ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

Austria's Annual Greenhouse Gas Inventory 1990—2017

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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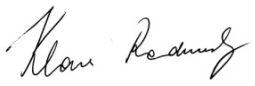
Date 15.01.2019	Responsible for the content of this report  Dr. Klaus Radunsky (Head of the inspection body)
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VORWORT

Dieser Bericht

Der vorliegende Bericht präsentiert die neuesten Daten der Emissionen von Treibhausgasen (THG) Österreichs. Diese Daten betreffen die Emissionen des Jahres 2017 sowie die aktualisierte Zeitreihe der Jahre 1990 bis 2016. Damit liefert der Bericht Daten für die ersten vier Jahre der zweiten Kyoto-Verpflichtungsperiode sowie für die ersten fünf Jahre 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

[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

und diese dazu verpflichtet, Daten und Informationen, die für die Erstellung der EU Inventur 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 10.–15.09.2018 statt, und konnte erfolgreich abgeschlossen werden. Ergebnisse dieser Prüfung, inkl. Empfehlungen zur Verbesserung, werden auf der Website der UNFCCC veröffentlicht[3]. Die Empfehlungen wurden in der vorliegenden Inventur bzw. im Bericht umgesetzt.

Am 29. Juni 2018 wurde der Review Bericht über den „Stufe 1-ESD-Review" an Österreich übermittelt. Da bei dem Review keine kritischen Punkte identifiziert wurden, konnte der Review nach dieser ersten Stufe der Überprüfung abgeschlossen werden.

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[4] 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 Luftschadstoff-Inventur* (OLI) als zentralem Kern aufbaut. Ein umfassendes Inventurverbesserungsprogramm und ein Qualitätsmanagementsystem entsprechend ISO/IEC 17020 sind ein wesentlicher Teil des NISA[5].

[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/inventory-review-reports-2018

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

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

Der vorliegende Bericht wurde vom Umweltbundesamt auf Grundlage des Umweltkontrollgesetzes BGBl. Nr. 152/1998[6] 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 2018	10. Jänner 2019	Common Reporting Format (CRF)

Tabelle B: Datengrundlage des vorliegenden Berichts.

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

ZUSAMMENFASSUNG

Die in dieser Zusammenfassung dargestellte Entwicklung der Emissionen der Treibhausgase in Österreich folgt in der Einteilung den Sektoren des Klimaschutzgesetzes. Die Sektoreinteilung in den übrigen Teilen dieses Berichts entspricht hingegen dem international festgelegten Format für die Berichterstattung unter der Klimarahmenkonvention (UNFCCC), wodurch diese Zahlen geringfügig von jenen in der Zusammenfassung abweichen.

Treibhausgas-Bilanz 2017

Im Jahr 2017 wurden in Österreich rd. 82,3 Mio. Tonnen Treibhausgase (THG) emittiert. Gegenüber 2016 bedeutet das einen Anstieg um 2,7 Mio. Tonnen CO_2-Äquivalent bzw. 3,3 %. Im Emissionshandelsbereich (EH) stiegen die THG-Emissionen gegenüber dem Vorjahr um 1,6 Mio. Tonnen (+ 5,4 %) an, die Emissionen ohne EH nach Klimaschutzgesetz (KSG) nahmen um 1,1 Mio. Tonnen zu (+ 2,2 %).

Die EU Effort-Sharing-Entscheidung (ESD 406/2009/EG) beinhaltet für jene Quellen, die nicht dem Emissionshandel unterliegen, Höchstmengen für klimaschädliche Emissionen. Der entsprechende nationale Zielwert für das Jahr 2017 (inkl. Anpassung) beträgt 49,5 Mio. Tonnen CO_2-Äquivalent. Die tatsächlichen Emissionen aus diesem Bereich betrugen im Jahr 2017 51,7 Mio. Tonnen CO_2-Äquivalent und lagen damit um ca. 2,1 Mio. Tonnen über dem Zielwert.

Energie und Industrie: + 1,0 % seit 1990

Der Sektor Energie und Industrie ist im Jahr 2017 mit ca. 37,0 Mio. Tonnen CO_2-Äquivalent der größte Emittent an Treibhausgasen in Österreich. Gegenüber dem vorangegangenen Jahr 2016 sind die Emissionen um 5,7 % (2,0 Mio. Tonnen) gestiegen.

