umweltbundesamt
ENVIRONMENT AGENCY AUSTRIA

Austria's Annual Greenhouse Gas Inventory 1990–2020

Submission under Regulation (EU) No 525/2013

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AUSTRIA'S ANNUAL GREENHOUSE GAS INVENTORY 1990–2020

Submission under Regulation (EU) No 525/2013

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The information covered refers to the following accreditation scope of the IBE: 2006 IPCC GL for National Greenhouse Gas Inventories, 2006 GL Revised Supplementary KP and 2006 GL Supplement Wetlands (www.bmdw.gv.at/akkreditierung)

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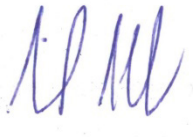
Date 13.01.2022	Responsible for the content of this report  DI Michael Anderl (Head of the inspection body)
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VORWORT

Dieser Bericht

Der vorliegende Bericht präsentiert die neuesten Daten der Emissionen von Treibhausgasen (THG) Österreichs. Diese Daten betreffen die Emissionen des Jahres 2020 sowie die aktualisierte Zeitreihe der Jahre 1990 bis 2019. Damit liefert der Bericht Daten für alle Jahre der zweiten Kyoto-Verpflichtungsperiode sowie der Zielperiode (2013–2020) unter der „Effort Sharing-Entscheidung" (2009/406/EG).

Der Bericht folgt in Format und Inhalt den Anforderungen des THG-Überwachungssystems (Monitoring Mechanism), in Umsetzung von Artikel 7 der Verordnung Nr. 525/2013/EG[1]. Dieses System umfasst die jährliche Übermittlung von aktualisierten THG-Emissionsdaten sowie zusätzlicher Informationen (z. B. SEF, Indikatoren) und einem dazugehörigen Kurzbericht („Short-NIR") mit 15. Jänner an die Europäische Kommission (EK).

Eine detaillierte Darstellung der Daten im Common Reporting Format (CRF) wird der Europäischen Kommission in digitaler Form übermittelt. Auch die Berichtstabellen gemäß Durchführungsverordnung (EU) Nr. 749/2014 der Kommission über die Struktur, das Format, die Verfahren der Vorlage und die Überprüfung der von den Mitgliedstaaten gemäß der Verordnung (EU) Nr. 525/2013 gemeldeten Informationen sind nicht Bestandteil des vorliegenden Berichts, sondern werden der Europäischen Kommission separat übermittelt (EIONET/CDR).

Rechtlicher Hintergrund

Als Vertragsstaat der Klimarahmenkonvention (*Rahmenübereinkommen der Vereinten Nationen über Klimaänderungen* (UN Framework Convention on Climate Change – UNFCCC, BGBl. Nr. 414/1994[2]) ist Österreich verpflichtet, jährlich seine Emissionen und Senken bezüglich der direkten Treibhausgase CO_2, CH_4, N_2O, HFC, PFC, SF_6 und NF_3, sowie der indirekten Treibhausgase NO_x, NMVOC, CO und SO_2 zu erheben und zu berichten. Die dafür anzuwendende Methodik ist in einem umfassenden Regelwerk entsprechend den Beschlüssen der Vertragsstaatenkonferenz der UNFCCC festgelegt.

Auch die Europäische Union (EU) ist Vertragsstaat der Klimarahmenkonvention. Die EU Inventur wird aus der Summe der Mitgliedsstaaten-Inventuren errechnet. Deshalb hat die EU mit dem o. g. THG-Überwachungssystem die Anforderungen, die an die EU gestellt werden, an die Mitgliedsstaaten weitergegeben und diese dazu verpflichtet, Daten und Informationen, die für die Erstellung der EU Inventur

[1] Verordnung (EU) Nr. 525/2013 des Europäischen Parlaments und des Rates vom 21. Mai 2013 über ein System für die Überwachung von Treibhausgasemissionen sowie für die Berichterstattung über diese Emissionen und über andere klimaschutzrelevante Informationen auf Ebene der Mitgliedstaaten und der Union und zur Aufhebung der Entscheidung Nr. 280/2004/EG. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0013:0040:DE:PDF

[2] BGBl. Nr. 414/1994: Rahmenübereinkommen der Vereinten Nationen über Klimaänderungen samt Anlagen. Änderung durch BGBl. III Nr. 12/1999.
http://www.ris.bka.gv.at/Dokumente/BgblPdf/1994_414_0/1994_414_0.pdf
http://www.ris.bka.gv.at/Dokumente/BgblPdf/1999_12_3/1999_12_3.pdf

benötigt werden, rechtzeitig zur Verfügung zu stellen. Mit dem vorliegenden Bericht kommt Österreich dieser Berichtspflicht nach.

Die Erhebung der Daten berücksichtigt außerdem die Ergebnisse der jährlichen Überprüfung durch internationale FachexpertInnen im Rahmen der so genannten UNFCCC-Reviews. Eine solche Tiefenprüfung fand zuletzt als Desk-Review von 21.–26.09.2020 statt, und konnte erfolgreich abgeschlossen werden. Ergebnisse dieser Prüfung, inkl. Empfehlungen zur Verbesserung, werden auf der Website der UNFCCC veröffentlicht[3]. 2021 fand kein UNFCCC Review der Österreichischen Treibhausgas-Inventur statt.

Neben dem UNFCCC-Review findet auch auf Ebene der EU eine jährliche Prüfung der THG-Inventur statt („ESD-Review"). Dieser wurde 2021 als ‚annual review' durchgeführt und konnte erfolgreich (d. h. ohne ‚technical corrections') abgeschlossen werden.[4]

Tabelle A: Jährlicher Prozess zur Erstellung und Überarbeitung der THG Inventur.

15. Jänner *(Jahr n)*	Übermittlung der THG-Inventur an Europäische Kommission (CRF für die Jahre 1990 bis zum Jahr n-2)
15. Jänner bis 28. Februar *(Jahr n)*	Überprüfung der Daten durch die EK
15. März *(Jahr n)*	Übermittlung des (endgültigen) nationalen Inventurberichtes (NIR) an die EK
15. Jänner bis 28. Februar *(Jahr n)*	Überprüfung der Daten (CRF) und des nationalen Inventurberichtes (NIR) durch die EEA im Rahmen der ‚initial QA/QC checks'
15. April *(Jahr n)*	Übermittlung der THG-Inventur (CRF und NIR) an die UNFCCC
15. April bis 30. Juni	Überprüfung der THG-Inventur (CRF und NIR) durch die EEA im Rahmen des Reviews unter der Effort-Sharing-Decision (‚ESD-Review')
Juni *(Jahr n)* bis März *(Jahr n+1)*	Überprüfung der Daten durch die UNFCCC: ● Stufe 1: Initial Check ● Stufe 2: Synthesis and Assessment ● Stufe 3: Individual Review
bis 15. Januar *(Jahr n +1)*	Berücksichtigung der Verbesserungsvorschläge der EK und der UNFCCC bei der Erstellung und Überarbeitung der THG-Inventur

Zur Erfüllung der Anforderungen, die sich aus der Klimarahmenkonvention und vor allem aus dem Inkrafttreten des Kyoto-Protokolls[5] am 16. Februar 2005 ergeben haben, wurde entsprechend Artikel 5.1 des Kyoto-Protokolls ein Nationales System eingerichtet. Ziel ist es, die Qualität der Inventur sicherzustellen und kontinuierlich zu verbessern. Dazu wurde ein Gesamtkonzept für das Nationale Inventur System Austria (NISA) entwickelt, das auf der *Österreichischen Luftschad-*

[3] https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/inventory-review-reports-2020

[4] https://ec.europa.eu/clima/eu-action/effort-sharing-member-states-emission-targets/implementation-effort-sharing-decision_en

[5] http://unfccc.int/kyoto_protocol/items/2830.php

stoff-Inventur (OLI) als zentralem Kern aufbaut. Ein umfassendes Inventurverbesserungsprogramm und ein Qualitätsmanagementsystem entsprechend ISO/IEC 17020 sind ein wesentlicher Teil des NISA[6].

Der vorliegende Bericht wurde vom Umweltbundesamt auf Grundlage des Umweltkontrollgesetzes BGBl. Nr. 152/1998[7] erstellt. Dem Umweltbundesamt wird in diesem Bundesgesetz in § 6 (2) Z.15 unter anderem die Aufgabe übertragen, fachliche Grundlagen zur Erfüllung des Rahmenübereinkommens der Vereinten Nationen über Klimaänderungen zu erstellen. In § 6 (2) Z.20 werden die Entwicklung und Führung von Inventuren und Bilanzen zur Dokumentation des Zustandes und der Entwicklung der Umwelt sowie der Umweltbelastungen und ihrer Ursachen ausdrücklich als besondere Aufgaben des Umweltbundesamtes genannt. Dieser Aufgabe wird mit der Erstellung sowie der jährlichen Aktualisierung der *Österreichischen Luftschadstoff-Inventur* (OLI) gemäß den in den relevanten internationalen Übereinkommen vereinbarten Richtlinien vom Umweltbundesamt nachgekommen. Die OLI deckt sowohl Treibhausgasemissionen, als auch Emissionen sonstiger Luftschadstoffe ab und ist damit u. a. die Datenbasis für die Erstellung des vorliegenden Berichts. Um eine vergleichbare Zeitreihe zur Verfügung zu haben wird die OLI erforderlichenfalls auch für zurückliegende Jahre aktualisiert. Die in diesem Bericht dargestellten Emissionsdaten ersetzen somit die publizierten Daten vorhergehender Berichte.

Inventur	Datenstand	Berichtsformat
OLI 2021	05. Jänner 2022	Common Reporting Format (CRF)

Tabelle B: Datengrundlage des vorliegenden Berichts.

[6] Umweltbundesamt (2005): NISA National Inventory System Austria, Implementation Report, REP-0004; Umweltbundesamt, Vienna.

[7] https://www.ris.bka.gv.at/Dokumente/BgblPdf/1998_152_1/1998_152_1.pdf

1 INTRODUCTION

This report presents the latest results from the Austrian greenhouse gas (GHG) inventory, which documents the annual national GHG emissions for the years 1990 to 2020. By documenting annual emissions up to the year 2020, the report presents GHG data for the entire 2013-2020 time series of the second commitment period under the Kyoto-Protocol as well as the EU Effort-sharing decision target period.

The greenhouse gas inventory is submitted to the European Commission by the Austrian Federal Government in fulfilment of Austria's obligations under Article 7 of Regulation (EU) No 525/2013[8] ("*Monitoring Mechanism Regulation*"; MMR) repealing Decision No 280/2004/EC[9] ("*Monitoring Mechanism Decision*") concerning a mechanism for monitoring European Community greenhouse gas emissions and for implementing the Kyoto Protocol. The purpose of this decision is to monitor all anthropogenic greenhouse gas emissions not controlled by the Montreal Protocol[10] and to evaluate the progress towards meeting the greenhouse gas reduction commitments under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

According to the above mentioned regulation and the reporting requirements, which are in accordance with those under UNFCCC, Member States are obliged to determine their anthropogenic emissions by sources and removals by sinks applying the methods described in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*[11], and to submit information in accordance with the *Reporting Guidelines (Decision 24/CP.19)*[12] established by the Conference of the Parties to the UNFCCC and under the Kyoto Protocol.

The national greenhouse gas inventory has to be submitted to the European Commission (EC) every year no later than 15 January. Furthermore, Member States have to submit by 15 January elements of their National Inventory Reports (NIR) relevant for the preparation of the Union greenhouse gas inventory report (Article 7 (1) p of 525/2013/EC). A complete and up-to-date national inventory report shall be subsequently submitted by 15 March each year.

The elements of the so-called "Short-NIR" are based on Article 7 paragraph 1 of the MMR and Articles 3-16 of the *Commission Implementing Regulation (EU) No 749/2014* on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council (MMR IR). The overview table of reporting requirements according to the Commission Implementing Regulation (EU) No 749/2014 ('MMR-IR_Annex1_overview_AT_2022-01-15') as well as the

[8] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0013:0040:EN:PDF

[9] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1999&qid=1610553048239&from=EN

[10] https://www.ozone.unep.org/treaties/montreal-protocol

[11] http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

[12] http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2

http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf

completed MMR IR reporting templates are not part of this report but submitted separately by uploading at EIONET/CDR.

The complete tables of the Common Reporting Format (CRF), including in particular Sectoral Reports, Sectoral Background Tables and the Reference Approach for CO_2 are submitted separately in digital form only[13].

Reporting Obligation	Format	Inventory	Version
Mechanism for monitoring Community greenhouse gas emissions	Common Reporting Format (CRF)	OLI 2021	January 5th 2022

Table 1: Status of the present report.

Geographical coverage is complete. There is no part of the Austrian territory that is not covered by the inventory. Emissions from most sources specified in the CRF have been estimated. Information on sources not estimated ('NE') and emissions included under sources other than those stipulated in the CRF ('IE') are included in CRF Table 9 on *Completeness*.

[13] http://cdr.eionet.europa.eu/at/eu/AT%20GHG/coluq7lfw/envuq7obg

2 EMISSION TRENDS

In 2020 Austria's total greenhouse gas (GHG) emissions (without Land Use, Land Use Change and Forestry – LULUCF) amounted to 73.6 Mt CO_2 equivalents (CO_2e). Compared to the 1990 base year[14], 2020 GHG emissions without LULUCF decreased by 6.2% and were furthermore 7.7% lower than emissions in 2019.

Greenhouse gas emissions according to Article 2(1) of Decision No. 406/2009/EC amounted to 46.5 Mt CO_2 equivalents in 2020 (see 'MMR-IR_AnnexX_ESD_AT_2022-01-15'), which is 7.2% (3.6 Mt CO_2e) less than in 2019.

Table 2: Emissions and status of ESD-target achievement

Mio. t CO_2-Äquivalent	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Total GHG emissions without LULUCF	79.8	76.2	78.5	79.5	81.8	78.6	79.7	73.6
Total verified emissions from stationary installations under Directive 2003/87/EC2	29.9	28.1	29.5	29.0	30.6	28.4	29.6	27.0
GHG emissions according to Article 2(1) of Decision No. 406/2009/EC ("ESD emissions")[15]	49.8*	48.1*	48.9*	50.4*	51.2*	50.1*	50.1*	46.5
Annual Emission Allocations (AEA)	52.6	52.1	51.5	51.0	49.5	48.9	48.3	47.8
Deviation from AEA	-2.8	-4.0	-2.6	-0.6	+1.7	+1.2	+1.8	-1.2

** based on the results of the comprehensive and annual inventory reviews referred to in Article 19(1) or 19(2) of Regulation (EU) No 525/2013, published in the following COMMISSION IMPLEMENTING DECISIONS (EU): 2016/2132, 2017/1015, 2017/2377, 2018/1855, 2019/2005, 2020/1834, 2021/1876. https://ec.europa.eu/clima/eu-action/effort-sharing-member-states-emission-targets/implementation-effort-sharing-decision_en*

[14] Austria's base year under the UNFCCC is 1990. Under the Kyoto Protocol the base year for CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 is 1990, for NF_3 it is 2000. Under the EU Effort Sharing Decision, the base year is 2005 (relates only to emissions not included in the EU Emissions Trading Scheme). Unless otherwise specified, references to the base year in this report refer always to 1990.

[15] Defined as: Total greenhouse gas emissions without LULUCF minus NF_3 emissions minus total verified emissions from stationary installations under Directive 2003/87/EC ("ETS emissions") minus CO_2 emissions from 1.A.3.a civil aviation.

Emissions in 2019, 2018 and 2017 were above their respective annual emission allocation (AEA[16]) levels, while in 2013, 2014, 2015, 2016 and 2020, emissions were below AEA values.

