/t]	in [g/t]	in [%]	in [g]	in [g]	in [g]	in [g]	
1.A.3.a.i - Passenger Cars	Gasoline	pre-Cars	15 782	15 782	0%	634.75	644.11	-9%	7 470 914	6 410 967	-1 059 947	-14%
		Car 1	20 270	20 270	0%	372.25	341.68	-8%	7 545 483	4 986 888	-2 558 595	-34%
		Car 2	36 062	36 062	0%	212.73	143.11	-33%	7 671 581	5 180 897	-2 490 684	-33%
		Car 3	83 039	83 039	0%	76.17	75.50	-1%	4 881 482	4 759 259	-122 223	-1%
		Car 4	334 413	334 413	0%	53.74	50.17	-7%	17 369 364	16 777 445	-591 919	-3%
		Car 5	183 374	183 374	0%	19.09	50.17	163%	3 580 745	9 189 834	5 609 089	163%
	Diesel Oil	Car 6	65 332	65 332	0%	25.67	50.17	89%	1 768 917	3 327 855	1 558 938	88%
		Gasoline total	715 272	715 272	0%	70.93	70.65	-0%	58 736 267	50 535 049	-8 201 218	-14%
		pre-Cars	1 280	1 280	0%	364.76	254.66	-30%	365 262	339 173	-26 089	-7%
		Car 1	3 749	3 749	0%	298.36	269.66	-9%	1 122 449	1 011 625	-110 824	-10%
		Car 2	16 584	16 584	0%	407.19	221.43	-46%	6 720 132	3 653 964	-3 066 168	-46%
		Car 3	81 398	81 398	0%	802.50	179.24	-78%	36 981 999	11 085 409	-25 896 590	-70%
	Diesel Oil	Car 4	175 040	175 040	0%	405.76	156.24	-61%	71 362 220	27 474 086	-43 888 134	-61%
		Car 5	299 054	299 054	0%	433.34	156.24	-64%	130 032 044	46 019 229	-83 912 815	-64%
		Car 6	116 034	116 034	0%	268.75	156.24	-41%	30 427 555	10 232 785	-19 194 770	-63%
		Diesel oil total	625 119	625 119	0%	418.36	160.76	-61%	277 947 660	188 535 230	-89 412 430	-61%
		Pkx Total	1 380 391	1 380 391	0%	235.75	154.41	-35%	67 778 627	159 070 289	-191 291 662	-28%
1.A.3.b.i - Light Duty Vehicles (LDVs)	Gasoline	pre-Cars	910	910	0%	602.79	645.35	-7%	593 186	547 543	-45 643	-8%
		Car 1	136	136	0%	908.31	312.78	-66%	122 126	42 425	-79 701	-65%
		Car 2	540	540	0%	308.39	217.84	-29%	162 311	117 737	-44 574	-27%
		Car 3	650	650	0%	108.43	111.57	-3%	70 432	72 731	2 299	3%
		Car 4	1 684	1 684	0%	43.06	52.36	21%	78 714	84 003	5 289	7%
		Car 5	1 724	1 724	0%	19.82	52.36	164%	34 157	80 258	46 101	164%
	Diesel Oil	Car 6	363	363	0%	19.85	52.36	181%	6 764	19 992	13 228	181%
		Gasoline total	5 506	5 506	0%	588.27	171.66	-7%	1 068 292	1 013 678	-54 614	-5%
		pre-Cars	2 189	2 189	0%	414.81	385.79	-7%	899 549	885 433	-14 116	-2%
		Car 1	1 780	1 780	0%	391.89	276.25	-29%	780 189	385 371	-394 818	-50%
		Car 2	4 223	4 223	0%	323.43	153.31	-53%	1 365 994	676 452	-689 542	-50%
		Car 3	13 582	13 582	0%	588.91	150.77	-74%	8 064 323	2 040 233	-6 024 090	-74%
	Diesel Oil	Car 4	43 141	43 141	0%	504.48	32.40	-93%	21 783 989	3 986 141	-17 797 848	-82%
		Car 5	74 231	74 231	0%	434.16	32.40	-93%	32 223 283	6 658 780	-25 564 503	-79%
		Car 6	4 921	4 921	0%	113.49	32.40	-72%	755 285	454 676	-300 609	-40%
		Diesel oil total	148 068	148 068	0%	456.12	185.62	-77%	65 712 132	15 256 007	-50 456 125	-77%
		LDVs Total	149 994	149 994	0%	445.23	188.29	-76%	66 787 625	16 229 684	-50 557 941	-76%
1.A.3.b.ii - Heavy Duty Vehicles (HDVs)	Diesel Oil	pre-Cars	891	891	0%	1076.81	1919.23	-43%	964 197	988 234	24 037	2%
		Car 1	583	583	0%	731.36	732.67	0%	433 675	446 236	12 561	3%
		Car 2	4 375	4 375	0%	708.25	645.03	-9%	3 440 614	2 822 621	-617 993	-18%
		Car 3	10 333	10 333	0%	632.87	458.91	-27%	6 530 364	4 741 827	-1 788 537	-27%
		Car 4	4 449	4 449	0%	475.90	382.29	-20%	2 117 219	1 586 881	-530 338	-25%
		Car 5	34 380	34 380	0%	366.36	185.22	-49%	8 935 974	4 517 517	-4 418 457	-49%
	Diesel Oil	Car 6	9 126	9 126	0%	62.79	185.22	196%	573 066	1 680 431	1 107 365	196%
		HDVs Total	54 157	54 157	0%	404.73	388.24	-2%	23 082 189	16 885 117	-6 197 072	-27%
		pre-Cars	3 933	3 933	0%	1034.81	737.35	-29%	4 087 249	2 980 379	-1 106 870	-29%
		Car 1	1 555	1 555	0%	748.16	587.92	-21%	1 163 482	789 813	-373 669	-32%
		Car 2	8 876	8 876	0%	817.75	585.42	-28%	7 258 047	4 486 626	-2 771 421	-38%
		Car 3	34 167	34 167	0%	638.91	588.64	-8%	21 553 280	12 251 155	-9 302 125	-43%
	Diesel Oil	Car 4	34 287	34 287	0%	396.94	281.86	-29%	9 640 384	6 885 621	-2 754 763	-29%
		Car 5	269 735	269 735	0%	267.22	153.60	-42%	74 680 233	39 976 610	-34 703 623	-46%
		Car 6	261 480	261 480	0%	61.77	153.60	149%	16 149 289	40 244 036	24 094 748	149%
		HDVs Total	594 013	594 013	0%	226.31	180.97	-20%	134 431 899	101 486 262	-32 945 637	-24%
		pre-Cars	5 543	5 543	0%	125.59	155.78	24%	696 072	883 289	187 217	24%
		Car 1	3 360	3 360	0%	127.11	177.29	39%	427 113	585 796	158 683	39%
		Car 2	3 375	3 375	0%	125.94	187.68	50%	421 961	687 078	265 117	63%
		Car 3	6 443	6 443	0%	48.36	187.68	381%	209 627	1 273 671	1 064 044	508%
		Car 4	65	65	0%	17.47	187.68	1031%	1 134	12 632	11 498	1011%
		HDVs Total	16 185	16 185	0%	96.14	181.68	89%	1 885 897	3 452 476	1 566 579	83%
		1.A.3.b - Road Transport	2 267 339	2 267 339	0%	258.89	137.22	-46%	553 799 598	362 981 820	-190 817 778	-46%