<u>Emissionshandelsbereich</u>

Die Emissionshandelsbetriebe verursachten im Jahr 2017 Treibhausgasemissionen im Ausmaß von 30,6 Mio. Tonnen CO_2-Äquivalent (Energie: 9,6 Mio. Tonnen, Industrie: 21,0 Mio. Tonnen). Das ist um 5,4 % (+1,6 Mio. Tonnen CO_2-Äquivalent) mehr als im Jahr 2016.

Die Emissionen der Industriebetriebe im Emissionshandel sind um 4,7 % (+0,9 Mio. Tonnen) gestiegen, die Emissionen der Energiebetriebe (Strom- und Wärmeproduktion in großen Anlagen sowie Raffinerie und Erdgasverdichterstationen) weisen ebenfalls einen Emissionszuwachs auf (+6,8 % bzw. +0,6 Mio. Tonnen).

Wesentlich für den Zuwachs der Emissionen bei den Energiebetrieben im Jahr 2017 war die vermehrte Stromproduktion aus Großgaskraftwerken. Weniger Strom wurde in Wasserkraftwerken erzeugt, die Produktion in Wind- und Photovoltaikkraftwerken stieg an. Insgesamt erhöhte sich die inländische Stromerzeugung im Jahr 2017 um 3,4 %. Stromimporte deckten 2017 rd. 9 % des Verbrauchs ab. Der Inlandsstromverbrauch ist im Jahr 2017 um 1,6 TWh (+ 2,2 %) gestiegen.

Nicht-Emissionshandelsbereich (KSG/ESD)

Die Emissionen der Industrie- und Energiebetriebe, die nicht dem Emissionshandel unterliegen, sind zwischen 2016 und 2017 um 7,4 % bzw. 0,4 Mio. Tonnen gestiegen, im Wesentlichen durch den vermehrten Einsatz fossiler Brennstoffe (+ 0,3 Mio. Tonnen aus Erdgas und + 0,1 Mio. Tonnen aus Kohle). Die diffusen Emissionen nahmen von 2016 auf 2017 aufgrund des erhöhten Rohgasdurchsatzes bei der Entschwefelung von Erdgas ebenfalls zu (+ 9,0 %).

Verkehr: + 71,8 % seit 1990

Der Sektor Verkehr weist im Jahr 2017 THG-Emissionen im Ausmaß von ca. 23,7 Mio. Tonnen CO_2-Äquivalent auf. Im Vergleich zu 2016 sind die Emissionen um 2,9 % (+0,7 Mio. Tonnen CO_2-Äquivalent) gestiegen. Ohne die CO_2-Emissionen aus dem nationalen Flugverkehr, welche gemäß ESD/KSG nicht berücksichtigt werden, betragen die THG-Emissionen aus dem Verkehrssektor rd. 23,6 Mio. Tonnen CO_2-Äquivalent.

Grund für diesen deutlichen Anstieg ist der stark gestiegene fossile Kraftstoffabsatz: im Vergleich zu 2016 wurden um 2,9 % mehr Dieselkraftstoffe abgesetzt (inkl. Beimengung von Biokomponenten), bei Benzin waren es 1,2 % weniger.

Die Fahrleistung des Pkw-Verkehrs im Inland ist gegenüber 2016 um rund 2 % gestiegen, jene von LKW und Bussen im hochrangigen Straßennetz um rund 3 %. Diesel-Pkw dominieren bei der Pkw-Fahrleistung mit rund 70 %.

Insgesamt wurden im Jahr 2017 rd. 6,1 % des verkauften Kraftstoffes durch Biokraftstoffe substituiert. Dieser Anteil liegt über dem in der Kraftstoffverordnung festgesetzten Substitutionsziel von 5,75 % (gemessen am Energieinhalt) des in Verkehr gebrachten fossilen Treibstoffs, ist aber deutlich niedriger als noch 2016 (7,1 %) und sinkt bereits das zweite Jahr in Folge. Der Einsatz von Biokraftstoffen bewirkte im Jahr 2017 im Verkehrssektor eine Emissionsminderung von rd. 1,55 Mio. Tonnen CO_2.[7]

Gebäude: − 35,1 % seit 1990

Der Sektor Gebäude verursacht im Jahr 2017 ca. 8,3 Mio. Tonnen an THG-Emissionen. Das entspricht einem Anstieg von 1,8 % (+ 0,1 Mio. Tonnen) gegenüber dem Jahr 2016. Die Anzahl der Heizgradtage (erweiterte Heizperiode) sank nach einem durchschnittlichen Jahr um 0,6 % geringfügig ab und befindet sich weiter nahe dem langjährigen Trend.