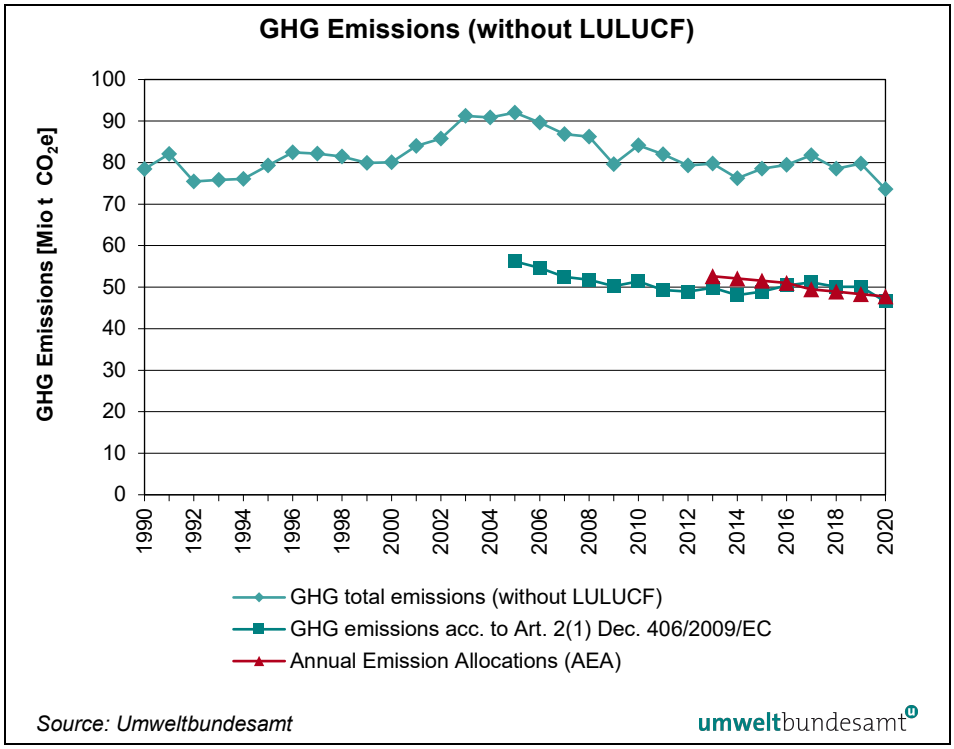


Figure 1: Trend in GHG emissions for 1990–2020 without LULUCF.

Trend 2019–2020

The key drivers for the emissions decrease between 2019 and 2020 were decreases in the sectors *Energy (CRF 1)* (-5 047 kt CO_2e; -9.2%) and *Industrial Processes and Other Product Use (CRF 2)* (-1 030 kt CO_2e; -6.2%).

The main reasons for the emissions decrease in sector *Energy (CRF 1)* were the lower diesel oil and motor gasoline sales in category *1.A.3 Transport* as well as the decommissioning of coal-fired power plants and lower electricity production from natural gas power plants in category *1.A.1 Energy Industries.*

Emissions from *Industrial Processes and Other Product Use (CRF 2)* decreased due, in large part, to reduced iron and steel production due to economic effects of the COVID 19 pandemic as well as declining emissions in the F-gas sector.

[16] Initial AEAs: Annex II of Commission Decision (No 2013/162/EU) of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013D0162&from=EN) adjusted by Commission Implementing Decision (No 2013/634/EU) of 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013D0634&from=EN). COMMISSION DECISION (EU) 2017/1471 of 10 August 2017 amending Decision 2013/162/EU to revise Member States' annual emission allocations for the period from 2017 to 2020

For F-gases, the decrease in emissions was due to a cold summer, as well as measures related to the EU F-gas regulation (No. 517/2014).

Net removals from *LULUCF* (*CRF 4*) show a decrease of 53% (1 344 kt CO_2e) from 2019 to 2020, mainly caused by the decrease in the harvested wood products sink.

Emissions from *Agriculture (CRF 3)* decreased slightly by 0.3% (−20 kt CO_2e) from 2019 to 2020, mainly due to lower emissions from *enteric fermentation* as a result of falling numbers of cattle (other cattle). This reduction was partly counterbalanced by rising emissions from *agricultural soils* because of larger emissions from mineral fertilizer application and crop residues as a result of increased plant production values.

The declining emission trend of recent decades continues for the sector *Waste (CRF 5)* with a further decline by 4.0% (−51 kt CO_2e) mainly due to the trend of decreasing carbon content of waste that is deposited in preceding years.

Table 3: Summary of Austria's anthropogenic greenhouse gas emissions by sector (without LULUCF).

GHG source and sink categories	1. Energy	2. IPPU	3. Agriculture	4. LULUCF	5. Waste	6. Other
	CO_2 equivalents (kt)					
1990	52 805	13 574	8 119	-12 065	3 926	NO*
1995	54 279	13 514	7 837	-13 277	3 653	NO
2000	55 253	14 491	7 376	-16 561	2 965	NO
2001	59 473	14 344	7 303	-19 408	2 868	NO
2002	60 681	15 009	7 190	-14 373	2 866	NO
2003	66 202	15 105	7 033	-4 982	2 870	NO
2004	66 315	14 614	6 993	-9 300	2 933	NO
2005	66 867	15 440	6 928	-10 770	2 794	NO
2006	63 953	16 078	6 901	-5 047	2 675	NO
2007	60 594	16 750	6 950	-5 274	2 547	NO
2008	59 697	17 063	7 064	-3 992	2 435	NO
2009	56 511	13 727	7 077	-2 459	2 268	NO
2010	59 419	15 680	6 926	-3 778	2 125	NO
2011	57 089	15 902	7 022	-4 159	1 995	NO
2012	54 942	15 517	6 969	-3 506	1 882	NO
2013	55 148	15 908	6 962	-2 538	1 754	NO
2014	51 424	16 063	7 106	-2 386	1 642	NO
2015	53 071	16 730	7 135	-2 201	1 551	NO
2016	54 299	16 448	7 256	-2 044	1 464	NO
2017	56 004	17 201	7 202	-2 789	1 385	NO
2018	54 573	15 584	7 090	-3 139	1 311	NO
2019	54 976	16 519	6 985	-2 531	1 260	NO
2020	49 929	15 489	6 964	-1 187	1 209	NO

** not occurring*

The most important gas in the Austrian GHG balance remains carbon dioxide (CO_2) with a share of 84% of total 2020 emissions (without LULUCF). Emissions of CO_2 primarily result from combustion activities. Methane (CH_4), which mainly arises from livestock farming and waste disposal, contributes 7.9% to total national GHG emissions; nitrous oxide (N_2O), with agricultural soils as the main source, contributes another 4.8% in 2020. The remaining 3.0% are emissions of fluorinated compounds, which are mostly emitted from the use of these gases as substitutes for ozone depleting substances (ODS) in refrigeration equipment.

GHG emissions	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3
	CO_2 equivalents (kt)						
1990	62 145	10 111	4 511	2.4	1 183	471	NO,NA
1995	64 023	9 382	4 338	351	83	1 100	6.4
2000	66 149	8 225	4 355	682	88	575	11
2001	70 149	8 055	4 222	807	116	629	11
2002	71 953	7 919	4 214	935	102	613	11
2003	77 460	7 852	4 203	996	126	549	22
2004	77 677	7 847	3 609	1 054	158	484	27
2005	79 077	7 613	3 607	1 047	163	494	28
2006	76 806	7 492	3 614	1 036	172	453	33
2007	74 106	7 372	3 632	1 074	230	367	59
2008	73 481	7 228	3 803	1 111	208	373	53
2009	67 298	7 116	3 580	1 207	36	342	4.5
2010	72 006	7 008	3 389	1 329	78	336	4.1
2011	69 893	6 801	3 493	1 435	74	307	4.1
2012	67 266	6 681	3 464	1 528	51	312	8.6
2013	67 759	6 573	3 447	1 629	49	305	10
2014	64 160	6 432	3 538	1 727	53	314	11
2015	66 349	6 354	3 555	1 856	50	310	13
2016	67 210	6 283	3 655	1 871	50	393	6.1
2017	69 592	6 256	3 593	1 894	44	400	12
2018	66 557	6 047	3 553	1 966	33	386	17
2019	67 935	5 914	3 551	1 851	38	436	14
2020	62 037	5 819	3 498	1 757	30	439	12

Table 4: Austria's anthropogenic greenhouse gas emissions (without LULUCF) by gas.

The dominant sector regarding GHG emissions in Austria is *Energy*, causing 68% of the total national GHG emissions in 2020 (67% in 1990), followed by the sectors *Industrial Processes and Other Product Use* (21% in 2020) and *Agriculture* (9.5% in 2020).

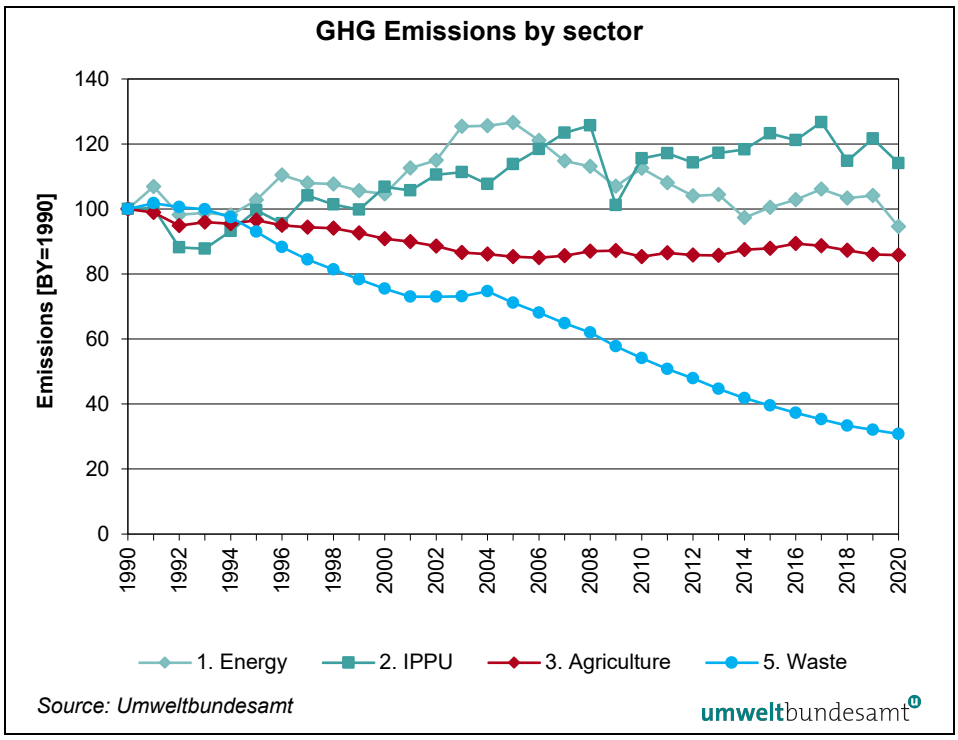
Table 5: Austria's greenhouse gas emissions (without LULUCF) for 1990 and 2020 expressed as aggregate levels and trends, as well as respective sector contributions.

GHG	1990	2020	Trend 1990–2020	1990	2020
	Emissions [kt CO_2e]			Share [%]	
Total	**78 423**	**73 592**	**-6.2%**	**100%**	**100%**
Energy	52 805	49 929	-5.4%	67%	68%
IPPU	13 574	15 489	+14%	17%	21%
Agriculture	8 119	6 964	-14%	10%	9.5%
Waste	3 926	1 209	-69%	5.0%	1.6%

Total emissions without emissions from sector LULUCF

The only sector with 2020 GHG emissions above the level in 1990 is *Industrial Processes and Other Product Use* (+14%; +1 916 kt CO_2e). The other sectors show decreasing trends, with the most significant decreases in GHG emissions in the sectors *Energy* (–5.4%; –2 876 kt CO_2e) and *Waste* (–69%; –2 717 kt CO_2e).

Figure 2: Trend in 1990-2020 emissions by sector in index form (1990 = 100).



A more detailed description and interpretation of emissions trends per sector is given in the following sub-chapters.

2.1 Energy

In 2020, greenhouse gas emissions from sector *1 Energy* amounted to 49 929 kt CO_2 equivalents which corresponds to 67.8% of total national emissions. Emissions from fuel combustion (*1.A*) contribute 99.3% of total Energy emissions, while fugitive emissions from fuels (*1.B*) are of minor importance.

The most important **sub-category** of *1.A Fuel Combustion Activities* is *1.A.3 Transport* with a share of 42.7% in 2020, followed by *1.A.2 Manufacturing Industries and Construction* (21.3%), *1.A.4 Other Sectors* (18.2%) and the sub-category *1.A.1 Energy Industries* (17.8%). The most important **greenhouse gas** is CO_2, contributing 98.1% to total sectoral GHG emissions, followed by CH_4 (0.7%) and N_2O (1.2%).

From 2019 to 2020, emissions from sector *1.A Fuel Combustion Activities* decreased by 9.2% (-5 029 kt CO_2e). The main driver of the trend was category *1.A.3 Transport* (-3 325 kt CO_2e) due to lower diesel oil (-11.2%) and motor gasoline (-17.1%) sales. Decreases in emissions from *1.A.1 Energy Industries* (-1.370 kt CO_2e) due to the decommissioning of coal-fired power plants and lower electricity production from natural gas power plants also contributed significantly to the 2019-2020 decline in *Energy* emissions. Emissions from category *1.A.2 Manufacturing Industries and Construction* decreased by 2.8%, mainly due to lower consumption of natural gas and liquid fuels from stationary and from mobile sources. Category *1.A.4 Other Sectors* emissions decreased by only 0.3% despite heating degree days being 2% higher in 2020. Between 2019 and 2020, slightly lower natural gas consumption in the sector was essentially offset by slightly higher gasoil consumption.

The **overall trend** in GHG emissions from the sector *Energy* shows decreasing emissions with a 5.4% decline from 1990 to 2020. Greenhouse gas emissions from road transport are however 53% higher than in 1990. Year to year variations are mainly due to the following factors:

- Weather circumstances in the corresponding years (in particular cold or mild winters, and/or dry or wet summers) which affect the heating demand, and the availability of electricity from hydro and wind power plants
- Economic situation as reflected in the gross domestic product (GDP)
- Change in power generation (switch from coal to gas)

Sub-category trends between 1990 and 2020

In 2020 emissions from sub-category ***1.A.1 Energy Industries*** were 37% below the level in 1990. Emissions from power plants have generally been decreasing since 2005, mainly because of the growing contribution of renewable energy sources, the substitution of solid and liquid fuels by natural gas and biomass, as well as improvements in efficiency.

The share of biomass used as a fuel in this sector increased from 0.9% in 1990 to 28% in 2020. The contribution of hydro, wind and photovoltaic power plants to total public electricity production increased from 69% in 1990 to 83% in 2020. Electricity consumption increased by 46% since 1990; however, since 2002 the increase in consumption has been largely covered by electricity imports.

Energy related GHG emissions from ***1.A.2 Manufacturing Industries and Construction*** increased by 7.1% from 1990 to 2020, mainly from *Off-road vehicles and other machinery (1.A.2.g.7)* as well as the *Chemicals Industry (1.A.2.c)*. Emissions from *Pulp, Paper and Print (1.A.2.d)*, *Other Manufacturing Industries (1.A.2.g.8)* and *Iron and Steel (1.A.2.a)* are however decreasing since 1990. Fuel consumption increased by 34% in that period, mainly due to increased use of natural gas and biomass. As natural gas has a lower carbon content, and CO_2 emissions from biomass combustion are not accounted for under the UNFCCC

reporting framework, the increase in GHG emissions from this category is significantly smaller (only +7.1%) compared to the increase in fuel combustion.

The sector ***1.A.3 Transport*** showed an increase in GHG emissions since 1990 (+52%) mainly due to an increase of road performance (mileage) of diesel cars and freight transport. In addition to the increase of road performance within Austria, the amount of fuel sold in Austria but used elsewhere – an effect called fuel export mainly caused by a lower fuel tax compared to Austria's neighbouring countries – has increased considerably since 1990. Between 2005 and 2012 total GHG emissions decreased due to lower amounts of fuel sold together with an increased use of biofuels for blending and the gradual replacement with newer vehicles with lower specific fuel consumption. Since then GHG emissions from transport have been gradually increasing with rising traffic volumes, although a sharp decrease in the pandemic year 2020 was observed. The drop in emissions is mainly due to the slump in car mileage and fuel sales: compared to 2019, around 11% less diesel fuel and around 17% less gasoline fuel was sold (incl. biofuels for blending). Sales of biofuels – pure and for blending – also fell.

The variation in demand for heating and hot water generation due to climatic circumstances and the shift in the fuel mix are the most important drivers for emissions from sub-category ***1.A.4 Other Sectors***. Emissions in 2020 were 37% lower than in 1990. This reduction is mainly attributable to the declining consumption of heating oil and coal and the increase in the consumption of biomass and natural gas as well as the growing importance of district heating and the modernisation of heating systems. Total fuel consumption of this sub-category has decreased by 13% since 1990.