Adjustment details for 2027												
NFR Code	Fuel	Activity Data			Implied Emission Factor			NO <sub>x</sub> Emissions				
		current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference	
		in [T]	in [T]	in [%]	in [g/t]	in [g/t]	in [%]	in [kg]	in [kg]	in [kg]	in [%]	
1.A.3.a.i - Passenger Cars	Gasoline	pre-Cars	12,282	12,282	0%	636.73	644.11	-16%	7,614,267	6,680,187	-1,134,100	-16%
		Car 1	17,449	17,449	0%	372.96	341.68	-8%	6,588,211	4,217,644	-2,370,567	-36%
		Car 2	30,435	30,435	0%	217.43	141.75	-35%	6,617,570	4,314,140	-2,303,430	-36%
		Car 3	54,271	54,271	0%	78.48	76.27	-3%	4,254,938	4,139,376	-115,562	-3%
		Car 4	315,086	315,086	0%	54.96	51.26	-7%	17,316,320	16,151,881	-1,164,439	-7%
		Car 5	180,240	180,240	0%	19.17	51.26	167%	3,485,382	9,239,815	5,754,433	167%
	Diesel Oil	Car 6	114,791	114,791	0%	25.65	51.26	102%	3,063,235	5,884,372	2,821,137	102%
		Gasoline total	724,571	724,571	0%	67.66	60.88	-10%	49,046,874	38,634,374	-10,412,500	-21%
		pre-Cars	1,780	1,780	0%	364.96	264.56	-13%	483,963	347,620	-136,343	-13%
		Car 1	3,360	3,360	0%	298.17	271.67	-9%	1,082,288	910,182	-172,106	-9%
		Car 2	13,780	13,780	0%	407.17	222.43	-45%	5,614,130	3,066,393	-2,547,736	-45%
		Car 3	52,128	52,128	0%	808.95	179.65	-78%	31,696,478	9,364,788	-22,331,690	-70%
	Diesel Oil	Car 4	187,047	187,047	0%	418.16	158.34	-61%	64,733,485	24,983,323	-39,750,162	-61%
		Car 5	283,480	283,480	0%	423.99	158.34	-63%	120,187,696	44,073,190	-76,114,506	-63%
		Car 6	184,768	184,768	0%	262.61	158.34	-40%	48,521,183	29,255,985	-19,265,198	-40%
		Diesel oil total	696,582	696,582	0%	294.65	161.95	-50%	272,126,081	112,890,721	-159,235,360	-58%
		Pkx Total	1,621,142	1,621,142	0%	225.98	155.61	-49%	121,152,965	163,445,435	42,292,470	35%
1.A.3.b.i - Heavy Duty Vehicles (HDVs)	Gasoline	pre-Cars	940	940	0%	611.41	645.35	-7%	612,247	686,978	74,732	12%
		Car 1	124	124	0%	908.23	312.78	-66%	112,083	39,682	-72,401	-65%
		Car 2	485	485	0%	302.12	221.62	-27%	140,344	102,950	-37,394	-27%
		Car 3	596	596	0%	118.57	115.36	-3%	65,955	68,812	2,857	4%
		Car 4	1,476	1,476	0%	50.72	53.38	5%	74,877	78,816	3,939	5%
		Car 5	1,680	1,680	0%	21.73	53.38	146%	35,240	89,034	53,794	150%
	Diesel Oil	Car 6	910	910	0%	19.18	53.38	180%	17,052	49,080	32,028	180%
		Gasoline total	6,186	6,186	0%	171.55	167.18	-2%	1,058,799	1,034,211	-24,588	-2%
		pre-Cars	2,067	2,067	0%	413.41	385.79	-7%	860,499	631,183	-229,316	-28%
		Car 1	1,538	1,538	0%	398.47	276.25	-30%	680,795	331,158	-349,637	-50%
		Car 2	3,580	3,580	0%	321.26	153.04	-52%	1,143,793	682,023	-461,770	-40%
Diesel Oil	Car 3	11,654	11,654	0%	595.38	150.73	-75%	5,240,935	1,798,242	-3,442,693	-66%	
	Car 4	39,600	39,600	0%	306.76	83.03	-73%	19,749,647	3,626,025	-16,123,622	-82%	