Der ansteigende Einsatz erneuerbarer Energieträger konnte den Mehrverbrauch von Heizöl (+ 3,1 %) und bei Erdgas (+ 0,7 %) nicht kompensieren.

[7] BMNT (2018): Biokraftstoffe im Verkehrssektor 2018 - Bericht, im Auftrag des BMNT, Wien 2018.

Landwirtschaft: − 13,3 % seit 1990

Im Jahr 2017 wurden Treibhausgasemissionen im Ausmaß von 8,2 Mio. Tonnen CO_2-Äquivalent verursacht. Das sind um 1,4 % (− 0,1 Mio. Tonnen) weniger Emissionen als im Jahr 2016.

Hauptverantwortlich dafür sind der rückläufige Verbrauch fossiler Kraftstoffe beim landwirtschaftlichen Maschineneinsatz sowie die geringeren N_2O-Emissionen aus dem Einarbeiten von Ernterückständen aufgrund der geringeren Ernte durch ungünstige Witterungsverhältnisse im Jahr 2017 (frühsommerliche Trockenperiode mit wochenlangem Niederschlagsdefizit im Mai und Juni). Verringerte Mineraldüngermengen trugen ebenfalls zum Rückgang der THG-Emissionen bei.

Abfallwirtschaft: − 33,3 % seit 1990

Der Sektor Abfallwirtschaft emittierte im Jahr 2017 2,9 Mio. Tonnen CO_2-Äquivalent und somit etwas weniger (− 4,2 % bzw. 0,1 Mio. Tonnen) als im Jahr 2016. Diese Reduktion ist auf die gesunkenen Emissionen aus der Abfallverbrennung sowie auf die Deponiegaserfassung zurückzuführen.

Der starke Rückgang seit 1990 ist hauptsächlich auf die sinkenden Emissionen aus Abfalldeponien zurück zu führen. Neben der verstärkten Abfalltrennung ist vor allem die in Österreich verpflichtende (Vor-)Behandlung von Abfällen gemäß Deponieverordnung (ab 2004 mit Ausnahmen, ab 2009 flächendeckend) für den Rückgang verantwortlich. Zusätzlich führten die verstärkte mechanisch-biologische Behandlung von Siedlungsabfällen sowie die gegenüber 1990 höhere Deponiegaserfassung zu einer Abnahme der Emissionen in dieser Subkategorie. Im Gegensatz dazu haben sich die Emissionen aus der Abfallverbrennung seit 1990 mehr als vervierfacht und lagen 2017 bei 1,4 Mio. Tonnen CO_2-Äquivalent.

Fluorierte Gase: + 31,6 % seit 1990

Im Jahr 2017 wurden in Österreich F-Gase im Ausmaß von 2,2 Mio. Tonnen CO_2-Äquivalent emittiert. Damit liegen die Emissionen um 4,7 % bzw. 0,1 Mio. Tonnen CO_2-Äquivalent über dem Niveau von 2016. Ohne NF_3-Emissionen, welche nach ESD/KSG nicht berücksichtigt werden, ist der Anstieg geringfügig niedriger (+ 4,5 %).

Hauptgrund für diese starke Zunahme sind Vorsorgekäufe an diversen Kältemitteln mit hohem Treibhausgaspotenzial, welche durch das Fortschreiten der EU F-Gas Verordnung nach und nach vom Markt genommen werden.

Im Juni 2014 trat die EU VO Nr. 517/2014 in Kraft, die vorsieht, bis 2030 die Herstellung und den Import von F-Gasen mit einem hohen Treibhausgaspotenzial deutlich zu reduzieren. Dadurch ist – allerdings um einige Jahre verzögert – mit einer Abnahme der Emissionen in diesem Sektor zu rechnen.

Angepasster Zielpfad 2017 bis 2020

Mit dem Beschluss (EU) 2017/1471 der Europäischen Kommission vom 10. August 2017 wurden die jährlichen Emissionszuweisungen gemäß Entscheidung Nr. 406/2009/EG („ESD Decision“) für den Zeitraum 2017 bis 2020 angepasst,

um die Kohärenz zwischen den Methoden für die Festlegung der jährlichen Emissionszuweisungen und der jährlichen Berichterstattung durch die Mitgliedstaaten sicherzustellen. Diese Anpassung führte zu einer Änderung des Zielpfades für Österreich 2017 bis 2020 um rd. – 1 Mio. Tonnen CO_2-Äquivalent pro Jahr.