Emissions from ***1.B Fugitive emissions*** decreased by 53% since 1990 due to the progressive closure of coal mines up until 2006. There have been no coal-mining activities in Austria since 2007. Fugitive Emissions from ***1.B.2 Oil and Natural gas*** are also below 1990 level (-11%) as volumes of crude oil and crude gas produced declined and the material of gas distribution network has changed over time (less cast iron).

2.2 Industrial Processes and Other Product Use

In 2020, greenhouse gas emissions from *Industrial Processes and Other Product Use* amounted to 15 491 kt CO_2 equivalent, which correspond to 21% of total national emissions.

The most important **sub-categories** of this sector are *metal industry* and *mineral industry*, generating 61% and 18% of total sectoral emissions, respectively. The most important **greenhouse gas** of this sector is CO_2 with a contribution of 85% to total sectoral emissions, followed by HFCs with 11%, SF_6 with 2.8%, N_2O with 0.6%, CH_4 with 0.3% and PFCs with 0.2%. NF_3 contributes 0.1% to total emissions from this sector in 2020.

From 2019 to 2020, overall emissions from this sector decreased by 6.2%, which is mainly caused by reduced iron and steel production due to the economic effects of the COVID-19 pandemic as well as decreased emissions in the F-gas

sector. For F-gases, the decrease in emissions was also due to a cold summer, and generally measures related to the EU F-gas regulation (No. 517/2014).

The **overall trend** in GHG emissions from *Industrial Processes and Other Product Use* is an increase of 14.1% from 1990 to 2020. Within this period, emissions fluctuated, with a minimum in 1993 and a maximum in 2017. **Main drivers** for the trend in emissions from this sector were (i) the termination of primary aluminium production in 1993, (ii) the introduction of N_2O abatement technologies in the chemical industry in 2004 and in 2009 (which became fully operational in 2010), (iii) increasing iron and steel production resulting in 43% higher GHG emissions in 2020 compared to 1990 and (iv) a strong increase of HFC emissions over the 1990-2020 period from 2 to 1 757 kt CO_2 equivalent.

Sub-category trends between 1990 and 2020

The largest increase in GHG emissions between 1990 and 2020 can be observed in the *metal industry* due to an increase in GHG emissions from iron and steel production (+43%). In sub-categories *mineral industry* and *chemical industry*, GHG emissions declined over the same period by 8.8% and 50%, respectively. Emissions from *non-energy products from fuels and solvent use* dropped by 56%, due to legal measures controlling the solvent content of products and their use.

Emissions of *fluorinated gases* increased by 35% since 1990, driven by increasing emissions of HFCs (+401% since 1995) due HFCs replacing Ozone Depleting Substances (ODSs) as cooling agents.

2.3 Agriculture

In 2020, greenhouse gas emissions from *Agriculture* amounted to 6 964 kt CO_2 equivalent, which correspond to 9.5% of total national emissions.

The **most important sub-categories** of this sector are *enteric fermentation* (54%) and *agricultural soils* (29%). *Agriculture* is the largest source of national N_2O and CH_4 emissions: in 2020, 72% (8.5 kt N_2O) of total N_2O emissions and 74% (171 kt CH_4) of total CH_4 emissions in Austria originated from this sector. Total GHG emissions from the sector *Agriculture* are dominated by CH_4 with a share of 62% and N_2O with a share of 36%. CO_2 emissions account for 2.1% of the emissions from this sector.

From 2019 to 2020 GHG emissions decreased slightly by 0.3%, mainly due to lower emissions from *enteric fermentation* as a result of falling numbers of cattle (other cattle). However, the impact of these declining emissions on the sector total was largely offset by rising emissions from *agricultural soils* because of larger emissions from mineral fertilizer application and crop residues as a result of increased plant production values.

The **overall trend** in GHG emissions from *Agriculture* shows a decrease of 14% from 1990 to 2020. The **main drivers** for this trend are decreasing livestock numbers and lower amounts of N-fertilizers applied on agricultural soils.

2.4 Land Use, Land Use Change and Forestry (LULUCF)

In 2020, net removals from sector *LULUCF* amounted to −1 187 kt CO_2 equivalent, which correspond to 1.6% of national total GHG emissions (without LULUCF) in 2020 compared to 15% in the base year.

With regard to the **overall trend**, the net removals from *LULUCF* have decreased by 90% over the observed period. The **main driver** for this trend is the biomass carbon stock change in *Forest land*. Fluctuations are due to weather conditions which influence growth rates (e.g. very low increment in 2003) and natural disturbances (windthrow and bark beetle), as well as timber demand and prices (e.g. very high harvest rates in 2007 and 2008).

The **most important sub-category** is *Forest land (4.A)* with net removals of −2 420 kt CO_2 equivalent in 2020 (including indirect emissions). *Harvested Wood Products (4.G)* is the second largest sink category and contributed –106 kt CO_2 equivalent in 2020. The net sink of both categories has decreased in the last years, with the HWP sink declining significantly from 2019 to 2020. Together, CH_4 and N_2O emissions amounted to 173 kt CO_2 equivalent (including indirect emissions). Total net emissions arising from the other non-forest sub-sectors (excluding HWPs) amounted to 1 340 kt CO_2 equivalent in 2020 (including indirect emissions).

Regarding **LULUCF activities pursuant to Decision No 529/2013/EU**, Austria decided to account only for greenhouse gas emissions and removals from af-/reforestation, deforestation and forest management.

The GHG removals from forest management decreased significantly from 2019 to 2020 and amounted to −367 kt CO_2 equivalent in 2020 (including HWPs). However, net removals from *Forest management* across the entire second KP-period (2013-2020) are above the Forest Management Reference Level (FMRL) including technical corrections. Afforestation/reforestation (incl. HWPs) contribute to GHG removals as well (−2 218 kt CO_2 equivalents), whereas emissions from deforestation amounted to 486 kt CO_2 equivalent in 2020 (both including indirect emissions).

2.5 Waste

In 2020, greenhouse gas emissions from the sector *Waste* amounted to 1 209 kt CO_2 equivalent, which correspond to 1.6% of total national emissions.

The most important sub-category of *Waste* is *solid waste disposal*, which caused 69% of the emissions from this sector in 2020, followed by *waste water treatment and discharge* (16%) and *biological treatment of solid waste* (15%). The most important greenhouse gas is CH_4 with a share of 77.5% in emissions, mainly arising from *solid waste disposal*, followed by N_2O with 22.4% and CO_2 with 0.2%.

From 2019 to 2020 GHG emissions continued to decrease (−4.0%) mainly due to the decreasing carbon content of waste deposited in preceding years.

The **overall trend** in GHG emissions from *Waste* is decreasing, with a decrease of 69% from 1990 to 2020. The **main driver** for this trend is the implementation of waste management policies: Waste separation, reuse and recycling activities have increased since 1990 and the amount of disposed waste has decreased correspondingly especially since 2004 when pre-treatment of waste became obligatory (although some exceptions were granted to some Austrian provinces). The legal basis for the reduced disposal of waste as well as the landfill gas recovery is the Landfill Ordinance. Since 2009 all waste with high organic content has to be pre-treated before deposition (without exceptions). Furthermore, methane recovery from landfills was implemented in the 1990s.

3 RECALCULATIONS

This chapter describes the changes in the emissions estimates made since the last submission to the UNFCCC and supplements the tabular format on recalculations as set out in Annex III to the Commission Implementing Regulation (EU) No 749/2014 ('MMR-IRArticle8_Recalculations_AT_2022-01-15').

3.1 Background

The Austrian greenhouse gas inventory is subject to continuous improvement. An inventory improvement programme is a formal part of the Quality Management System (QMS) of the National Inventory System (see chapter 4).This programme enhances transparency and enables monitoring of findings by the ESD (EC) and the UNFCCC review experts (or other sources) on quality of activity data, emission factors, methods and other relevant technical elements of the national inventory. Any findings and discrepancies are documented; responsibilities, resources and a time schedule for implementation of measures and improvements (incl. recalculations) are included for each of them in the improvement plan (specified for each sector).

3.2 Implications (level, trend)

As can be seen in Figure 3, Austria's GHG emissions reported this year in sum differ only slightly from the data submitted last year. The national total (excl. LULUCF) for the base year is 0.003% (+2.4 kt CO_2e) higher than reported last year; the national total (excl. LULUCF) for 2019 is 0.13% (−102 kt CO_2e) lower than the value submitted last year.

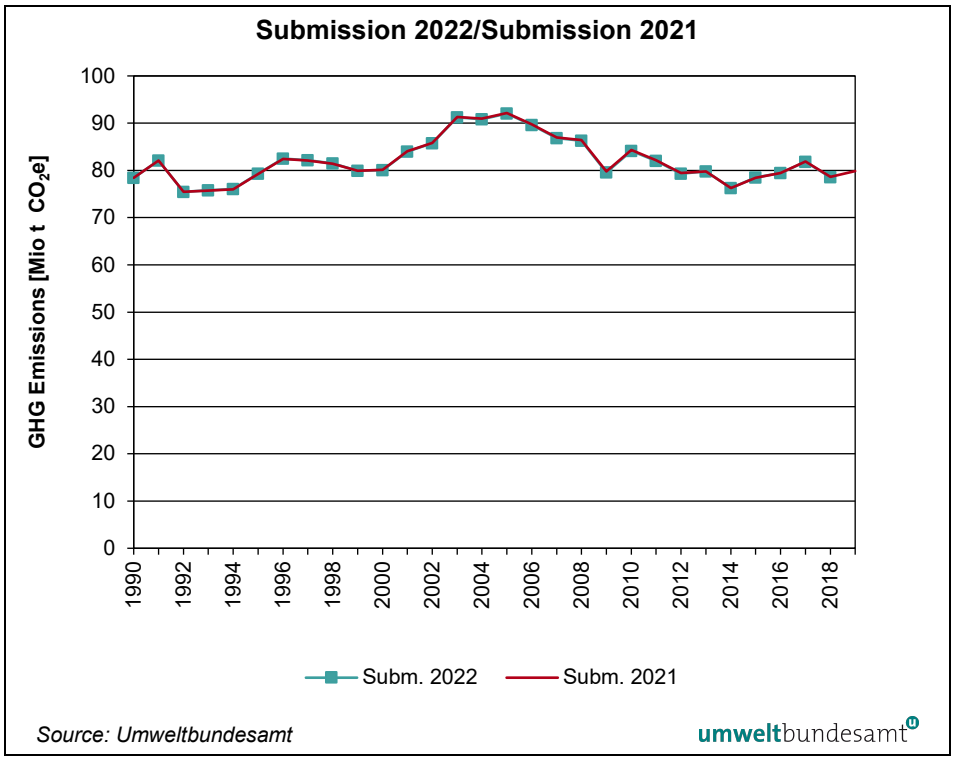


Figure 3: Comparison of 1990-2019 emissions submitted in 2021 and 2022 (Recalculations).

National total emissions **1990** (without LULUCF) have hardly changed since last years' submission (+0.003 %; +2.4 kt CO_2e). However, it is worth noting that the upward and downward revisions of subcategory emissions within the sector *3 Agriculture*, largely offset one another.

Revised total emissions for **2019** (without LULUCF) are 0.13% lower (−102 kt CO_2e) than total emissions submitted for 2019 in the previous year, mainly due to revised estimates for Sector *3 Agriculture*, in particular category *3.A Enteric Fermentation* due to methodological improvements, and *1.A.1 Energy Industries*, where revisions in the energy balance on data for energy consumption have had an effect. Furthermore, upward revisions were reported for categories *1.A.2.g.8 Other Manufacturing Industries* as well as *3.B Manure Management* and *2.F.1 Refrigeration and Air Conditioning* due to methodological improvements.

Estimates for *LULUCF* were revised for the entire time series (1990: +132 kt CO_2e; 2019: +2 105 kt CO_2e) as new forest inventory results (2016/18 interim results of the 2016/21 forest inventory) were incorporated. Furthermore new methods to estimate land use changes between *Cropland* and *Grassland* categories were implemented.

Table 6: Recalculation difference of Austria's GHG emissions compared to the previous submission.

	National Total GHG emissions without LULUCF			
	Submission 2022	Submission 2021	Recalculation Difference	
	[kt CO_2e]	[kt CO_2e]	[kt CO_2e]	[%]
1990	78 423	78 420	2.4	0.003%
1991	82 095	82 082	13	0.02%
1992	75 464	75 469	-5.5	-0.01%
1993	75 806	75 709	97	0.13%

	National Total GHG emissions without LULUCF			
	Submission 2022	Submission 2021	Recalculation Difference	
	[kt CO_2e]	[kt CO_2e]	[kt CO_2e]	[%]
1994	76 039	75 958	81	0.11%
1995	79 283	79 238	45	0.06%
1996	82 482	82 453	30	0.04%
1997	82 134	82 116	17	0.02%
1998	81 452	81 433	19	0.02%
1999	79 922	79 898	23	0.03%
2000	80 084	80 129	-45	-0.06%
2001	83 989	84 065	-76	-0.09%
2002	85 747	85 815	-69	-0.08%
2003	91 209	91 307	-98	-0.11%
2004	90 855	90 985	-130	-0.14%
2005	92 029	92 147	-119	-0.13%
2006	89 606	89 729	-122	-0.14%
2007	86 841	86 984	-143	-0.16%
2008	86 259	86 440	-182	-0.21%
2009	79 584	79 779	-195	-0.24%
2010	84 150	84 337	-187	-0.22%
2011	82 007	82 127	-120	-0.15%
2012	79 310	79 432	-123	-0.15%
2013	79 772	79 817	-45	-0.06%
2014	76 235	76 239	-3.8	0.00%
2015	78 487	78 462	24	0.03%
2016	79 468	79 471	-3.1	0.00%
2017	81 792	81 862	-71	-0.09%
2018	78 558	78 628	-70	-0.09%
2019	79 740	79 842	-102	-0.13%

Table 7: Recalculations per sector

	Submission 2022		Submission 2021		Recalculation Difference	
THG	**1990**	**2019**	**1990**	**2019**	**1990**	**2019**
	[Mt CO_2e]		[Mt CO_2e]		[Mt CO_2e]	
Total*	**78.42**	**79.74**	**78.42**	**79.84**	**0.00**	**-0.10**
Energy	52.80	54.98	52.80	55.05	0.00	-0.07
IPPU	13.57	16.52	13.57	16.38	0.00	0.14
Agriculture	8.12	6.98	8.12	7.15	0.00	-0.17
LULUCF	-12.06	-2.53	-12.20	-4.64	0.13	2.11
Waste	3.93	1.26	3.93	1.26	0.00	0.00

** without emissions from LULUCF*

The following table presents the recalculation difference with respect to last years' submission for each gas (positive values indicate that this years' estimate is higher). Emissions of CO_2, and CH_4 in 2019 were revised downwards, whereas emissions of N_2O and fluorinated compounds were revised upwards.

Recalculations of CH_4 are almost entirely attributable to improved estimates in sector *3 Agriculture*, category *3.A. Enteric Fermentation*, where results of a new research project on feeding and nutrition (MiNutE[17] study, HÖRTENHUBER et. al. 2021) were incorporated in the Austrian agricultural model. Furthermore, selected methods from the IPCC 2019 Refinement have been applied for cattle and swine.

Recalculations of N_2O are largely attributable to the source category *3.B Manure Management* due to an update of activity data and other parameters (e.g. N excretion) based on the MiNutE research project and the application of the IPCC 2019 Refinement mentioned above.

Emissions reported under *2.F.1 Refrigeration and Air Conditioning* (F gases), in particular commercial and industrial refrigeration, were revised in the course of the implementation of improvements in the Austrian refrigerant model.

Table 8: Recalculations per gas

	1990 (Base year)	**2019**
	Recalculation Difference [%]	
Total	**0.003%**	**-0.13%**
CO_2	0.01%	-0,04%
CH_4	-2,72%	-4,52%
N_2O	6,64%	3,01%
HFC, PFC, SF_6, NF_3	0.00%	4,50%

without emissions from LULUCF

[17] „Minderungspotenziale zu Treibhausgas- und Luftschadstoff- Emissionen aus der Nutztierhaltung unter besonderer Berücksichtigung ernährungsbezogener Faktoren“

3.3 Sectoral recalculations

The following section provides explanations for sectoral recalculations. Further background information and a complete description of the recalculation for the period 1990–2019 will be presented in Austria's National Inventory Report 2022.