	Car 5	75,789	75,789	0%	432.66	83.03	-79%	32,790,566	7,054,565	-25,736,001	-79%	
	Car 6	19,625	19,625	0%	167.71	83.03	-50%	2,977,239	1,626,675	-1,350,564	-46%	
	Diesel oil total	153,284	153,284	0%	424.66	183.89	-57%	65,083,930	15,925,274	-49,158,656	-74%	
1.A.3.b.ii - Heavy Duty Vehicles (HDVs)	Gasoline	pre-Cars	199,470	199,470	0%	418.16	196.35	-53%	66,152,729	36,959,427	-29,193,302	-44%
		Car 1	736	736	0%	1073.33	1013.23	-5%	790,259	750,425	-39,834	-5%
		Car 2	411	411	0%	723.97	752.57	3%	300,684	399,082	98,398	33%
		Car 3	3,325	3,325	0%	731.91	646.79	-12%	2,523,087	2,147,480	-375,607	-15%
		Car 4	8,678	8,678	0%	673.23	459.12	-32%	5,478,480	3,984,085	-1,494,395	-27%
		Car 5	3,823	3,823	0%	474.07	352.49	-26%	1,912,380	1,347,680	-564,700	-30%
	Diesel Oil	Car 6	21,913	21,913	0%	363.92	186.64	-49%	7,937,975	4,053,686	-3,884,289	-49%
		Car 1	14,586	14,586	0%	68.52	186.64	270%	854,215	2,732,580	1,878,365	218%
		pre-Cars	53,382	53,382	0%	318.80	286.71	-10%	19,193,981	19,384,620	190,639	1%
		Car 2	3,685	3,685	0%	1034.40	731.35	-29%	3,730,272	2,659,076	-1,071,196	-29%
		Car 3	13,711	13,711	0%	748.03	483.48	-35%	10,942,614	6,151,358	-4,791,256	-43%
	Diesel Oil	Car 4	7,081	7,081	0%	817.96	540.55	-34%	5,794,676	3,580,026	-2,214,650	-38%
		Car 5	26,586	26,586	0%	626.17	365.73	-42%	18,942,041	9,852,565	-9,089,476	-48%
		Car 6	39,082	39,082	0%	397.77	279.34	-30%	7,964,414	5,637,487	-2,326,927	-30%
		Car 1	264,365	264,365	0%	268.16	154.36	-42%	49,280,789	31,085,347	-18,195,442	-43%
		Car 2	335,065	335,065	0%	65.82	154.36	135%	21,985,366	31,755,641	9,770,275	135%
	1.A.3.b.iii - Motorized Two-Wheelers (MOWs)	Gasoline	Trucks Total	598,263	598,263	0%	1055.14	175.92	-16%	116,671,141	185,248,060	68,576,919
pre-Cars			5,336	5,336	0%	125.91	157.13	25%	671,080	839,780	168,700	25%
Car 1			3,257	3,257	0%	126.39	177.06	41%	411,617	579,244	167,627	41%
Car 2			3,396	3,396	0%	122.55	180.33	47%	476,290	675,548	199,258	42%
Car 3			6,711	6,711	0%	41.22	180.33	363%	271,187	1,336,565	1,065,378	393%
Car 4			0	0	0%	0.00	0.00	0%	0	82,278	77,408	96%
MOWs Total		pre-Cars	19,160	19,160	0%	52.81	183.39	348%	7,782,484	3,553,787	-4,228,697	-54%
		Car 1	19,160	19,160	0%	52.81	183.39	348%	7,782,484	3,553,787	-4,228,697	-54%
		Car 2	19,160	19,160	0%	52.81	183.39	348%	7,782,484	3,553,787	-4,228,697	-54%
		Car 3	19,160	19,160	0%	52.81	183.39	348%	7,782,484	3,553,787	-4,228,697	-54%
		Car 4	19,160	19,160	0%	52.81	183.39	348%	7,782,484	3,553,787	-4,228,697	-54%
MOWs Total		pre-Cars	19,160	19,160	0%	52.81	183.39	348%	7,782,484	3,553,787	-4,228,697	-54%
		Car 1	19,160	19,160	0%	52.81	183.39	348%	7,782,484	3,553,787	-4,228,697	-54%
1.A.3.b - Road Transport		Total	2,291,427	2,291,427	0%	213.43	175.23	-42%	125,540,430	184,480,986	58,940,556	47%