Daten: Sektoreinteilung und Revisionen

Die Sektoreinteilung folgt der des Klimaschutzgesetzes. Aufgrund der kontinuierlichen Verbesserung der THG-Inventur, die jeweils die ganze Zeitreihe (Daten von 1990 bis 2017) betrifft, können die Emissionen von bisher publizierten Daten abweichen.

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 2017. It presents GHG data for the first five years under the second commitment period under the Kyoto-Protocol as well as under the Effort-sharing decision target period 2013–2020.

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 UNFCCC and the Kyoto Protocol.

According to the above mentioned regulation and the reporting requirements, which are in accordance with those under the United Nations Framework Convention on Climate Change (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 is expected to 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_2019') as well as the completed MMR IR reporting templates are not part of this report but submitted separately by uploading at EIONET/CDR.

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

[9] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:049:0001:0001:EN:PDF

[10] http://ozone.unep.org/new_site/en/Treaties/treaty_text.php?treatyID=2

[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

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].

Table 1: Status of the present report.

Reporting Obligation	Format	Inventory	Version
Mechanism for monitoring Community greenhouse gas emissions	Common Reporting Format (CRF)	OLI 2018	January 10th 2019

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

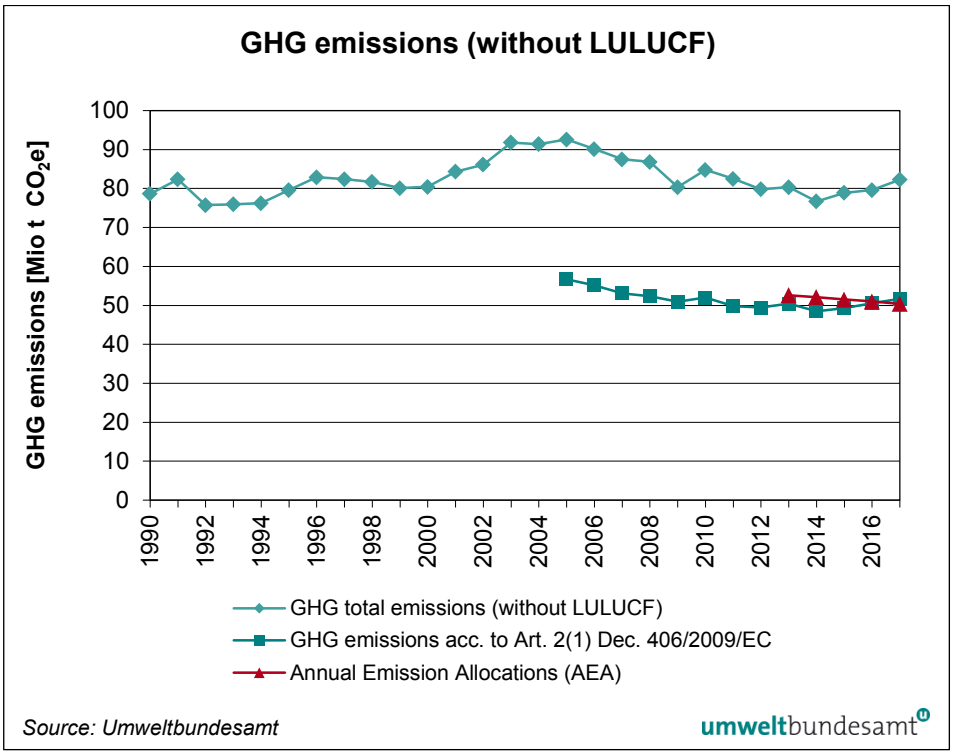
In 2017 Austria's total greenhouse gas (GHG) emissions (without LULUCF) amounted to 82.3 Mt CO_2 equivalents (CO_2e). Compared to the base year[14] 1990 GHG emissions increased by 4.6%, compared to 2016 GHG emissions increased by 3.3%.