3.3.1 Energy

3.3.1.1 Stationary sources

Update/Improvement of activity data

Revision of the energy balance

The federal statistics office "Statistik Austria" revised the energy balance (mainly for years 2018 and 2019) with the following **main implications** for energy consumption as used in the inventory and the corresponding CO_2 emissions:

- Natural gas 2019: about 2 PJ (108 kt CO_2) have been shifted from power plant transformation input to final energy consumption (1.5 PJ or 80 kt CO_2 to *Manufacturing Industries (1.A.2)* and 0.5 PJ or 28 kt CO_2 to C*ommercial/Institutional (1.A.4.a).*
- Natural gas 2017: about 0.5 PJ final energy consumption (31 kt CO_2) have been shifted from *Pulp/Paper Industries (1.A.2.d)* to C*ommercial/Institutional (1.A.4.a).*
- Gasoil 2019: gross inland consumption has been revised by -0.7 PJ (-54 kt CO_2). Final energy consumption of *Manufacturing Industries (1.A.2)* has been reduced by 1.2 PJ (-93 kt CO_2) and final energy consumption of C*ommercial/Institutional (1.A.4.a)* has been increased by 0.5 PJ (+38 kt CO_2).
- Gasoil 2018: about 0.6 PJ (45 kt CO_2) final energy consumption have been shifted from C*ommercial/Institutional (1.A.4.a)* to *Manufacturing Industries (1.A.2)*.
- Fuel oil 2019: about 1.8 PJ (136 kt CO_2) have been shifted from the energy sector's own use (*1.A.1.b Petroleum Refinery*) to final energy consumption of *Manufacturing Industries (1.A.2)*
- Motor Diesel 2019: gross inland consumption has been revised by -2.8 PJ (-207 kt CO_2)
- Motor Diesel 1990-2019: For reasons of consistency within the GHG inventory, between 0.1 and 0.7 PJ have been shifted from *Road Transport* (*1.A.3.b*) to *Inland Navigation (1.A.3.d)*.
- Industrial Waste 2019: Final energy consumption has been reduced by about 1.9 PJ (-0.7 PJ from *non-metal mineral industries* (*1.A.2.f*) and 1.2 PJ from *chemical industries (1.A.2.c*) and replaced with solid biomass. While CO_2-emissions from non-metal mineral industries have remained unchanged, CO_2 emissions from chemical industries was reduced by 92 kt CO_2.
- Solid fuels 2019: gross inland consumption has been revised by about +3.3 PJ which does not have large implications on CO_2 emission calculations, because the affected energy balance categories are mainly iron and steel industries (blast furnace use, final energy consumption, non-energy consumption of energy sector).

- Solid biomass 2019: Final energy consumption of *Manufacturing Industries (1.A.2)* has been revised by +2.4 PJ, of which about +1.2 PJ for *non-metal mineral industries (1.A.2.f)* and +1 PJ for *wood processing industries (1.A.2.gviii)*.

Methodological changes

- For 1990 to 2019, natural gas (CNG) consumption of new category *1.A.3.eii Airport Ground activities* has been subtracted from *Manufacturing Industries* (1.A.2.g.viii).
- For 2019, about 42 kt of CO_2 from solid fuels have been shifted from *1.A.2.a Iron and Steel* (combustion emissions) to *2.C.1 Iron and Steel Production* (process emissions).
- For 1990 to 2019, minor changes in greenhouse gas emissions of categories *Commercial/Institutional (1.A.4.a)* and *Residential (1.A.4.a)* occur because of updated heating stock data and newly allocated shares of combustion technologies per energy carrier (updated energy demand model for space heating).

3.3.1.2 Mobile sources

Update of activity data

1.A.3.e.II Other (Airport ground activities)

Based on a recommendation made by the UNFCCC in the course of the 2020 Review, fuel consumption data of mobile sources used for aircraft handling at Austrian airports was collected from Vienna's International Airport. Based on this information emissions for aircraft handling on all Austrian airports were estimated and reported separately under *1.A.3.e.II Other* for the first time. Emissions from this source were previously part of *1.A.3.b Road Transportation*.

However, the quantities refuelled at airports represent only a very small proportion of total national fuel sales (0.01% petrol; 0.03% diesel; 0.3% natural gas). Freight and car traffic to and from the airport is not part of the so-called "airport ground activities". With the help of a constant average fuel consumption factor ($FC_{\text{airport ground activity}}$ / flight movement) emissions for the whole time series have been calculated (14.6 kt CO_2e in 2019).

1.A.3.b Road transport

As a result of the above-mentioned separate reporting of emissions from aircraft handling, the entire time series of total annual fuel sales that flow into general road traffic emission modelling had to be updated resulting in minor annual revisions. It is merely a shift in emissions from *1.A.3.b road traffic* to *1.A.3.e.II* though (-14.4 kt CO_2e in 2019).

The stock of motorcycles has been updated from 2017 onwards. With this update a bug in the NEMO model data set was corrected and the fleet was correctly adapted to the methodology according to HBEFA version 4.1. The allocation of the size categories (<> 250 ccm) from 2017 is identical to HBEFA 4.1.

In the year 2021, plug-in hybrid electric vehicles (PHEVs) in light duty trucks were reported in the official inventory statistics for the first time with 9 pieces. Based on earlier forecast assumptions very small amounts of PHEVs in light

duty trucks were already planned for this vehicle category. These were set to zero before 2021 in accordance with Statistik Austria.

Due to the relatively strong reductions in activity data in 2020 according to traffic counting points, it was necessary to calibrate the mileage of heavy duty trucks in 2019 (towards somewhat lower total urban and rural mileage shares). This made it possible to better map the relatively constant level of activity on motorways. Recalculations due to vehicle stock and mileage only result in marginal changes in emissions (+0.1 kt CO_2e in 2019).

Update of methodology

CRF 1.A.5 Other (Mobile - Military)

In response to a recommendation made by the UNFCCC 2020 on Austria's methodology for estimating emissions from military aviation 2000–2018, data on kerosene consumption was re-evaluated. Based on a flight study (provided once by the Ministry of Defense, covering data for 1990-1998), the historical number of aircrafts (fighter jets, airplanes, helicopters, latest available data for 2008) was compared with current data on the number of operating military aircraft, assuming constant flight hours. The subsequent revision of activity data refers to the years 2009-2019 only; for the years 1999-2008 the previously applied method (linear extrapolation) has been retained, while for the years 1990-1998 the results of the flight study have been used directly as in previous submissions. The change in methodology results in recalculations for 2009–2019 (-17.7 kt CO_2e in 2019).

3.3.1.3 Fugitive Emissions

Activity data in *1.B.2.a.3 Transport of oil* had to be converted from unit tonnes to unit cubic metres, resulting in revised CH_4 and CO_2 emissions over the whole time series (e.g. 2019: +0.24 kt CO_2e). Moreover small recalculations were reported for category *1.B.2.b* (e.g. 2019: -0.01 kt CO_2e) as some transcription and rounding errors were identified and corrected.

3.3.2 Industrial Processes and Other Product Use

Update of activity or emissions data

2.B.1 Ammonia Production / 2.D.3 Other: Urea used as a catalyst

Updated urea amounts used in road traffic (see below, *2.D.3*) for the years 2005–2019, led to a redistribution of minor amounts between these two categories.

2.B.1 Ammonia Production / 2.B.10 Other chemical bulk production - fertilizer

Input data for fertilizer production was corrected for the year 2019. Due to the methodological approach this also affects emissions from ammonia production. For ammonia production, CO_2 emissions were revised by +8.85 kt CO_2e in 2019.

2.C.1.a Steel

Updated activity data from the energy balance led to a redistribution of emissions between this category and *1.A.2.a Iron and Steel*. For *2.C.1.a Steel* emissions were revised by +42.09 kt CO_2e in 2019.

2.F.1.d Transport Refrigeration

The estimation of stock was revised by correcting a transcription error, which led to recalculations from 2013 onwards (-4.37 kt CO_2e in 2019).

2.F.1.e MAC

A minor correction of stocks for trains led to recalculations from 2005 onwards (–0.11 kt CO_2e in 2019).

2.F.1.f Stationary Air Condition

Updated statistical data for heat pumps placed on the market in 2019 became available, which led to a minor recalculation (–0.00002 kt CO_2e in 2019).

2.F.4 Aerosols

A minor correction of a transcription error led to -0.28 kt CO_2e in 2019.

Improvements of methodologies and emission factors

2.C.1.b Pig Iron

Following an issue raised in the UNFCCC review 2020, methane emissions from sinter production are now estimated using plant specific data (+1.92 kt CO_2e in 2019).

2.F.1.a. Commercial Refrigeration

An inquiry on HFC use in supermarkets was conducted to update this part of the sub-category "commercial refrigeration" in the Austrian refrigerant models. Consumption, life time and leakage rates for supermarkets were updated for 2010 onwards, when the last update was made. As equipment life time was increased, the overall stock of refrigerants in equipment increased, resulting in higher emissions. It has to be noted that the parameters used for the residual commercial sector (commercial refrigeration other than supermarkets) are outdated, and are planned to be revised as soon as more data on installation level becomes available.

Additionally, the following improvements of the Austrian refrigerant model were implemented:

- The model design for commercial and industrial refrigeration was improved to better account for the low GWP blends that have been introduced to the market from 2014 onwards.
- Early replacement (i.e. before end-of-life replacement) of high GWP blends with low GWP refrigerants, due to retrofitting because of legal restrictions, are now being considered in the model from 2014 onwards.

- R 23, which is used for specific applications only (very low temperature applications) was taken out of the high-GWP blend mix, and is now considered separately.

All improvements led to a revision of emission data over the whole time series (+57.82 kt CO_2e in 2019)

2.F.1 c. Industrial Refrigeration

The improvements explained above also indirectly affected emissions from this sub category for the years from 1994 onwards (+47.72 kt CO_2e in 2019).

3.3.3 Agriculture

Update of activity data

3.B Manure Management, 3.D Agricultural Soils

Livestock data – poultry and deer

New livestock data for poultry (layers, broilers, turkeys and other poultry) as well as for deer became available for the year 2020, based on the preliminary results of the farm structure survey 2020 (STATISTIK AUSTRIA 2021[18]). For 2016, activity data of the farm structure survey 2016 was used (STATISTIK AUSTRIA 2018[19]). Values for the years 2017, 2018 and 2019 have been derived by interpolation.

Country-specific study on feeding and nutrition ("MiNutE" study)

The feeding of cattle and swine has changed substantially in the last two decades. Therefore, a new research project on country-specific animal feeding and nutrition (MiNutE[20] study, HÖRTENHUBER et. al. 2021) has been carried out. As a result, updated and representative values for nitrogen and energy intake, excretion of nitrogen (N_{ex}) and volatile solids (VS_{ex}) have been included into the inventory.

Livestock data – cattle

In previous calculations, the animal categories "cattle <1 year", "cattle 1-2 years, breeding animals", "cattle 1-2 years, fattening animals", "dairy cows", "suckling cows" and "Other Cattle > 2 years" were used in the Austrian inventory. For the present update, most of the mentioned cattle categories were further divided into several sub-categories to allow for an application of refined

[18] Statistik Austria (2021): Preliminary results of the farm structure survey 2020 http://www.statistik.at/wcm/idc/idcplg?IdcService=GET_NATIVE_FILE&RevisionSelectionMethod=LatestReleased&dDocName=113161

[19] STATISTIK AUSTRIA (2018): Agrarstrukturerhebung: Stichprobenerhebung 2016. Schnellbericht 1.17, Wien.

[20] „Minderungspotenziale zu Treibhausgas- und Luftschadstoff- Emissionen aus der Nutztierhaltung unter besonderer Berücksichtigung ernährungsbezogener Faktoren"

IPCC 2019-coefficients and to better differentiate the duration of feeding milk. A detailed description will be included in Austria´s NIR 2022.

Livestock data –swine

For emission calculation the swine number has been grouped into three categories: “breeding sows (including suckling piglets up to 8 kg live weight) and boars”, “piglets 8 to 32 kg live weight” and “fattening pigs”. The calculation methodology for *3.A Enteric Fermentation/Swine* is now a Tier 2 method. Emissions from piglets 0-8 kg are now considered in the calculations of breeding sows. Detailed information regarding the allocation of animal numbers will be added to Austria´s NIR 2022.

Raw material balance

For the year 2019 new information on input materials for Austria’s biogas plants became available (E-CONTROL 2021[21]). Furthermore, nitrogen amounts of specific plant-based substrates have been updated. In the context of “MiNutE”-study results, fermented manure quantities (VS-excretion and N-excretions) were recalculated. Inventory improvements resulted in revised CH_4 and N_2O emissions for the entire time series with an impact on source categories *3.B Manure Management*, *3.D.a.2.a Animal manure applied to soils* and *3.D.a.2.c Other organic fertilizers applied to soils*.

3.D.a.5 Mineral Soils

Revisions of activity data (perennial cropland to annual cropland, for more information see chapter 3.3.4 on LULUCF) resulted in marginally revised emissions (-0.000003 kt N_2O for 2019).

3.F Field burning

Land use data

Revisions of activity data (vineyards, for more information see chapter 3.3.4 on LULUCF) resulted in marginal recalculations of CH_4 and N_2O emissions for several years (-0.0003 kt CH_4 and -0.000003 kt N_2O).

Improvements of methodologies and emission factors

3.A Enteric Fermentation (CH_4)

Significant revisions have been carried out for this category. Emissions of cattle and swine were calculated on the basis of the refined methodologies outlined in the IPCC 2019 Refinement to the 2006 IPCC GL allowing a dynamic use of national parameters. Improved feeding and nutrition values were implemented (see above).

[21] E-CONTROL (2021): https://www.e-control.at/documents/1785851/1811582/E-Control_Oekostrombericht_2021_Final.pdf/d04142ba-cd89-5422-2972-fe721f90cd2a?t=1635952429306 accessed in November 2021

The strongest impact was the more accurate calculation of cattle < 1 year, resulting in consistently lower absolute values of other cattle. For dairy cattle the updated method shows higher absolute emission values in 1990 and lower absolute values from 2004 onwards compared to the previous inventory. This is due to the increasing efficiency of the cows and the resulting decrease in the methane conversion factor.

For the calculation of poultry emissions no default methodology is available. Like in previous inventories the Swiss methodology has been applied. However, the calculation was slightly modified: enteric CH_4 emissions were calculated from the net energy intake instead of the gross energy intake.

The improvements resulted in lower emissions for the whole time series (-11.95 kt CH_4 for 2019).

3.B Manure Management (CH_4, direct and indirect N_2O)

Reasons for revised estimates in category *3.B Manure Management* for cattle and swine are the improved calculations of energy intake, VS-excretion and N-excretion (see above).

Methane emissions have been revised upwards for the whole time series (+0.77 kt CH_4 for 2019), largely affected by a higher VS excretion for other cattle in total.

The annual nitrogen excretion of cattle shows consistently higher absolute values over the complete time series. Also for swine the new study results indicate increased N-excretion amounts. Overall, direct and indirect N_2O emissions from manure management have been increased compared to the previous inventory (+0.31 kt N_2O for 2019).

3.D Agricultural Soils (N_2O)

3.D.1.2.a Animal Manure Applied to Soils

Revisions have been carried out for the entire time series as a result of the updated livestock data, revised feeding and excretion values for specific animal categories as well as the improved biogas calculation (+0.11 kt N_2O for 2019).

3.D.1.3 Urine and dung deposited by Grazing Animals

Livestock related updates as already described above, resulted in higher emissions for the whole time series (+0.02 kt N_2O for 2019).

3.D.b Agricultural Soils (indirect soil emissions – N_2O)

Atmospheric deposition: reasons for revised emissions are updated activity data (see above: livestock data, revised N-excretion amounts, improved data on biogas slurry) and the consideration of NO_x emissions from *3.D.a.3 Urine and dung deposited by Grazing Animals* which were estimated in Austria's air emission inventory for the first time (previously reported as IE). As a consequence, indirect N_2O emissions from atmospheric deposition were revised upwards for the whole time series (+0.01 kt N_2O for 2019).

N leaching and run-off: updated AD (see above) are the reason for revised emissions (+0.003 kt N_2O for 2019).

3.H Urea Application (CO_2)

The consideration of stabilised urea amounts (additionally to the non-stabilised urea amounts which were previously used as AD) resulted in higher CO_2 emissions for the whole time series (+7.5 kt CO_2 for 2019).