Adjustment details for 2018													
NFR Code	Fuel	Activity Data			Implied Emission Factor			NO <sub>x</sub> Emissions					
		current	adjusted	difference	current	adjusted	difference	current	adjusted	adjustment	difference		
		in [t]	in [t]	in [%]	in [g/t]	in [g/t]	in [%]	in [kg]	in [kg]	in [kg]	in [%]		
1.A.3.a.i - Passenger Cars	Gasoline	pre-Cars	12,219	12,219	0%	637.58	644.11	-10%	7,780,965	6,648,721	-1,132,234	-15%	
		Car 1	14,362	14,362	0%	374.24	341.68	-9%	5,371,161	3,448,643	-1,922,518	-36%	
		Car 2	34,285	34,285	0%	221.97	111.66	-50%	5,360,977	2,688,161	-2,672,814	-50%	
		Car 3	43,642	43,642	0%	88.16	76.96	-13%	3,487,781	3,388,617	-99,164	-3%	
		Car 4	278,738	278,738	0%	55.98	52.30	-7%	15,683,488	14,756,755	-926,733	-6%	
		Car 5	186,830	186,830	0%	19.35	52.30	-170%	3,228,282	8,725,668	5,497,386	170%	
	Diesel Oil	pre-Cars	159,041	159,041	0%	6.00	52.30	-89%	4,190,422	8,716,250	4,525,828	89%	
		Car 1	2,949	2,949	0%	303.16	254.96	-16%	171,040	245,173	74,133	43%	
		Car 2	10,784	10,784	0%	407.20	222.67	-45%	4,391,383	2,483,536	-1,907,848	-45%	
		Car 3	40,786	40,786	0%	812.49	180.15	-78%	24,932,029	7,333,241	-17,598,788	-71%	
		Car 4	130,534	130,534	0%	414.71	180.40	-56%	54,133,837	20,937,329	-33,196,508	-61%	
		Car 5	251,212	251,212	0%	416.25	180.40	-56%	104,585,786	40,293,731	-64,292,055	-61%	
	Diesel oil total	pre-Cars	220,685	220,685	0%	254.87	180.40	-30%	58,284,140	35,680,446	-22,603,694	-39%	
		Car 1	666,076	666,076	0%	375.66	163.38	-56%	247,596,063	188,768,684	-158,767,459	-56%	
		Car 2	1,365,181	1,365,181	0%	214.34	154.68	-28%	262,589,060	156,555,421	-106,033,639	-40%	
		Car 3	917	917	0%	645.53	645.95	1%	596,851	582,652	-14,199	-2%	
		Car 4	188	188	0%	915.58	312.78	-66%	98,528	33,895	-64,633	-66%	
		Car 5	377	377	0%	303.64	224.45	-26%	114,682	84,713	-29,969	-26%	
	Gasoline	pre-Cars	911	911	0%	111.92	116.84	4%	57,282	60,739	3,457	6%	
		Car 1	1,275	1,275	0%	52.02	54.36	4%	65,290	69,270	3,980	4%	
		Car 2	1,483	1,483	0%	23.70	54.36	129%	35,160	80,626	45,466	129%	
		Car 3	1,643	1,643	0%	19.18	54.36	182%	39,550	89,326	49,776	182%	
		Car 4	6,315	6,315	0%	154.22	160.11	4%	999,199	1,011,138	11,939	1%	
		Car 5	1,872	1,872	0%	411.57	386.79	-6%	771,337	574,432	-196,905	-26%	
Diesel Oil	pre-Cars	1,285	1,285	0%	389.94	276.25	-29%	493,129	272,286	-220,843	-45%		
	Car 1	2,942	2,942	0%	318.56	193.88	-39%	965,389	550,789	-414,600	-43%		
	Car 2	9,383	9,383	0%	598.10	150.74	-75%	5,689,152	1,411,299	-4,277,853	-75%		
	Car 3	33,232	33,232	0%	508.42	93.81	-82%	16,929,185	3,117,457	-13,811,728	-82%		
	Car 4	66,283	66,283	0%	432.92	93.81	-78%	28,684,080	6,217,860	-22,466,220	-78%		
	Car 5	39,482	39,482	0%	158.79	93.81	-41%	5,941,615	3,686,228	-2,255,387	-38%		
1.A.3.b.i - Light Duty Vehicles (LDVs)	Gasoline	pre-Cars	154,259	154,259	0%	384.71	182.69	-53%	59,344,525	15,880,316	-43,464,210	-73%	