Greenhouse gas emissions according to Article 2(1) of Decision No. 406/2009/EC amounted to 51.7 Mt CO_2 equivalents in 2017 (see 'MMR-IR_AnnexX_ESD_AT_2019'), which is 2.2% (1.1 Mt CO_2e) more than in 2016. Emissions were above the annual emission allocation (AEA) for the year 2017 (+2.1 Mt CO_2e). However, emission data for the period 2013 to 2016 provided in submission 2019 were below the annual emission allocation: the difference amounted in 2016 to −0.4 Mt CO_2e, in 2015 to −2.2 Mt CO_2e, in 2014 to −3.6 Mt CO_2e and in 2013 to −2.2 Mt CO_2e the first year of the Effort-Sharing Decision target period[15].

[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] 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

Figure 1: Trend in GHG emissions 1990–2017 without LULUCF.



Trend 2016–2017

The key driver for the emissions increase between 2016 and 2017 was the increasing GHG emissions (+1.993 kt CO_2e; +3.7%) from *Energy (CRF 1)*. Within this sector *Road Transportation (CRF 1.A.3.b)* contributed most – with an increase of 669 kt CO_2e due to the higher overall amount of fossil fuel sold in Austria, in particular diesel. The use of biofuels decreased as a result of continuously low price levels of fossil fuel products and a decrease in pure biofuel sales. Emissions from *Energy Industries* rose by 632 kt CO_2e, mainly due to the increased electricity generation from natural gas power plants. The increase in emissions of the sector *Manufacturing Industries* (+494 kt CO_2e) was mainly driven by higher steel production and higher natural gas consumption in other branches.

Emissions from *Industrial Processes and Other Product Use (CRF 2)* increased by 4.9% (+803 kt CO_2e) from 2016 to 2017, mainly due to an increase in the production volume of iron and steel.

Emissions from *Agriculture (CRF 3)* decreased by 0.8% (−58 kt CO_2e) from 2016 to 2017, mainly due to reduced N_2O emissions resulting from crop residues left on agricultural soils.

Net removals from LULUCF (*CRF 4*) show an increase by 12.0% (527 kt CO_2e) from 2016–2017 mainly caused by the increase in the harvested wood products sink.

The declining emission trend of recent decades continues for Sector *Waste (CRF 5)* with a further decline by 4.7% (−73 kt CO_2e) as a result of reduced landfilling of waste and lower carbon content of deposited waste.

GHG source and sink categories	1. Energy	2. IPPU	3. Agriculture	4. LULUCF	5. Waste	6. Other
	CO_2 equivalents (kt)					
1990	52 946	13 662	8 137	-11 988	3 925	NO*
1995	54 500	13 605	7 828	-13 143	3 651	NO
2000	55 403	14 610	7 438	-16 419	2 963	NO
2001	59 591	14 488	7 380	-19 265	2 865	NO
2002	60 849	15 129	7 269	-14 262	2 863	NO
2003	66 529	15 271	7 121	-4 869	2 867	NO
2004	66 537	14 811	7 106	-9 188	2 930	NO
2005	67 138	15 600	7 037	-10 659	2 791	NO
2006	64 162	16 257	7 027	-5 169	2 671	NO
2007	60 935	16 912	7 082	-5 497	2 543	NO
2008	59 930	17 249	7 206	-4 262	2 431	NO
2009	56 882	13 922	7 240	-4 532	2 285	NO
2010	59 563	15 930	7 103	-5 864	2 158	NO
2011	57 283	15 970	7 164	-6 091	2 043	NO
2012	55 188	15 571	7 110	-5 467	1 942	NO
2013	55 520	15 902	7 106	-4 517	1 824	NO
2014	51 696	16 017	7 246	-4 724	1 721	NO
2015	53 409	16 602	7 249	-4 551	1 638	NO
2016	54 279	16 395	7 365	-4 379	1 557	NO
2017	56 272	17 197	7 308	-4 906	1 484	NO

Table 2: Summary of Austria's anthropogenic greenhouse gas emissions by sector.

** not occurring*

The most important GHG in Austria remains carbon dioxide (CO_2) with a share of 85% in 2017. The CO_2 emissions primarily result from combustion activities. Methane (CH_4), which mainly arises from stock farming and waste disposal, contributes 8.0% to the national total GHG emissions, and nitrous oxide (N_2O) with agricultural soils as the main source contributes another 4.3% in 2017. The remaining 2.6% 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.

Table 3: Austria's anthropogenic greenhouse gas emissions by gas.