3.3.4 Land Use, Land Use Change and Forestry (LULUCF)

Update of Activity Data

4.A Forest land

The intermediate increment, drain and dead wood results of the NFI 2016/21 for the measurement period 2016 to 2018 were taken to update the time series for the Forest land category for the years since 2009. This caused a reduction on the annual net removals of the Forest land category by 1 868.7 kt CO_2e per year for the time series since 2009 compared to the last submission in 2021.

4.B Cropland

The land-use changes between grassland and cropland were assessed by a changed method based on IACS/LPIS data. The land parcel numbers are no more available in the IACS/LPIS system, so the assessment for the whole time series was changed to a grid point survey by using the INSPIRE grid of 100 x 100 m to sample geographic land use information in IACS/LPIS. In addition, the vineyards area trend was harmonized by using just the results of the vineyard surveys. These area changes had an impact on the emissions/removals of these categories. For Cropland the annual emissions/removals are in the range of 115.7 to 212.0 kt CO_2e per year different compared to the last submission in 2021.

4.C Grassland

The land-use changes between grassland and cropland were assessed by a changed method based on IACS/LPIS data. The land parcel numbers are no more available in the IACS/LPIS system, so the assessment for the whole time series was changed to a grid point survey by using the INSPIRE grid of 100 x 100 m to sample geographic land use information in IACS/LPIS. These area changes had an impact on the emissions/removals of these categories. For Grassland the annual emissions/removals are in the range of -8.2 to 20.3 kt CO_2e per year different compared to the last submission in 2021.

4.E Settlements

The land-use changes between grassland and cropland were assessed by a changed method based on IACS/LPIS data (see above at the Cropland and Grassland categories). For area consistency in the LUC matrices, these LUC area changes also had an impact on the LUC areas from Cropland and Grassland to Settlements. For Settlements the annual emissions/removals are in the

range of -132.0 to 2.3 kt CO_2e per year different compared to the last submission in 2021.

4.F Other land

The land-use changes between grassland and cropland were assessed by a changed method based on IACS/LPIS data (see above at the Cropland and Grassland categories). For area consistency in the LUC matrices, these LUC area changes also had an impact on the LUC areas from Grassland to Other land. These area changes had an impact on the emissions/removals of the Other land category. For Other land the annual emissions/removals are in the range of -101.8 to 20.3 kt CO_2e per year different for the time series since 2006 compared to the last submission in 2021.

4.G HWPs

The HWP production figures for the year 2019 were updated in the most recent FAO statistics. Consequently, the removal figures for these years had to be updated accordingly.

The recalculations in the HWP category led to changes in the annual removals of this subcategory of 117.9 CO_2e for 2019.

LULUCF KP estimates

The intermediate increment, drain and dead wood results of the NFI 2016/21 for the measurement period 2016 to 2018 were taken to update the time series for the Forest management and Afforestation category. In addition, the HWP production figures for the year 2019 were updated in the most recent FAO statistics. Consequently, the HWP removal figures for Forest management and Afforestation for the year 2019 had to be updated accordingly.

This caused a reduction on the annual net removals of the Forest management category in the range of 1 867.9 and 1 982.8 kt CO_2e per year and a reduction on the annual net removals of the Afforestation category in the range of 0.14 and 2.43 kt CO_2e per year for the 2013-2019 time series compared to the last submission in 2021.

3.3.5 Waste

Update of activity data

5.A Solid Waste Disposal

Minor revisions are reported for category *5.A Solid Waste Disposal* for the years 2016-2019 (e.g. 2019: +0.005 kt CO_2e) due to slightly revised activity data.

5.B Biological Treatment of Solid Waste

Revisions are reported for category *5.B.1 Composting* for the year 2019 (+0.37 kt CO_2e) as a transmission error (composted waste) had to be corrected.

5.D Wastewater Treatment and Discharge

For *5.D.1 domestic wastewater* recalculations were carried out for 2019 (–0.13 kt CO_2e) as new data on the connection rate for 2020 became available and affected 2019 due to the interpolation between 2018 and 2020.

4 NATIONAL INVENTORY SYSTEM

The regulations under the UNFCCC and the Kyoto Protocol define the standards for national emission inventories related to transparency, consistency, comparability, completeness and accuracy (TACCC). Above this, each Party shall have in place a national system[22] including all institutional, legal and procedural arrangements made within a Party for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and for reporting and archiving inventory information.

To meet these requirements Austria has set up the National Inventory System Austria (NISA) covering all aspects from establishing a legal basis for inventory preparation along with defining responsibilities, over availability of data, quality control and quality assurance (QA/QC) to continuous improvement of the inventory.

In Austria, emissions of greenhouse gases are estimated together with emissions of air pollutants in a database based on the CORINAIR (CORe INventory AIR)/SNAP (Selected Nomenclature for sources of Air Pollution) system. This nomenclature is designed to estimate not only emissions of greenhouse gases but all kinds of air pollutants. To comply with the reporting obligations under the UNFCCC, emissions data are transferred according to the IPCC Guidelines into the UNFCCC Common Reporting Format (CRF).

This section provides a short description of the most important aspects of NISA; a detailed description including all required information as set down in Decision 15/CMP.1, part II ("Reporting of supplementary information under Article 7, paragraph 2", D. National systems in accordance with Article 5, paragraph 1) can be found in the Austrian Initial Report[23], in Austria's NIR 2021[24] and in the NISA Implementation Report[25].

Austria has a centralized inventory system, with all the work related to inventory preparation being carried out at a single national entity. The most important legal arrangement is the Austrian Environmental Control Act (Umweltkontrollgesetz, UKG[26]), which defines the Umweltbundesamt (Environment Agency Austria) as the single national entity with the overall responsibility for inventory preparation. To comply with the stringent reporting requirements, the Umweltbundesamt established the 'Inspection Body for Emission Inventories' which is entrusted with the preparation of emission inventories as assigned to the Umweltbundesamt under the UKG.

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[22] 19/CMP.1 Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol; FCCC/KP/CMP/2005/8/Add.3. http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf

[23] BMLFUW (2006): Austria's Initial Report under Article 7, paragraph 4, of the Kyoto Protocol, Federal Ministry of Agriculture and Forestry, Environment and Water Management, Vienna.

[24] UMWELTBUNDESAMT (2021): Austria's National Inventory Report 2021, Submission under the United Nations Framework Convention on Climate Change and under the Kyoto Protocol. Report REP-0761. Umweltbundesamt, Vienna.

[25] UMWELTBUNDESAMT (2005): NISA National Inventory System Austria, Implementation Report, REP-0004; Umweltbundesamt, Vienna https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0004.pdf

[26] „Umweltkontrollgesetz" – Bundesgesetz über die Umweltkontrolle und die Einrichtung einer Umweltbundesamt Gesellschaft mit beschränkter Haftung; Federal Law Gazette I 152/1998 (as amended by Federal Law Gazette I No. 40/2014)

Inspection Body for Emission Inventories
ID No. 0241

Umweltbundesamt GmbH, Environment Agency Austria
DI Michael Anderl (Head of Inspection Body), Mag. Katja Pazdernik (Deputy)
Spittelauer Lände 5
1090 Wien, Austria

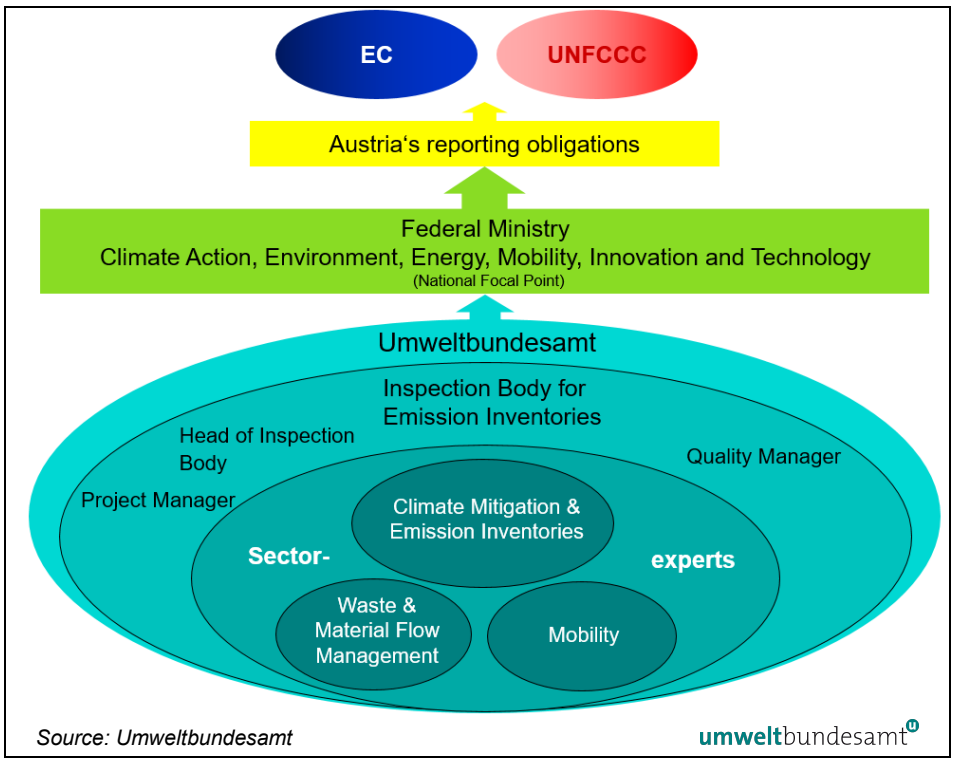

Figure 4: Responsibilities within the Austrian National Inventory System Austria.

The personnel of the Inspection Body for Emission Inventories (IBE) is made up of staff from various organisational units of the Umweltbundesamt, who in the course of their inspection activity for the IBE are assigned to the IBE and are therefore under the head of the inspection body. The head of the inspection body has the overall responsibility for the maintenance and continual improvement of the QMS.

The national energy balance is the most important data basis for the Austrian Air Emissions Inventory. The Austrian statistical office (Statistik Austria) is required by contract with the competent ministries to annually prepare the national energy balance. The compilation of several other relevant statistics is regulated by law; other data sources include reporting obligations under national and European regulations and reports of companies and associations.

4.1 Legal and institutional arrangements

The Umweltbundesamt is designated as the Single National Entity responsible for inventory preparation including QA/QC.

LEGAL ARRANGEMENT: ENVIRONMENTAL CONTROL ACT[27]

- § 5 (regulates responsibilities of the Umweltbundesamt)
  Regulates responsibilities regarding environmental control in Austria and is also the basis for the outsourcing of the 'Umweltbundesamt GmbH'
- § 6 (regulates tasks of the Umweltbundesamt)
  (2)15 …the *Umweltbundesamt* is obliged to prepare "technical expertise for *compliance* with UNECE/LRTAP convention […] and with the UNFCCC and the Kyoto Protocol, including the preparation of emission inventories, evaluation of the impact of measures, and assistance in preparation of reports regarding climate".
- § 11 (regulates financing of the Umweltbundesamt)
  …ensures financial resources for preparation of tasks as referred to in para 6.
- § 7 (regulates issues related to data security)
  …in processing the legally assigned tasks, the Umweltbundesamt is seen as a public authority and can therefore process (confidential) personal data and can exchange these data with other public authorities.

To ensure the availability of data necessary for the annual compilation of the GHG inventory, further legal and institutional arrangements have been made.

Due to the above mentioned ENVIRONMENTAL CONTROL ACT the following **INSTITUTIONAL ARRANGEMENTS** with data providers were agreed:

1. **Statistik Austria**
   - Statistical yearbook (public)
   - National Energy balance (comprehensive/detailed Energy balance and IEA/Eurostat questionnaire)
     - **Long-term Contract** with the competent ministries
   - Production/Import/Export statistics for solvents, F-gases
     - **Contract on annual basis** with the Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)
   - Agricultural statistics (public)
   - Transport statistics (public)
     Procedural arrangement:
     - close cooperation Umweltbundesamt – Statistik Austria on definition of data format and specification
   - Data flow is organised through (encrypted) communication (e-mail) or in case of confidential data through personal handover of CD/DVD
   - Harmonisation of data: elimination of discrepancies

[27] „Umweltkontrollgesetz" – Bundesgesetz über die Umweltkontrolle und die Einrichtung einer Umweltbundesamt Gesellschaft mit beschränkter Haftung; Federal Law Gazette I 152/1998 (as amended by Federal Law Gazette I No. 40/2014)

2. Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)

The BMK as representative of the Republic of Austria owns (100%) the Umweltbundesamt, which has the legal status of a limited liability company. As superior authority and in the framework of the ENVIRONMENTAL CONTROL ACT the following institutional agreements regarding access to data of different reporting obligations were agreed:

- Data on emissions and activity data from installations under the EU ETS (Federal law gazette 118/2011 establishing a scheme for greenhouse gas emission allowance trading)
- Activity data of certain F-gases (Austrian Fluorinated Compounds Ordinance 139/2007 regarding prohibitions and restrictions of HFCs, PFCs, SF_6)
- Activity data from landfill sites (Austrian Landfill Ordinance No. 39/2008) – EDM (Electronic Data Management)
- Activity data regarding waste incineration (Austrian Waste Incineration Ordinance No. 35/2013)
- Emissions data collected in the framework of E-PRTR (Austrian Ordinance No. 380/2007 concerning the establishment of the European Pollutant Release and Transfer Register)
- Emissions data (SO_2, NO_x, dust) and activity data from steam boiler installations (Federal law gazette 127/2013 establishing integrated pollution prevention and control)
- Forest fire statistics

  Procedural arrangement: The access to the data is organised for free via the EDM – Electronic Data Management – http://edm.gv.at, which is an information network which allows enterprises and authorities to handle registration and notification obligations in the waste and environment sectors online.
  - EDM is the Federal Ministry's central eGovernment initiative and is operated by the Umweltbundesamt
  - EDM aims at sustainably reducing the administrative burden of enterprises and authorities to efficient, electronic recording and notification systems and to ensure a high level of environmental protection in Austria.

3. Austrian Research Centre for Forests (BFW)

- National Forest inventory
  - **Contract on a regular interval** with the Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)
- Forest soil condition survey (of all federal provinces)
- Forest soil modelling

  Procedural arrangement: close cooperation Umweltbundesamt – BFW on definition of data format and specification

4. Research institutions:

a. TU Graz (Graz University of Technology)

- NEMO – Emission model road (IPCC sector 1.A.3.b): calculation of road emissions

- GEORG – Emission model of non-road mobile machinery (NRMM): calculation of mobile off-road emissions
  - Contract on annual basis with Umweltbundesamt
    Procedural arrangement: close cooperation Umweltbundesamt – TU Graz

b. University of Natural Resources and Life Sciences Vienna (BOKU) / Leibniz Institute for Agricultural Engineering Potsdam-Bornim (ATB)

- Agricultural model: calculation of emissions
  - Contract on a regular interval with Umweltbundesamt
    Procedural arrangement: close cooperation Umweltbundesamt – BOKU

5. Austrian Economic Chambers and Associations of the Austrian Industries as well as Individual plant operators/companies

- Activity data, emission data and relevant parameters; information on the process and abatement technology
  - No formal agreements were made but it is good practice in Austria to have a good cooperation and exchange of knowledge regarding the requirements of GHG and Air pollutants Inventory on a continuing basis

    Procedural arrangement: close cooperation

6. AustroControl

- Flight movements per aircraft type and airports (non-standard analysis)
  - *Procedural arrangement*: no formal agreement, but close cooperation Umweltbundesamt – AustroControl on definition of data format and specification

4.2 Data Sources

The following table presents the main data sources used for activity data (for unpublished studies a detailed description of the methodologies is given in the NIR):

Table 9: Main data sources for activity data.