		LDVs total	160,574	160,574	0%	375.86	184.94	-51%	69,343,125	36,851,449	-32,491,676	-51%	
		Car 1	547	547	0%	1078.16	1919.23	78%	589,267	557,147	-32,120	-5%	
		Car 2	237	237	0%	732.78	732.57	0%	173,676	168,368	-5,308	-3%	
		Car 3	2,270	2,270	0%	787.83	646.33	-18%	1,780,686	1,487,437	-293,249	-16%	
		Car 4	6,757	6,757	0%	638.89	459.32	-29%	4,262,734	3,183,482	-1,079,252	-25%	
	Diesel Oil	pre-Cars	3,043	3,043	0%	473.16	382.73	-19%	1,439,790	1,073,333	-366,457	-25%	
		Car 1	18,189	18,189	0%	362.42	186.37	-49%	6,663,265	3,376,016	-3,287,249	-49%	
		Car 2	20,670	20,670	0%	64.89	186.37	289%	1,176,026	3,682,314	2,506,288	289%	
		Buses total	91,634	91,634	0%	309.75	283.53	-9%	15,993,546	13,687,186	-2,306,360	-15%	
		Car 1	3,262	3,262	0%	1034.82	737.35	-29%	3,375,359	2,485,071	-890,288	-29%	
		Car 2	1,094	1,094	0%	747.82	488.39	-35%	918,052	512,378	-405,674	-44%	
	1.A.3.b.ii - Heavy Duty Vehicle Buses	Gasoline	pre-Cars	5,544	5,544	0%	817.44	581.68	-29%	4,532,190	2,781,516	-1,750,674	-39%
			Car 1	6,757	6,757	0%	629.54	563.68	-10%	12,967,751	7,277,279	-5,690,472	-44%
			Car 2	2,040	2,040	0%	473.16	382.73	-19%	1,439,790	1,073,333	-366,457	-25%
			Car 3	18,189	18,189	0%	362.42	186.37	-49%	6,663,265	3,376,016	-3,287,249	-49%
			Car 4	20,670	20,670	0%	64.89	186.37	289%	1,176,026	3,682,314	2,506,288	289%
			Buses total	31,634	31,634	0%	309.75	283.53	-9%	15,993,546	13,687,186	-2,306,360	-15%
1.A.3.b.iii - Heavy Duty Vehicle Trucks & Lorries	Diesel Oil	pre-Cars	3,262	3,262	0%	1034.82	737.35	-29%	3,375,359	2,485,071	-890,288	-29%	
		Car 1	1,094	1,094	0%	747.82	488.39	-35%	918,052	512,378	-405,674	-44%	
		Car 2	5,544	5,544	0%	817.44	581.68	-29%	4,532,190	2,781,516	-1,750,674	-39%	
		Car 3	20,583	20,583	0%	629.54	563.68	-10%	12,967,751	7,277,279	-5,690,472	-44%	
		Car 4	15,912	15,912	0%	358.89	276.23	-23%	6,334,421	4,386,424	-1,947,997	-31%	
		Car 5	154,983	154,983	0%	292.40	154.68	-47%	45,964,153	24,283,389	-21,680,764	-47%	
1.A.3.b.iv - Motorised Two-Wheelers (M2Ws)	Gasoline	pre-Cars	381,799	381,799	0%	68.78	154.68	125%	28,251,482	69,665,886	41,414,404	146%	
		Trucks total	585,186	585,186	0%	515.18	172.19	-67%	188,173,537	180,760,889	-7,412,648	-4%	
		Car 1	4,940	4,940	0%	128.95	188.61	46%	622,695	783,451	160,756	26%	
		Car 2	2,966	2,966	0%	128.14	177.79	41%	374,114	527,294	153,180	41%	
		Car 3	3,221	3,221	0%	128.33	188.64	46%	387,596	639,833	252,237	65%	
		Car 4	6,241	6,241	0%	48.24	188.64	284%	251,126	1,239,686	988,560	394%	
	Diesel Oil	pre-Cars	1,130	1,130	0%	58.41	188.64	324%	23,966	224,682	200,716	837%	
		Car 1	0	0	0%	0.00	188.64	0%	0	0	0	0%	
		M2Ws total	18,487	18,487	0%	85.66	188.61	198%	1,658,568	3,454,767	1,796,199	108%	
		Car 1	2,180,983	2,180,983	0%	215.85	133.49	-38%	478,758,286	291,129,652	-187,628,634	-38%	
		Car 2	1,130	1,130	0%	58.41	188.64	324%	23,966	224,682	200,716	837%	
		Car 3	0	0	0%	0.00	188.64	0%	0	0	0	0%	