GHG emissions	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3
	CO_2 equivalents (kt)						
1990	62 323	10 363	4 329	2.4	1 183	471	0.0
1995	64 268	9 518	4 254	353	83	1 100	6.4
2000	66 313	8 396	4 320	714	88	575	11
2001	70 275	8 236	4 194	863	116	629	11
2002	72 124	8 095	4 196	969	102	613	11
2003	77 799	8 033	4 185	1 073	126	549	22
2004	77 921	8 035	3 599	1 160	158	484	27
2005	79 395	7 748	3 590	1 148	163	494	28
2006	77 061	7 648	3 594	1 155	172	453	33
2007	74 469	7 542	3 606	1 198	230	367	59
2008	73 727	7 418	3 787	1 250	208	373	53
2009	67 724	7 346	3 566	1 310	36	342	4.5
2010	72 228	7 256	3 365	1 486	78	336	4.1
2011	70 143	7 060	3 459	1 414	74	307	4.1
2012	67 577	6 949	3 422	1 492	51	312	8.6
2013	68 161	6 891	3 416	1 520	49	305	9.8
2014	64 467	6 750	3 499	1 587	53	313	11
2015	66 733	6 678	3 498	1 616	50	310	13
2016	67 315	6 618	3 582	1 632	50	393	6.1
2017	69 979	6 598	3 505	1 725	44	399	12

The dominant sector regarding GHG emissions in Austria is *Energy*, causing 68% of the total national GHG emissions in 2017 (67% in 1990), followed by the sectors *Industrial Processes and Other Product Use* (21% in 2017) and *Agriculture* (8.9% in 2017).

Table 4: Austria's greenhouse gas emissions by sector 1990 and 2017 as well as their share and trend.

GHG	1990	2017	Trend 1990–2017	1990	2017
	Emissions [kt CO_2e]			Share [%]	
Total	**78 670**	**82 261**	**+4.6%**	**100%**	**100%**
Energy	52 946	56 272	+6.3%	67%	68%
IPPU	13 662	17 197	+26%	17%	21%
Agriculture	8 137	7 308	–10%	10%	8.9%
LULUCF	–11 988	–4 906	–59%	–15%	–6.0%
Waste	3 925	1 484	–62%	5.0%	1.8%

Total emissions without emissions from sector LULUCF

In 2017 emissions from *Industrial Processes and Other Product Use* were 26% higher than in 1990. Greenhouse gas emissions from *Energy* increased by 6.3% between 1990 and 2017. The other sectors show decreasing GHG emissions with the most significant decreases in the sector *Waste*. But there has also been a decrease in *LULUCF* (decrease of net removals).

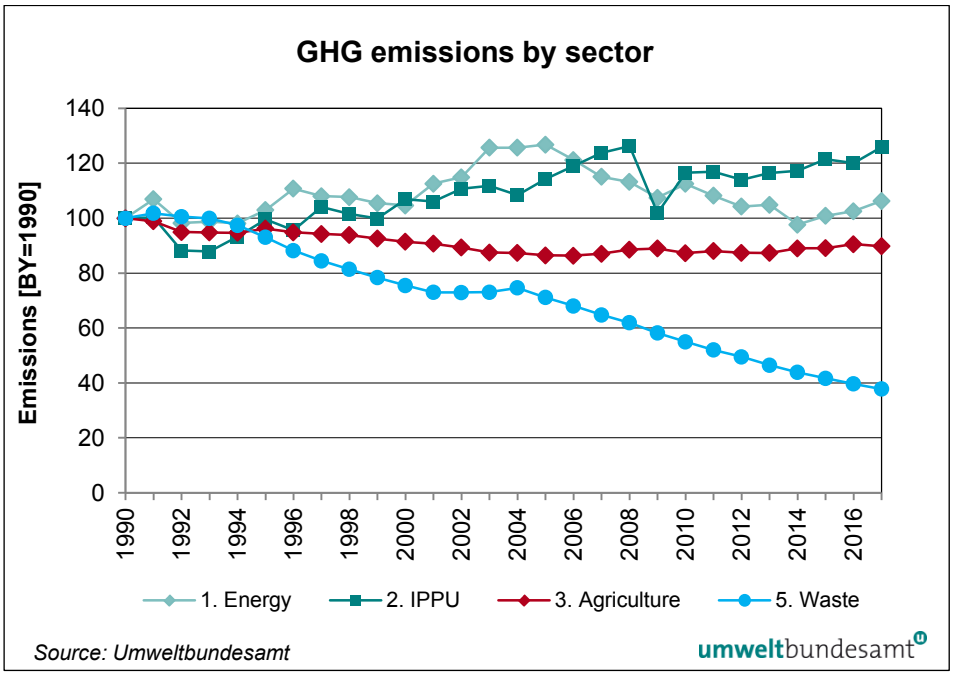


Figure 2: Trend in emissions 1990–2017 by sector in index form (1990 = 100).