Sector	Data Sources for Activity Data
Energy	• Energy Balance from Statistik Austria • EU-ETS • Steam boiler database • Small scale combustion market data • Direct information from industry or associations of industry
Transport	• Energy Balance from Statistik Austria • Yearly new vehicle registrations from Statistik Austria • Yearly growth rates of transport performance on Austrian roads from Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) • ZBD: Zentrale Beguchtachtungsdatenbank (periodically updated specific mileage) • Yearly flight movements from AustroControl • Yearly FC of airport ground activities at Vienna International Airport

Sector	Data Sources for Activity Data
IPPU	• National production statistics • Import/export statistics • EU-ETS • Direct information from industry or associations of industry • Short term statistics for trade and services • Austrian foreign trade statistics • Structural business statistics • Surveys at companies and associations
Agriculture	• National studies • National agricultural statistics obtained from Statistik Austria • National fertilizer statistics obtained from Agrarmarkt Austria (AMA) • Distributing company (sales data)
LULUCF	• National forest inventory obtained from the Austrian Research Centre for Forests • National agricultural statistics and land use statistics obtained from Statistik Austria and from the IACS system • Wetland and settlement areas from the Real Estate Database
Waste	• Federal Waste Management Plan (Data sources: Database on landfills (1998–2007), Electronic Data Management (EDM) in environment and waste management) • EMREG-OW (Electronic Emission Register of Surface Water Bodies) • National studies

The main sources for emission factors are:

- National studies for country specific emission factors
- Plant-specific data reported by plant operators
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories[28]
- 2019 Refinement to the 2006 IPCC Guidelines
- EMEP/EEA air pollutant emission inventory guidebooks[29]
- Handbook emission factors for road transport (HBEFA), Version 4.1
- National forest inventory obtained from the Austrian Research Centre for Forests
- Soil inventories by the Federal States and by the Austrian Federal Office and Research Centre for Forests
- Modelling of the forest soil C stock changes Austrian Research Centre for Forests

[28] https://www.ipcc-nggip.iges.or.jp/public/2006gl/

[29] Prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections (TFEIP) and published by the European Environment Agency (EEA). Latest update: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

4.3 QA/QC Plan (QMS of IBE)

A Quality Management System (QMS) has been designed and implemented to fulfil all requirements of *good practice, i.e.* to improve transparency, consistency, comparability, completeness and accuracy as well as confidence in the national inventory. Since December 2005 the inventory team at the Umweltbundesamt has been accredited as an inspection body (ID No. 0241) in accordance with the Austrian Accreditation Law (AkkG)[30] by decree of Accreditation Austria[31]. This standard takes into account standards regarding a QMS as set out in the EN/ISO 9000 series and goes beyond: it also provides a clear statement of requirements regarding competence, as well as independence, impartiality and integrity.

The implementation of QA/QC procedures as required by the IPCC supports the development of national greenhouse gas inventories that can be readily assessed in terms of quality and completeness. The QMS as implemented in the Austrian inventory includes all elements of the QA/QC system outlined in IPCC 2006 GL Volume 1 'QA/QC and Verification', and goes beyond. It comprises supporting and management processes in addition to the QA/QC procedures in inventory compilation and thus ensures agreed standards not only within (i) the inventory compilation process and (ii) supporting processes (e.g. archiving), but also for (iii) management processes (e.g. annual management reviews, internal audits, regular training of personnel, error prevention).

As part of the QMS an efficient process is established to ensure transparency when collecting and analyzing findings by UNFCCC review experts or any other issues concerning the quality of activity data, emission factors, methods and other relevant technical elements of inventories. Any findings and discrepancies are documented; responsibilities, resources and a time schedule are attributed to each of these in the improvement plan. Measures, which include possible recalculations, are taken by the sector experts.

The Austrian Quality Management System is described in detail in Austria's NIR 2021, some aspects and improvements compared to the previous submission are described below (QMS activities and improvements 2021).

The Quality Manual can be downloaded at:
https://www.umweltbundesamt.at/klima/emissionsinventur/emi-akkreditierung

Sector Experts

Within the inventory system specific responsibilities for the different emission source/sink categories ('Sector Experts') are defined. There are 8 sectors defined (Energy, Transport, Fugitive Emissions, Industrial Processes, Product Use, Agriculture, LULUCF and Waste). At least two experts form a sector team with one of them nominated as team leader ('Sector Lead'). Sector experts collect activity data, emission factors and finally estimate emissions. The sector experts are also responsible for the choice of methods, data processing, archiving, for contracting

[30] *„Akkreditierungsgesetz"*; Federal Law Gazette I No. 28/2012 (as amended by Federal Law Gazette I No. 40/2014)

[31] first decree No. BMWA-92.715/0036-I/12/2005, issued by Accreditation Austria / Federal Ministry of Economics and Labour on 19 January 2006, valid from 23 December 2005

studies (if needed), and performing sector-specific Quality Assurance and Quality Control (QA/QC) activities.

In cases which exceed the IBE's capabilities or resources, some of its inventory activities are subcontracted, in some cases routinely (e.g. the emission inventory for road transport), in other cases as required (e.g. revision of methodologies for a complex emission source). However, the final assessment of fulfillment of the requirements is made by the IBE.

Subcontracts have so far been concluded with:

- Technical University Graz (road and off-road transport)
- University of Natural Resources and Applied Life Sciences, Research Center Seibersdorf (Agriculture)
- Öko-Recherche, Büro für Umweltforschung und -beratung GmbH (f gases)
- Institute for Industrial Ecology (Product Use)
- Barbara Amon and Stefan Hörtenhuber (Agriculture)

Data Management

The Austrian Inventory is based on the SNAP nomenclature and has to be transformed into the UNFCCC Common Reporting Format to comply with the reporting obligations under the UNFCCC. In addition to the actual emission data, the background tables of the CRF are filled in by the sector experts, and finally QA/QC procedures as defined in the inventory planning process are carried out before the data are submitted to the European Commission and to the UNFCCC.

As part of the QMS's documentation and archiving procedures, a reliable data management system has been established to fulfil the data collecting and reporting requirements. This ensures the necessary documentation and archiving for future reconstruction of the inventory and consequently enables easy access to up-to-date and previously submitted data for the quantitative evaluation of recalculations.

QMS activities and improvements 2021

In 2021 several improvements concerning the personnel of the inventory team have been made: the number of sector experts of the LULUCF team was raised to four and the Energy team was extended to three experts. Additionally a deputy was nominated for the calculations of KCA and uncertainties. Currently, the IBE team consists of 22 persons and each position is at least double staffed. As the sector teams expanded over the last years the role definitions of the team members have been adapted to strengthen team work within the teams and better include the expertise of all experts.

Five of our experts participated 2021 in the international review process.

Rules and procedures for teleworking specific issues have furthermore been included in the inventory quality manual, and amongst others, the rules and procedures for planning and implementation of QA measures and for QC checks have been improved.

4.4 Changes in the national inventory system

The national inventory system, as described in this chapter (4), is unchanged compared to the description given in the Austrian Initial Report under the Kyoto Protocol[32].

[32] http://unfccc.int/files/national_reports/initial_reports_under_the_kyoto_protocol/application/pdf/at-initial-report-200611-corr.pdf

5 CHANGES IN THE NATIONAL REGISTRY

The following changes to the national registry of Austria have occurred in 2021.

Note that the 2021 SIAR (SIAR/2021/AT/2/1) states that there are no recommendations and there were no recommendations from previous Annual Review report (FCCC/ARR/2020/AUT).

Table 10: Changes to the national registry of Austria in 2021.

Reporting Item	Description
15/CMP.1 annex II.E paragraph 32.(a) Change of name or contact	The name and contact of the registry administrator as an institution has not changed. A change of the alternate registry administrator was notified to the Secretariat in 2021.
15/CMP.1 annex II.E paragraph 32.(b) Change regarding cooperation arrangement	No change of cooperation arrangement occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(c) Change to database structure or the capacity of national registry	There has been 6 new EUCR releases (versions 12.4, 13.0.2, 13.2.1, 13.3.3, 13.5.1 and 13.5.2) after version 11.5 (the production version at the time of the last submission of the NIR (NIR 2021 Chapter 14). No changes were applied to the database, whose model is provided in Annex A. No change was required to the application backup plan or to the disaster recovery plan. No change to the capacity of the national registry occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(d) Change regarding conformance to technical standards	The changes that have been introduced with versions 12.4, 13.0.2, 13.2.1, 13.3.3, 13.5.1 and 13.5.2 compared with version 11.5 of the national registry are presented in Annex B. It is to be noted that each release of the registry is subject to both regression testing and tests related to new functionality. These tests also include thorough testing against the DES and are carried out prior to the relevant major release of the version to Production (see Annex B). No other change in the registry's conformance to the technical standards occurred for the reported period.
15/CMP.1 annex II.E paragraph 32.(e) Change to discrepancies procedures	No change of discrepancies procedures occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(f) Change regarding security	No changes regarding security occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(g) Change to list of publicly available information	No change to the list of publicly available information occurred during the reporting period.

Reporting Item	Description
15/CMP.1 annex II.E paragraph 32.(h) Change of Internet address	No change to the registry internet address occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(i) Change regarding data integrity measures	No change of data integrity measures occurred during the reporting period.
15/CMP.1 annex II.E paragraph 32.(j) Change regarding test results	No change during the reported period.

6 REPORTING UNDER ARTICLE 7 MMR

Information on Article 7(1) a – d of the MMR is provided in the respective CRF Tables and MMR IR reporting template ('MMR-IR_AnnexX_ESD_AT_2022-01-15'). Emission trends 1990–2020 (Article 7(1) e) are described in Chapter 2. Changes to the national system and the national registry are presented in Chapter 0 (Article 7(1) n) and Chapter 5 (Article 7(1) o). Article 7(1) p-information is given in Chapter 4.3 (QA/QC Plan) and the respective MMR IR reporting template ('MMR-IRArticle14_Uncertainty_AT_2022-01-15').

Information on Article 7(1) f – m is given hereinafter:

6.1 Article 7 (1) f

Information on indicators, as set out in Annex III of the MMR, is reported as a separate file ('Annex_II_AT_Indicators_2022-01-15') by EIONET/CDR upload. See also Annex II of this report.

6.2 Article 7 (1) g

Information from the national registry on acquisition, holding, transfer, cancellation, retirement and carry-over of AAUs, RMUs, ERUs, CERs, tCERs and lCERs for 2021 is reported as a separate file ('SEF_AT_CP2_2021_20220104' and 'SEF_AT_CP1_2021_20220104') in xlsx and xml format by EIONET/CDR upload.

6.3 Article 7 (1) h

Summary information on concluded transfers pursuant to Article 3(4) and (5) of Decision No 406/2009/EC for the year 2021 has been reported as XML file in the directory 'Concluded transfers 2021' by EIONET/CDR upload.

6.4 Article 7 (1) i

Information on the use of joint implementation, of the CDM and of international emissions trading, pursuant to Articles 6, 12 and 17 of the Kyoto Protocol, or any other flexible mechanism provided for in other instruments adopted by the Conference of the Parties to the UNFCCC or the Conference of the Parties to the UNFCCC serving as the meeting of the Parties to the Kyoto Protocol, to meet their quantified emission limitation or reduction commitments pursuant to Article 2 of Decision 2002/358/EC and the Kyoto Protocol or any future commitments

under the UNFCCC or the Kyoto Protocol is reported as a separate file ('Art-7-1-i_Mechanisms_AT_2022') by EIONET/CDR upload.

6.5 Article 7 (1) j

According to Article 9 of the Commission Implementation Regulation (EU) No 749/2014 Member States shall report on the status of implementation of each adjustment and each recommendation listed in the most recently published individual UNFCCC review report.

No UNFCCC review took place in 2021, thus the information given in the template ('MMR_IR Article9_recommendations_AT_2022-01-15') can only refer to the UNFCCC review conducted in 2020 where Austria was subject to a centralized review[33].

The initial checks of ESD emissions performed under Art. 19(2) of Regulation EU No 525/2012 in 2021 did not identify any significant issues. So Austria was not subject to a second step review, and no recommendations were made.

6.6 Article 7 (1) k

The allocation of the verified emissions reported by installations and operators under Directive 2003/87/EC to the source categories of the national greenhouse gas inventory and the ratio of those verified emissions to the total reported greenhouse gas emissions in those source categories for 2020 is reported as a separate file ('MMR-IRArticle10_ETS_AT_2022-01-15').

6.7 Article 7 (1) l

ETS reports are fully considered in the Austrian greenhouse gas inventory. Consistency of data is thus given and the Article is not relevant for Austria.

For details, especially the methodology of consideration of ETS-data ('bottom up' data) see chapter 3.2.9.2 of the National Inventory Report 2021.

6.8 Article 7 (1)m (i)

The Austrian Air Emission Inventory (OLI) covers both, greenhouse gases and air pollutants reported under the NEC Directive 2001/81/EC and CLRTAP. Data

[33] https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/inventory-review-reports-2020

basis (activity data and other relevant parameters) is thus consistent for NEC, CLRTAP and MMR reporting.

Results of the checks performed for each air pollutant on the consistency of the data, for the year 2020 show no differences of more than +/−5% between the total emissions excluding LULUCF. Minor differences are solely due to different reporting requirements regarding air transport and international navigation.

6.9 Article 7 (1)m (ii)

There are no producers of F-gases in Austria, only a small number of companies applied for a quota for imports from outside the EU. Most imports are from inside the EU. Calculation of emissions of F-gases follows a top-down, bottom-up approach, where amounts of F-gases sold in Austria are collected from all importers.

6.10 Article 7 (1)m (iii)

Checks performed on the consistency of the data used to estimate emissions in preparation of the greenhouse gas inventory for 2020 with the energy data reported pursuant to Article 4 of Regulation (EC) No 1099/2008 show no differences of more than +/−2%.

7 ABBREVIATIONS

BFW ..... Bundesamt und Forschungszentrum für Wald
Austrian Federal Office and Research Centre for Forest

BMLFUW..... Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft
Federal Ministry of Agriculture, Forestry, Environment and Water Management

BMK ..... Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie
Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology

BMDW ..... Bundesministerium für Wirtschaft und Arbeit
Federal Ministry for Digital and Economic Affairs (former BMWA)

BMWA ..... Bundesministerium für Wirtschaft und Arbeit
Federal Ministry for Economic Affairs and Labour

CDR ..... Central Data Repository

CNG ..... Compressed Natural Gas

COP ..... Conference of the Parties

CORINAIR..... Core Inventory Air

CRF ..... Common Reporting Format

EC ..... European Community

EEA ..... European Environment Agency

EIONET ..... European Environment Information and Observation NETwork

EMEP ..... Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

EN ..... European Norm

ETC ..... European Topic Centre

EU ..... European Union

ERT ..... Expert Review Team (in context of the UNFCCC review process)

FAME ..... Fatty Acid Methyl Ester (Fettsäuremethylester, Biodiesel)

FAO..... Food and Agricultural Organisation of the United Nations

FC ..... Fuel Consumption

FMRL ..... Forest Management Reference Level

GHG ..... Greenhouse Gas

GWP..... Global Warming Potential

IBE ..... Inspection Body for Emission Inventories

IPCC..... Intergovernmental Panel on Climate Change

IEA ..... International Energy Agency

IED ..... Industrial Emissions Directive

ISO ..... International Standards Organisation

LTO ..... Landing/Take-Off cycle

LULUCF ..... Land Use, Land-Use Change and Forestry – IPCC CRF Category 4

MMR..... Monitoring Mechanism Regulation

MM IR..... Monitoring Mechanism – Commission Implementing Regulation

NEMO ..... Network Emission Model (for the Transport Sector)

NFI ..... National Forest Inventory

NFR..... Nomenclature for Reporting (Format of Reporting under the UNECE/CLRTAP Convention)

NISA..... National Inventory System Austria

OLI ..... Österreichische Luftschadstoff-Inventur
Austrian Air Emission Inventory

QA/QC..... Quality Assurance/Quality Control

QMS ..... Quality Management System

SNAP ..... Selected Nomenclature on Air Pollutants

TERT..... Technical Expert Review Team (under the MMR)

UNECE/CLRTAP.. United Nations Economic Commission for Europe,
Convention on Long-range Transboundary Air Pollution

UNFCCC ..... United Nations Framework Convention on Climate Change

ANNEX I: EMISSION TRENDS

This Annex presents emission trends for CO_2, CH_4, N_2O and FCs.

This report uses the following UNFCCC notation keys for all tables:

NE (not estimated) ..... for existing emissions by sources and removals by sinks of greenhouse gases which have not been estimated.

IE (included elsewhere) ..... for emissions by sources and removals by sinks of greenhouse gases estimated but included elsewhere in the inventory instead of the expected source/sink category.

NO (not occurring)..... for emissions by sources and removals by sinks of greenhouse gases that do not occur for a particular gas or source/sink category.

NA (not applicable) ..... for activities in a given source/sink category that do not result in emissions or removals of a specific gas.

C (confidential)..... for emissions which could lead to the disclosure of confidential information if reported at the most disaggregated level. In this case a minimum of aggregation is required to protect business information.

Table A.I-1: Emission Trends GHG emissions (kt CO_2e).