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Adjustment 2014 (accepted) <sup>8), 9)</sup>	-105.6	-101.3	-95.7	-91.7						
Adjustment 2015 (accepted) <sup>10), 11)</sup>	-100.3	-95.5	-89.9	-85.1						
Adjustment 2016 (accepted) <sup>12), 13)</sup>	-151.3	-146.9	-145.1	-142.5	-128.1					
Adjustment 2017 (accepted) <sup>14)</sup>	-151.3	-146.8	-145.0	-142.4	-127.2	-100.9				
Adjustment 2018 (accepted) <sup>15)</sup>	-172.3	-174.5	-177.4	-180.4	-171.5	-148.9	-123.2			
Adjustment 2019 (accepted) <sup>16)</sup>	-172.3	-174.5	-177.4	-180.3	-171.4	-148.8	-123.3	93.7		
Adjustment 2020 (accepted)	-297.8	-302.3	-301.3	-306.1	-294.5	-269.0	-244.3	-214.9	-174.6	
<b>Adjustment 2021 (proposal)</b>	<b>-296.1</b>	<b>-300.7</b>	<b>-300.4</b>	<b>-305.2</b>	<b>-294.9</b>	<b>-274.9</b>	<b>-250.9</b>	<b>-221.1</b>	<b>-179.6</b>	<b>-144.8</b>
Change against Adjustment 2020	1.7	1.6	0.9	0.9	-0.4	-5.9	-6.6	-6.2	-5.0	

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". <sup>17)</sup>

The even bigger changes between adjustment 2019 and adjustment proposal 2020 result from an additional rather fundamental revision of the *Handbook Emission Factors for Road Transport* now available in version 4.1 <sup>18)</sup> strongly effecting the TREMOD model underlying Germany's emission reporting for road transport and hence any adjustments of NO<sub>x</sub> emissions. With such major model revision between submissions 2019 and 2020, the 2020 adjustment proposal differed significantly from the adjustment applied for and accepted in 2019.

**In comparison to 2020, the TREMOD model applied for the 2021 submission has been revised only slightly in terms of NO<sub>x</sub> emission factors. Hence, the 2021 adjustment proposal differs only slightly from the (accepted) proposal provided with submission 2020.**

#### **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](#)

<sup>1)</sup> IIASA, 1999: Amann, M.; Bertok, I.; Cofala, J.; Gyarfas, F.; Heyes, Chr.; Klimont, Zb.; Syri, S.; Schöpp, W.: Further analysis of scenario results obtained with the RAINS model - Interim Report to the Ministère de L'Aménagement du Territoire et de l'Environnement Direction de la Prévention des Pollutions et des Risques 20, avenue de Ségur 75302 Paris 07 SP, April 1999 - URL: <https://iiasa.ac.at/web/home/research/researchPrograms/air/policy/france3b.pdf>

<sup>2)</sup> EB, 2012a: CLRTAP EB Decision 2012/3, ECE/EB.AIR/111/Add.1: Adjustments under the Gothenburg Protocol to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them URL: [http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE\\_EB.AIR\\_111\\_Add.1\\_ENG\\_DECISION\\_3.pdf](http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE_EB.AIR_111_Add.1_ENG_DECISION_3.pdf)

<sup>3)</sup> EB, 2012c: CLRTAP EB Decision 2012/12: Guidance for adjustments under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them URL: [http://www.unece.org/fileadmin/DAM/env/documents/2012/EB/Decision\\_2012\\_12.pdf](http://www.unece.org/fileadmin/DAM/env/documents/2012/EB/Decision_2012_12.pdf)

<sup>4)</sup> EB, 2012b: CLRTAP EB Decision 2012/4: Provisional Application of Amendment to the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone URL: [http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE\\_EB.AIR\\_111\\_Add.1\\_ENG\\_DECISION\\_4.pdf](http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE_EB.AIR_111_Add.1_ENG_DECISION_4.pdf)

<sup>5)</sup> (b) cite 4)

<sup>6)</sup> ifeu, 2002: Final report to UFOPLAN study FKZ 201 45 112 (German version only): Aktualisierung des Daten- und Rechenmodells: Energieverbrauch und Schadstoffemissionen des motorisierten Verkehrs in Deutschland 1980-2020; Im Auftrag des Umweltbundesamtes; ifeu Institut für Energie- und Umweltforschung Heidelberg GmbH (Institute for Energy and Environmental Research), Wilckensstraße 3, D-69120 Heidelberg, Germany, phone: +49 (0) 6221 / 47 67 -0, fax: +49 (0) 6221 / 47 67 -19, Heidelberg, 31. Oktober 2002

<sup>7)</sup> Knörr et al. (2020a): 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, 2020.

<sup>8)</sup> CEIP, 2014a: Centre on Emission Inventories and Projections (CEIP): CEIP/Adjustment RR/2014/GERMANY: Review of the 2014 Adjustment Application by Germany, URL: [https://webdab01.umweltbundesamt.at/download/adjustments2014/Adjustment\\_Review\\_Report\\_GERMANY\\_2014.pdf?cgiprox\\_y\\_skip=1](https://webdab01.umweltbundesamt.at/download/adjustments2014/Adjustment_Review_Report_GERMANY_2014.pdf?cgiprox_y_skip=1), 5 August 2014.

<sup>10)</sup> CEIP, 2015a: Centre on Emission Inventories and Projections (CEIP): CEIP/Adjustment RR/2015/Germany: Review of the 2015 Adjustment Application by Germany, URL:

[https://webdab01.umweltbundesamt.at/download/adjustments2015/Germany2015-adj.pdf?cgiproxy\\_skip=1](https://webdab01.umweltbundesamt.at/download/adjustments2015/Germany2015-adj.pdf?cgiproxy_skip=1), September 2015.

<sup>11)</sup> CEIP, 2015b: Centre on Emission Inventories and Projections (CEIP): CE/EB.AIR/GE.1/2015/10-ECE/EB.AIR/WG.1/2015/13: Review of adjustment applications 2015; URL:

[http://www.ceip.at/fileadmin/inhalte/emep/Adjustments/ece.eb.air.ge.1.2015.10\\_ece.eb.air.wg.1.2015.13.AV.pdf](http://www.ceip.at/fileadmin/inhalte/emep/Adjustments/ece.eb.air.ge.1.2015.10_ece.eb.air.wg.1.2015.13.AV.pdf), 6 July 2015.