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Emissions/Removals with LULUCF	**66 358**	**63 523**	**81 258**	**84 560**	**81 567**	**82 267**	**77 126**	**80 372**	**77 848**	**75 803**	**77 234**	**73 849**	**76 285**	**77 424**	**79 002**	**75 419**	**77 209**	**72 405**
Total Emissions without LULUCF	**78 423**	**80 084**	**92 029**	**89 606**	**86 841**	**86 259**	**79 584**	**84 150**	**82 007**	**79 310**	**79 772**	**76 235**	**78 487**	**79 468**	**81 792**	**78 558**	**79 740**	**73 592**
1. Energy	**52 805**	**55 253**	**66 867**	**63 953**	**60 594**	**59 697**	**56 511**	**59 419**	**57 089**	**54 942**	**55 148**	**51 424**	**53 071**	**54 299**	**56 004**	**54 573**	**54 976**	**49 929**
A. Fuel Combustion (Sectoral Approach)	52 103	54 756	66 430	63 487	60 122	59 265	56 031	58 951	56 627	54 467	54 676	50 985	52 647	53 907	55 577	54 202	54 629	49 600
1. Energy Industries	14 011	12 318	16 032	14 828	13 629	13 454	12 445	13 756	13 418	11 984	11 015	9 396	10 511	10 296	10 911	10 062	10 177	8 807
2. Manufacturing Industries and Construction	9 845	10 035	11 541	11 250	10 879	11 285	10 711	11 351	11 237	11 129	10 898	10 500	10 227	10 541	10 744	10 856	10 855	10 549
3. Transport	13 957	18 804	24 943	23 678	23 903	22 432	21 776	22 585	21 935	21 751	22 932	22 247	22 725	23 579	24 331	24 453	24 508	21 183
4. Other Sectors	14 253	13 557	13 869	13 685	11 665	12 047	11 054	11 214	9 994	9 560	9 790	8 803	9 145	9 454	9 555	8 795	9 054	9 027
5. Other	36	42	45	45	46	46	45	44	43	42	41	40	39	38	37	36	35	34
B. Fugitive Emissions from Fuels	702	497	437	466	472	433	480	468	461	475	472	438	425	392	427	371	347	329
1. Solid Fuels	333	27	0	0	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA	NO, IE,NA
2. Oil and Natural Gas	369	469	437	465	472	433	480	468	461	475	472	438	425	392	427	371	347	329
C. CO_2Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes and Other Product Use	**13 574**	**14 491**	**15 440**	**16 078**	**16 750**	**17 063**	**13 727**	**15 680**	**15 902**	**15 517**	**15 908**	**16 063**	**16 730**	**16 448**	**17 201**	**15 584**	**16 519**	**15 489**
A. Mineral Industry	3 092	2 733	2 889	3 053	3 266	3 276	2 715	2 661	2 779	2 704	2 718	2 720	2 738	2 786	2 798	2 907	2 809	2 821
B. Chemical Industry	1 555	1 624	943	983	908	1 010	791	783	785	759	695	809	782	798	739	644	843	785
C. Metal Industry	8 180	8 484	9 631	10 105	10 593	10 784	8 417	10 268	10 300	9 956	10 313	10 256	10 808	10 370	11 146	9 454	10 346	9 460
D. Non-Energy Products from Fuels and Solvent Use	349	198	174	188	192	188	167	169	169	161	152	146	133	135	143	145	146	154

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
E. Electronics Industry	134	420	352	370	391	371	114	150	119	101	91	98	107	92	92	83	89	58
F. Product Uses as Substitutes for ODS	NO	678	1 042	1 029	1 065	1 102	1 205	1 327	1 433	1 526	1 627	1 725	1 854	1 868	1 889	1 961	1 847	1 754
G. Other Product Manufacture and Use	263	354	408	349	336	332	318	322	317	311	312	309	307	399	393	391	440	459
3. Agriculture	**8 119**	**7 376**	**6 928**	**6 901**	**6 950**	**7 064**	**7 077**	**6 926**	**7 022**	**6 969**	**6 962**	**7 106**	**7 135**	**7 256**	**7 202**	**7 090**	**6 985**	**6 964**
A. Enteric Fermentation	4 513	4 191	3 935	3 904	3 907	3 888	3 928	3 913	3 862	3 829	3 838	3 854	3 855	3 864	3 870	3 819	3 764	3 733
B. Manure Management	1 137	993	931	940	965	962	991	1 001	1 011	1 020	1 035	1 055	1 074	1 090	1 114	1 097	1 085	1 079
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	2 381	2 101	1 965	1 953	1 967	2 089	2 031	1 898	2 022	1 986	1 961	2 064	2 060	2 150	2 066	2 018	1 985	2 003
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
G. Liming	46	43	54	58	62	72	72	69	77	81	75	75	83	84	86	97	99	99
H. Urea application	10	19	22	25	28	26	31	29	27	31	30	34	35	39	38	32	27	25
I. Other carbon-containing fertilizers	31	27	20	20	20	27	23	15	21	22	22	24	27	29	26	26	25	25
4. Land Use, Land-Use Change and Forestry	**-12 065**	**-16 561**	**-10 770**	**-5 047**	**-5 274**	**-3 992**	**-2 459**	**-3 778**	**-4 159**	**-3 506**	**-2 538**	**-2 386**	**-2 201**	**-2 044**	**-2 789**	**-3 139**	**-2 531**	**-1 187**
A. Forest Land	-10 877	-15 997	-8 800	-2 985	-1 957	-1 062	-2 630	-2 597	-2 564	-2 531	-2 498	-2 465	-2 458	-2 451	-2 444	-2 437	-2 430	-2 423
B. Cropland	323	105	-2	11	26	62	52	57	61	59	82	117	210	277	311	338	356	402
C. Grassland	649	471	677	676	675	670	374	371	368	368	369	369	367	353	344	333	331	329
D. Wetlands	42	36	47	37	39	51	68	69	73	70	101	71	59	77	67	66	60	59
E. Settlements	449	321	424	485	510	535	346	355	301	318	280	381	400	353	327	220	235	289
F. Other Land	457	380	333	520	466	494	446	407	276	252	253	500	462	470	310	296	266	249

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
G. Harvested Wood Products	-3 122	-1 889	-3 461	-3 803	-5 045	-4 755	-1 126	-2 452	-2 687	-2 055	-1 138	-1 372	-1 254	-1 137	-1 719	-1 969	-1 363	-106
5. Waste	**3 926**	**2 965**	**2 794**	**2 675**	**2 547**	**2 435**	**2 268**	**2 125**	**1 995**	**1 882**	**1 754**	**1 642**	**1 551**	**1 464**	**1 385**	**1 311**	**1 260**	**1 209**
A. Solid Waste Disposal on Land	3 644	2 667	2 438	2 314	2 184	2 074	1 909	1 766	1 635	1 519	1 399	1 281	1 185	1 090	1 013	939	882	831
B. Biological Treatment of Solid Waste	36	83	151	157	162	164	165	167	170	174	166	172	175	180	178	179	183	185
C. Incineration and Open Burning of Waste	28	12	12	10	8	6	4	2	2	2	2	2	2	2	2	2	2	2
D. Waste Water Treatment and Discharge	219	203	193	193	192	191	190	189	188	187	187	186	188	191	192	191	192	191
6. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

TableA.I-2: Emission Trends CO_2 (kt).

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Emissions/Removals with LULUCF	**49 914**	**49 445**	**68 171**	**71 621**	**68 691**	**69 344**	**64 694**	**68 080**	**65 583**	**63 606**	**65 066**	**61 615**	**63 982**	**64 998**	**66 633**	**63 248**	**65 234**	**60 677**
Total Emissions without LULUCF	**62 145**	**66 149**	**79 077**	**76 806**	**74 106**	**73 481**	**67 298**	**72 006**	**69 893**	**67 266**	**67 759**	**64 160**	**66 349**	**67 210**	**69 592**	**66 557**	**67 935**	**62 037**
1. Energy	**51 160**	**53 997**	**65 640**	**62 697**	**59 341**	**58 455**	**55 285**	**58 120**	**55 827**	**53 655**	**53 859**	**50 206**	**51 838**	**53 055**	**54 715**	**53 358**	**53 772**	**48 775**
A. Fuel Combustion (Sectoral Approach)	51 058	53 832	65 480	62 516	59 157	58 293	55 080	57 937	55 647	53 471	53 668	50 037	51 676	52 923	54 577	53 231	53 654	48 666
1. Energy Industries	13 961	12 263	15 947	14 731	13 525	13 343	12 330	13 623	13 282	11 847	10 881	9 270	10 379	10 167	10 782	9 936	10 056	8 686
2. Manufacturing Industries and Construction	9 763	9 899	11 377	11 080	10 706	11 114	10 548	11 189	11 075	10 964	10 739	10 347	10 078	10 396	10 600	10 713	10 713	10 411
3. Transport	13 756	18 624	24 743	23 480	23 701	22 237	21 580	22 379	21 729	21 540	22 703	22 012	22 477	23 317	24 053	24 162	24 207	20 919
4. Other Sectors	13 543	13 005	13 371	13 182	11 180	11 553	10 578	10 702	9 519	9 079	9 305	8 369	8 705	9 007	9 107	8 385	8 644	8 617
5. Other	35	41	44	44	45	45	44	43	42	41	40	39	38	37	36	35	34	33
B. Fugitive Emissions from Fuels	102	165	160	180	185	162	205	184	180	184	191	169	162	131	138	127	118	109
1. Solid Fuels	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA
2. Oil and Natural Gas	102	165	160	180	185	162	205	184	180	184	191	169	162	131	138	127	118	109
C. CO_2 Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes and Other Product Use	**10 871**	**12 051**	**13 329**	**13 996**	**14 647**	**14 896**	**11 883**	**13 771**	**13 938**	**13 475**	**13 770**	**13 819**	**14 363**	**14 002**	**14 724**	**13 041**	**14 010**	**13 111**
A. Mineral Industry	3 092	2 733	2 889	3 053	3 266	3 276	2 715	2 661	2 779	2 704	2 718	2 720	2 738	2 786	2 798	2 907	2 809	2 821
B. Chemical Industry	644	674	644	666	601	650	586	675	692	661	598	714	688	716	654	542	715	683
C. Metal Industry	6 786	8 445	9 622	10 089	10 588	10 781	8 415	10 266	10 298	9 949	10 302	10 238	10 804	10 366	11 129	9 447	10 341	9 454
D. Non-Energy Products from Fuels and Solvent Use	349	198	174	188	192	188	167	169	169	161	152	146	133	135	143	145	146	154

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
E. Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Product Uses as Substitutes for ODS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other Product Manufacture and Use	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
3. Agriculture	**86**	**89**	**96**	**103**	**110**	**125**	**126**	**112**	**126**	**134**	**127**	**133**	**145**	**152**	**151**	**155**	**151**	**149**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
G. Liming	46	43	54	58	62	72	72	69	77	81	75	75	83	84	86	97	99	99
H. Urea application	10	19	22	25	28	26	31	29	27	31	30	34	35	39	38	32	27	25
I. Other carbon-containing fertilizers	31	27	20	20	20	27	23	15	21	22	22	24	27	29	26	26	25	25
4. Land Use, Land-Use Change and Forestry	**-12 231**	**-16 704**	**-10 907**	**-5 185**	**-5 415**	**-4 138**	**-2 605**	**-3 926**	**-4 309**	**-3 660**	**-2 693**	**-2 545**	**-2 367**	**-2 213**	**-2 960**	**-3 309**	**-2 702**	**-1 360**
A. Forest Land	-10 908	-16 021	-8 823	-3 009	-1 980	-1 085	-2 654	-2 621	-2 588	-2 555	-2 522	-2 489	-2 482	-2 476	-2 469	-2 463	-2 456	-2 449
B. Cropland	296	80	-26	-15	-2	31	20	25	28	25	47	80	170	235	268	295	313	357
C. Grassland	625	447	653	653	651	646	350	347	345	344	345	345	343	329	320	309	307	305
D. Wetlands	42	36	47	37	39	51	68	69	73	70	101	71	59	77	67	66	60	59
E. Settlements	392	276	383	444	467	492	303	310	253	269	229	328	345	297	271	164	179	232
F. Other Land	444	366	320	508	454	483	435	397	266	242	245	492	454	463	303	289	259	243

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
G. Harvested Wood Products	-3 122	-1 889	-3 461	-3 803	-5 045	-4 755	-1 126	-2 452	-2 687	-2 055	-1 138	-1 372	-1 254	-1 137	-1 719	-1 969	-1 363	-106
5. Waste	**28**	**12**	**12**	**10**	**8**	**6**	**4**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
A. Solid Waste Disposal on Land	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
B. Biological Treatment of Solid Waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Incineration and Open Burning of Waste	28	12	12	10	8	6	4	2	2	2	2	2	2	2	2	2	2	2
D. Waste Water Treatment and Discharge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

TableA.I-3: Emission Trends CH_4 (kt).

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Emissions/Removals with LULUCF	**405.40**	**329.94**	**305.46**	**300.65**	**295.85**	**290.08**	**285.61**	**281.27**	**272.98**	**268.18**	**263.87**	**258.22**	**255.12**	**252.25**	**251.21**	**242.85**	**237.53**	**233.74**
Total Emissions without LULUCF	**404.43**	**328.99**	**304.50**	**299.69**	**294.90**	**289.12**	**284.66**	**280.31**	**272.03**	**267.23**	**262.91**	**257.27**	**254.15**	**251.30**	**250.26**	**241.89**	**236.57**	**232.78**
1. Energy	**48.58**	**29.67**	**25.79**	**26.33**	**25.96**	**25.42**	**25.35**	**27.03**	**25.69**	**26.55**	**26.29**	**24.17**	**24.28**	**24.42**	**25.78**	**22.89**	**22.23**	**21.77**
A. Fuel Combustion (Sectoral Approach)	24.58	16.40	14.70	14.92	14.47	14.61	14.33	15.66	14.42	14.91	15.06	13.39	13.76	13.99	14.22	13.15	13.08	12.98
1. Energy Industries	0.33	0.39	0.62	0.70	0.74	0.82	0.89	1.00	1.00	1.03	1.00	0.96	1.03	1.03	1.04	1.01	0.98	1.00
2. Manufacturing Industries and Construction	0.54	0.65	0.82	0.85	0.87	0.86	0.83	0.86	0.87	0.90	0.86	0.83	0.82	0.80	0.81	0.79	0.77	0.76
3. Transport	2.97	1.25	1.11	0.99	0.94	0.84	0.79	0.75	0.71	0.68	0.67	0.66	0.68	0.73	0.79	0.84	0.86	0.76
4. Other Sectors	20.74	14.10	12.15	12.38	11.92	12.09	11.81	13.04	11.84	12.30	12.53	10.95	11.22	11.42	11.58	10.52	10.46	10.46
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	23.99	13.28	11.09	11.41	11.49	10.81	11.02	11.38	11.27	11.64	11.23	10.78	10.52	10.43	11.56	9.73	9.15	8.79
1. Solid Fuels	13.33	1.09	0.01	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	10.66	12.19	11.08	11.40	11.49	10.81	11.02	11.38	11.27	11.64	11.23	10.78	10.52	10.43	11.56	9.73	9.15	8.79
C. CO_2 Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes and Other Product Use	**1.53**	**1.56**	**1.61**	**2.08**	**2.07**	**1.96**	**1.90**	**1.94**	**1.95**	**1.95**	**2.05**	**1.95**	**1.95**	**1.94**	**1.95**	**1.90**	**1.94**	**2.04**
A. Mineral Industry	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
B. Chemical Industry	1.40	1.40	1.45	1.92	1.90	1.88	1.84	1.87	1.87	1.87	1.96	1.87	1.88	1.86	1.86	1.83	1.86	1.97
C. Metal Industry	0.13	0.16	0.16	0.16	0.17	0.08	0.06	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.08	0.07

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
D. Non-Energy Products from Fuels and Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Product Uses as Substitutes for ODS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other Product Manufacture and Use	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
3. Agriculture	**203.16**	**187.10**	**175.37**	**174.44**	**175.14**	**174.45**	**176.76**	**176.46**	**174.77**	**173.70**	**174.55**	**175.71**	**176.24**	**177.00**	**177.80**	**175.37**	**172.86**	**171.50**
A. Enteric Fermentation	180.52	167.64	157.40	156.17	156.27	155.51	157.14	156.52	154.46	153.14	153.53	154.16	154.20	154.57	154.81	152.78	150.55	149.32
B. Manure Management	22.58	19.41	17.93	18.23	18.84	18.91	19.58	19.90	20.28	20.54	21.00	21.53	22.02	22.41	22.97	22.57	22.30	22.16
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils [(2)]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
G. Liming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H. Urea application	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Land Use, Land-Use Change and Forestry	**0.97**	**0.96**	**0.95**	**0.96**	**0.95**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.95**	**0.95**	**0.96**	**0.96**	**0.96**
A. Forest Land	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01
B. Cropland	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO
C. Grassland	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested Wood Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Waste	**151.16**	**110.66**	**101.74**	**96.84**	**91.72**	**87.28**	**80.65**	**74.88**	**69.62**	**65.02**	**60.03**	**55.43**	**51.68**	**47.94**	**44.74**	**41.74**	**39.54**	**37.47**
A. Solid Waste Disposal on Land	145.76	106.67	97.51	92.55	87.36	82.94	76.37	70.64	65.40	60.77	55.94	51.25	47.42	43.62	40.54	37.57	35.30	33.24
B. Biological Treatment of Solid Waste	0.52	1.25	2.48	2.70	2.86	2.94	2.98	3.03	3.06	3.15	3.02	3.15	3.24	3.30	3.24	3.26	3.34	3.33
C. Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste Water Treatment and Discharge	4.88	2.73	1.75	1.59	1.50	1.41	1.30	1.21	1.16	1.11	1.07	1.03	1.02	1.02	0.97	0.91	0.90	0.89
6. Other *(please specify)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

TableA.I-4: Emission Trends N_2O (kt).

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Emissions/Removals with LULUCF	**15.62**	**15.01**	**12.48**	**12.51**	**12.58**	**13.17**	**12.42**	**11.79**	**12.15**	**12.06**	**12.01**	**12.33**	**12.40**	**12.75**	**12.55**	**12.41**	**12.41**	**12.24**
Total Emissions without LULUCF	**15.14**	**14.62**	**12.10**	**12.13**	**12.19**	**12.76**	**12.01**	**11.37**	**11.72**	**11.62**	**11.57**	**11.87**	**11.93**	**12.27**	**12.06**	**11.92**	**11.92**	**11.74**
1. Energy	**1.44**	**1.73**	**1.95**	**2.01**	**2.02**	**2.04**	**1.99**	**2.09**	**2.08**	**2.09**	**2.12**	**2.06**	**2.10**	**2.13**	**2.16**	**2.16**	**2.18**	**2.05**
A. Fuel Combustion (Sectoral Approach)	1.44	1.73	1.95	2.01	2.02	2.04	1.99	2.09	2.08	2.09	2.12	2.06	2.10	2.13	2.16	2.16	2.18	2.05
1. Energy Industries	0.14	0.15	0.23	0.27	0.29	0.30	0.31	0.36	0.37	0.37	0.37	0.34	0.36	0.35	0.35	0.34	0.33	0.32
2. Manufacturing Industries and Construction	0.23	0.40	0.48	0.50	0.51	0.50	0.48	0.47	0.47	0.48	0.46	0.44	0.43	0.42	0.42	0.41	0.41	0.40
3. Transport	0.43	0.50	0.58	0.58	0.60	0.59	0.59	0.63	0.63	0.65	0.71	0.74	0.77	0.82	0.86	0.91	0.94	0.82
4. Other Sectors	0.64	0.67	0.65	0.65	0.63	0.64	0.61	0.62	0.60	0.58	0.58	0.54	0.54	0.54	0.53	0.49	0.50	0.50
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. CO_2 Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes and Other Product Use	**3.38**	**3.51**	**1.14**	**1.12**	**1.08**	**1.25**	**0.69**	**0.38**	**0.32**	**0.32**	**0.31**	**0.30**	**0.30**	**0.26**	**0.26**	**0.32**	**0.41**	**0.30**
A. Mineral Industry	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
B. Chemical Industry	2.94	3.07	0.88	0.90	0.87	1.05	0.53	0.20	0.15	0.17	0.16	0.16	0.16	0.12	0.13	0.19	0.27	0.18
C. Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-Energy Products from Fuels and Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
E. Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Product Uses as Substitutes for ODS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other Product Manufacture and Use	0.44	0.44	0.25	0.22	0.21	0.20	0.16	0.18	0.16	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.13
3. Agriculture	**9.91**	**8.75**	**8.21**	**8.18**	**8.26**	**8.65**	**8.50**	**8.06**	**8.48**	**8.36**	**8.29**	**8.66**	**8.67**	**8.99**	**8.75**	**8.56**	**8.43**	**8.48**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management	1.92	1.70	1.62	1.62	1.66	1.64	1.68	1.69	1.69	1.70	1.71	1.73	1.76	1.78	1.81	1.79	1.77	1.76
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	7.99	7.05	6.59	6.55	6.60	7.01	6.82	6.37	6.79	6.66	6.58	6.93	6.91	7.21	6.93	6.77	6.66	6.72
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Liming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H. Urea application	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Land Use, Land-Use Change and Forestry	**0.48**	**0.40**	**0.38**	**0.38**	**0.39**	**0.41**	**0.41**	**0.42**	**0.42**	**0.44**	**0.44**	**0.45**	**0.47**	**0.48**	**0.49**	**0.49**	**0.49**	**0.50**
A. Forest Land	0.10	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09
B. Cropland	0.09	0.08	0.08	0.09	0.09	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.15	0.15
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
E. Settlements	0.19	0.15	0.14	0.14	0.14	0.15	0.15	0.15	0.16	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19
F. Other Land	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
G. Harvested Wood Products																		
5. Waste	**0.40**	**0.62**	**0.80**	**0.82**	**0.82**	**0.83**	**0.83**	**0.84**	**0.85**	**0.85**	**0.84**	**0.85**	**0.86**	**0.88**	**0.89**	**0.89**	**0.90**	**0.91**
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Biological Treatment of Solid Waste	0.08	0.17	0.30	0.30	0.31	0.30	0.30	0.31	0.31	0.32	0.30	0.31	0.32	0.33	0.33	0.33	0.33	0.34
C. Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste Water Treatment and Discharge	0.32	0.45	0.50	0.51	0.52	0.52	0.53	0.53	0.53	0.54	0.54	0.54	0.55	0.56	0.56	0.56	0.57	0.57
6. Other *(please specify)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

TableA.I-5: Emission Trends HFCs, PFCs, SF_6 and NF_3

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	kt CO_2 equivalent																	
Emissions of HFCs	**2.44**	**682.37**	**1 047.1**	**1 035.9**	**1 073.6**	**1 111.4**	**1 207.3**	**1 329.2**	**1 435.3**	**1 528.2**	**1 628.7**	**1 727.4**	**1 856.4**	**1 870.6**	**1 893.9**	**1 965.7**	**1 851.0**	**1 756.6**
HFC-23	0.00	2.24	9.55	10.85	14.63	26.31	28.19	28.55	28.91	29.17	29.30	29.32	28.83	28.38	27.96	27.58	27.25	26.94
HFC-32	0.00	6.39	16.17	16.74	17.17	17.28	18.55	20.04	24.05	25.81	28.56	32.70	35.41	37.78	38.96	46.33	53.29	55.66
HFC-43-10mee / act	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-125	0.00	107.98	258.37	276.00	284.99	300.16	345.49	394.45	446.40	476.50	513.56	551.07	601.60	597.92	598.90	639.92	608.47	577.49
HFC-134a	0.00	394.46	515.95	463.78	478.90	492.45	495.67	518.15	545.94	583.03	618.78	658.63	689.11	724.98	748.70	762.09	766.71	755.00
HFC-143a	0.00	89.58	207.24	225.06	233.54	250.88	296.85	345.09	381.69	405.64	432.75	449.20	494.23	474.55	468.99	468.11	384.60	331.84
HFC-152a	0.00	73.81	25.38	30.73	30.84	10.81	16.04	16.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-227ea	0.00	0.01	1.00	2.02	0.34	0.01	0.28	0.29	2.38	2.16	0.00	0.92	1.38	1.39	2.50	13.29	2.06	0.76
HFC-245fa	0.00	1.55	4.69	2.43	2.38	2.32	2.27	2.22	2.17	2.12	2.07	2.02	1.98	1.93	1.89	1.85	2.59	3.27
HFC-365mfc	0.00	1.19	3.68	1.89	1.85	1.81	1.77	1.73	1.69	1.65	1.61	1.57	1.54	1.50	1.47	1.43	2.02	2.55
Unspecified mix of listed HFCs	2.44	4.78	5.03	6.36	8.94	9.35	2.16	2.05	2.06	2.09	2.12	2.01	2.37	2.13	4.50	5.14	4.04	3.08
Emissions of PFCs	**1 182.8**	**87.87**	**163.29**	**172.39**	**230.33**	**208.19**	**36.02**	**78.05**	**73.51**	**50.72**	**49.23**	**53.03**	**49.55**	**50.39**	**44.09**	**32.52**	**38.45**	**29.89**
CF_4	1 014.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C_2F_6	134.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C_3F_8	0.00	0.00	0.00	1.82	1.48	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C_4F_{10}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C_5F_{12}	0.00	0.55	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unspecified mix of listed PFCs	34.03	87.32	157.79	170.57	228.85	207.25	36.02	78.05	73.51	50.72	49.23	53.03	49.55	50.39	44.09	32.52	38.45	29.89

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	kt CO_2 equivalent																	
Emissions of SF_6	**470.61**	**574.53**	**493.63**	**453.46**	**367.01**	**373.43**	**341.68**	**335.87**	**307.35**	**311.88**	**305.32**	**313.98**	**309.55**	**392.84**	**399.93**	**386.32**	**436.42**	**438.63**
Emissions of NF_3	**NO,NA**	**10.51**	**28.16**	**32.73**	**59.39**	**53.47**	**4.54**	**4.12**	**4.10**	**8.56**	**9.75**	**10.56**	**13.46**	**6.14**	**12.01**	**16.51**	**13.61**	**12.04**

ANNEX II: INDICATORS

This Annex presents the indicators pursuant to Article 7(1) f of Regulation (EU) No 525/2013 'Monitoring Mechanism Regulation'. Information on all priority indicators, additional priority indicators and supplementary indicators is provided[34].

Table A.III:Indicators pursuant to Article 7 (1) f of the Regulation No. 525/2013/EC 'Monitoring Mechanism Regulation' (MMR) for the years 1990, 2000, 2005–2020.

No	Indicator	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Priority Indicators																		
1	Total CO_2 intensity of GDP [t CO_2/Mio Euro]	318	274	301	282	262	257	244	256	242	231	233	219	224	223	226	210	212	207
2	Energy related CO_2 intensity of GDP [t CO_2/Mio Euro]	261	223	249	230	210	203	200	206	193	184	184	171	175	175	177	168	167	163
3	Specific CO_2 emissions of passenger cars [g CO_2/km]	212	198	191	186	184	179	175	174	173	171	171	170	168	168	168	167	167	166
4	Energy related CO_2 intensity of industry [t/Mio Euro]	288	239	250	232	212	216	235	244	229	226	221	213	209	209	206	200	202	209
5	Specific CO_2 emissions of households [t CO_2/dwelling]	3.4	2.8	2.6	2.5	2.2	2.2	2.1	2.3	2.0	1.9	1.9	1.7	1.7	1.8	1.8	1.6	1.6	1.6
6	CO_2 intensity of the commercial and institutional sector [t CO_2/Mio Euro]	20	20	22	23	16	16	13	10	8.5	8.0	8.0	7.1	7.3	6.8	7.7	7.2	7.1	7.2
7	Specific CO_2 emissions of public and autoproducer power plants [t CO_2/TJ]	126	109	113	109	106	97	86	92	95	88	92	93	88	79	85	82	81	75
	Additional Priority Indicators																		
1	Freight transport on road [g CO_2/ton-km]	119	90	83	82	79	78	77	76	77	76	73	72	71	74	74	74	74	72
2	Total CO_2 intensity – iron and steel industry [t CO_2/Mio Euro]	2 321	1 672	2 258	2 336	2 238	2 189	4 089	3 989	4 027	3 594	3 848	3 589	3 630	3 685	3 933	3 456	3 948	3 873
3	Energy related CO_2 intensity – chemical industry [t CO_2/Mio Euro]	538	463	446	408	344	446	496	491	433	428	385	371	370	397	403	364	339	350
4	Energy related CO_2 intensity – glass, pottery and building materials industry [t CO_2/Mio Euro]	609	564	590	606	639	692	734	670	666	681	669	661	658	648	620	646	626	692

[34] The units of the transport indicators (No. 3 Priority Indicator, No. 1 Additional Priority Indicator, and No.1-3 Supplementary Indicator) were changed to the common unit g CO_2/km (the suggested unit was g CO_2/100 km). Furthermore, the names of the transport indicators No. 3 and 4 Supplementary Indicator have been adapted for consistency reason.

No	Indicator	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
5	Specific CO_2 emissions of iron and steel industry [t CO_2/t production]	2.2	1.9	1.8	1.8	1.7	1.8	1.9	1.8	1.7	1.7	1.7	1.7	1.7	1.8	1.7	1.8	1.8	1.8
6	Specific energy related CO_2 emissions of cement industry [t CO_2/t production]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Supplementary Indicators																			
1	Specific diesel related CO_2 emissions of passenger cars [g CO_2/ km]	191	185	181	174	174	174	170	170	169	168	168	167	166	167	169	168	169	169
2	Specific petrol related CO_2 emissions of passenger cars [g CO_2/ km]	217	208	205	204	199	188	183	182	180	176	176	174	172	170	169	167	167	164
3	Passenger transport on road [g CO_2/passenger-km]	156	161	161	157	156	152	149	149	148	147	148	147	146	146	147	146	146	145
4	Passenger transport by air [kg CO_2/passenger]	224	114	96	97	96	86	81	70	72	73	75	73	77	73	63	66	71	120
5	Energy related CO_2 intensity – food, drink and tobacco industry [t CO_2/Mio Euro]	182	155	159	149	122	135	153	152	159	148	134	144	155	126	116	110	108	110
6	Energy related CO_2 intensity – paper and printing industry [t CO_2/Mio Euro]	895	717	652	575	534	552	621	644	595	529	494	458	488	471	466	496	524	524
7	Specific CO_2 emissions of households for space heating [t CO_2/m²]	37	29	26	25	22	22	21	22	19	18	19	16	17	18	17	16	16	16
8	Specific CO_2 emissions of commercial and institutional sector for space heating [kg CO_2/m²]	21	23	25	26	18	19	15	11	9.3	8.3	7.9	7.0	7.2	6.7	7.6	7.2	7.1	6.7
9	Specific CO_2 emissions of public power plants [t CO_2/TJ]	112	106	94	88	82	75	63	66	68	60	56	49	52	44	50	47	45	36
10	Specific CO_2 emissions of autoproducer plants [t CO_2/TJ]	168	117	180	175	174	161	155	167	166	158	173	179	167	157	165	164	168	162
11	Carbon intensity of total power generation [t CO_2/TJ]	52	41	54	52	49	44	38	44	47	37	37	34	36	32	36	33	32	28
12	Carbon intensity of transport [t CO_2/TJ]	66	64	65	63	62	60	60	60	60	61	61	59	59	59	61	60	59	62
13	Specific energy related CO_2 emissions of paper industry [t CO_2/t production]	0.8	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
14	Carbon intensity in Industry [kt CO_2 /PJ]	46	40	38	36	34	36	35	35	35	34	34	34	33	33	33	34	34	34
15	Carbon intensity Households [kt CO_2 /PJ]	41	35	32	32	29	29	28	28	26	25	24	24	24	24	23	23	23	23

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In „Austria's Annual Greenhouse Gas Inventory 1990–2020" the Umweltbundesamt presents updated greenhouse gas (GHG) emissions in Austria covering the 2nd commitment period under the Kyoto-Protocol. In 2020, total GHG emissions amounted to 73.6 Mt CO_2e. This corresponds to a 6.2% decrease compared to 1990 and a 7.7% decrease compared to 2019. Key drivers for the development were the pandemic-related lower fossil fuel sales as well as the decommissioning of a coal-fired power plant and lower electricity production from natural gas power plants in 2020.

GHG emissions according to Article 2(1) of Decision No. 406/2009/EC ("Effort Sharing Decision") amounted to 46.5 Mt CO_2e in 2020 and were thus 1.2 Mt CO_2e below the annual emission allocation for 2020. Content and format of this report are in accordance with the obligations under the GHG Monitoring Mechanism Regulation (EU) No. 525/2013.

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