<sup>12)</sup> CEIP, 2016a: Centre on Emission Inventories and Projections (CEIP): Review of the 2016 Adjustment Application by Germany, URL: [https://webdab01.umweltbundesamt.at/download/adjustments2016/Germany2016-adj.pdf?cgiproxy\\_skip=1](https://webdab01.umweltbundesamt.at/download/adjustments2016/Germany2016-adj.pdf?cgiproxy_skip=1), 2016.

<sup>13)</sup> CEIP, 2016b: Centre on Emission Inventories and Projections (CEIP): ECE/EB.AIR/GE.1/2016/10-ECE/EB.AIR/WG.1/2016/18: Review of adjustment applications 2016; URL:

[http://www.ceip.at/fileadmin/inhalte/emep/pdf/2016/ECE\\_EB.AIR\\_GE.1\\_2016\\_10\\_E.pdf](http://www.ceip.at/fileadmin/inhalte/emep/pdf/2016/ECE_EB.AIR_GE.1_2016_10_E.pdf), 2016.

<sup>14)</sup> CEIP, 2017a: Centre on Emission Inventories and Projections (CEIP): ECE/EB.AIR/GE.1/2017/10-ECE/EB.AIR/WG.1/2017/20: Review of adjustment applications 2017; URL:

[http://www.ceip.at/fileadmin/inhalte/emep/pdf/2017/Advance\\_ece\\_eb.air.ge.1\\_2017\\_10\\_ece\\_eb.air.wg.1\\_2017.pdf](http://www.ceip.at/fileadmin/inhalte/emep/pdf/2017/Advance_ece_eb.air.ge.1_2017_10_ece_eb.air.wg.1_2017.pdf), 2017.

<sup>15)</sup> CEIP, 2018a: Centre on Emission Inventories and Projections (CEIP): ECE/EB.AIR/GE.1/2018/10-ECE/EB.AIR/WG.1/2018/21: Review of adjustment applications 2018; URL:

[https://www.ceip.at/fileadmin/inhalte/emep/pdf/2018/ADJ\\_ece.eb.air.ge.1.2018.10-ece.eb.air.wg.1.2018.21\\_advance.pdf](https://www.ceip.at/fileadmin/inhalte/emep/pdf/2018/ADJ_ece.eb.air.ge.1.2018.10-ece.eb.air.wg.1.2018.21_advance.pdf), 2018.

<sup>16)</sup> CEIP, 2019a: Centre on Emission Inventories and Projections (CEIP): ECE/EB.AIR/GE.1/2019/10-ECE/EB.AIR/WG.1/2019/22: Review of adjustment applications 2019; URL:

[https://www.ceip.at/fileadmin/inhalte/emep/pdf/2019/ECE\\_EB.AIR\\_GE.1\\_2019\\_10-1909789E.pdf](https://www.ceip.at/fileadmin/inhalte/emep/pdf/2019/ECE_EB.AIR_GE.1_2019_10-1909789E.pdf), 2019.

<sup>17)</sup> Keller et al. (2017): Keller, M., Hausberger, S., Matzer, C., Wüthrich, P., & Notter, B.: Handbook Emission Factors for Road Transport, version 3.3 (Handbuch Emissionsfaktoren des Straßenverkehrs 3.3) URL:

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwj0y67pi5foAhWB16QKHfpYDIgQFjAAegQIAhAB&url=https%3A%2F%2Fwww.hbefa.net%2Fd%2Fdocuments%2FHBEFA33\\_Hintergrundbericht.pdf&usq=A0vVaw2sOF884KtccVyWLItdt1CIZ](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwj0y67pi5foAhWB16QKHfpYDIgQFjAAegQIAhAB&url=https%3A%2F%2Fwww.hbefa.net%2Fd%2Fdocuments%2FHBEFA33_Hintergrundbericht.pdf&usq=A0vVaw2sOF884KtccVyWLItdt1CIZ) - Dokumentation, Bern, 2017.

<sup>18)</sup> Notter et al. (2019): Keller, M., Althaus, H.-J., Cox, B., Knörr, W., Heidt, Ch., Biemann, K., Räder, D.: Handbook Emission Factors for Road Transport, version 4.1 (Handbuch Emissionsfaktoren des Straßenverkehrs 4.1), HBEFA 4.1 Development Report; URL: [https://www.hbefa.net/e/documents/HBEFA41\\_Development\\_Report.pdf](https://www.hbefa.net/e/documents/HBEFA41_Development_Report.pdf), Bern, Heidelberg, 21. August 2019.