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

2.1 Energy

In 2017, greenhouse gas emissions from sector *Energy* amounted to 56 272 kt CO_2 equivalents which corresponds to 68% of the total national emissions. 99% of the emissions from this sector originate from fuel combustion (*1.A*); fugitive emissions from fuels (1.B) are of minor importance.

The most important **sub-category** is *transport* with a share of 43% in 2017, followed by *energy industries* (20%), *manufacturing industries and construction* (20%) and the sub-category *other sectors* (16%). The most important **greenhouse gas** is CO_2, contributing 98% to the total sectoral GHG emissions, followed by CH_4 (1.1%) and N_2O (1.0%).

From 2016 to 2017, emissions from this sector increased by 3.7% (+1 993 kt CO_2e). The main increase occurred in the transport sector (+747 kt CO_2e) due to higher consumption of fossil fuels, in particular diesel. Emissions from *energy industries* rose by +632 kt CO_2e because of increased electricity production from natural gas power plants. The increase in emissions of *manufacturing industries* (+494 kt CO_2e) was mainly driven by higher steel production (*1.A.2.a*) and higher natural gas consumption in other branches.

The main driver for increasing emissions (+84 kt CO_2e) from *other sectors* in 2017 was the higher use of natural gas and gasoil as well as slightly increased heating demand of households (heating degree days increased by 0.5%).

The **overall trend** in GHG emissions from the sector *Energy* shows increasing emissions with a 6.3% rise from 1990 to 2017. Greenhouse gas emissions from road transport are 74% higher than 1990. The dips and jumps from year to year are mainly due to:

- the 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
- the economic situation as reflected in the gross domestic product (GDP)
- change in power generation (switch from coal to gas)

Trend 1990–2017 by sub-category

In 2017 emissions from sub-category ***energy industries*** were 21% below the level in 1990. Emissions from power plants are quite continuously 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% (1990) to 25% (2017), the contribution of hydro and wind power plants to total public electricity production increased from 69% (1990) to 77% (2017). Electricity consumption increased by 51.5% since 1990 and since 2002 the increase is covered by electricity imports to a large extent.

Energy related GHG emissions from ***manufacturing industries and construction*** increased by 12% from 1990 to 2017, mainly in the chemical and other manufacturing industries, while emissions from iron & steel and pulp & paper industries decreased since 1990. Fuel consumption increased by 41% 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 is significantly smaller (only +12%) compared to the increase in fuel combustion.

Transport showed a strong increase in GHG emissions since 1990 (+74%) mainly due to an increase of road performance (kilometres driven) in passenger 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 (fuel export) mainly caused by higher fuel prices in Austria's neighbouring countries – has increased considerably since 1990. Between 2005 and 2014 GHG emissions were decreasing due to lower amounts of fuel sold together with an increased use of biofuels and the gradual replacement with newer, vehicles with lower specific fuel consumption. The year 2017 is now the third year showing an increase in GHG emissions from *transport* and the second year with decreasing amounts of biofuels. Moreover, 2017 is the second year with higher total fuel sales compared to the peak year 2005.

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 ***other sectors***. Emissions in 2017 were 35% 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 nat-

ural gas as well as the growing importance of district heating and the modernisation of heating systems. Total fuel consumption of this sub-category decreased by 15% since 1990.

Fugitive emissions decreased by 39% since 1990 due to the progressive closure of coal mines up until 2006. There have been no coal-mining activities in Austria since 2007.

2.2 Industrial Processes and Other Product Use

In 2017, greenhouse gas emissions from *Industrial Processes and Other Product Use* amounted to 17 197 kt CO_2 equivalents, which correspond to 21% of total national emissions.

The most important **sub-categories** of this sector are *metal industry* and *mineral industry*, generating 65% and 16% of total sectoral emissions, respectively. The most important **greenhouse gas** of this sector is CO_2 with a contribution of 86% to total sectoral emissions, followed by HFCs with 10%, SF_6 with 2.3%, N_2O with 1.0%, PFCs and CH_4 with 0.3% each. NF_3 contributes 0.01% to total emissions from this sector.

From 2016 to 2017, overall emissions from this sector increased by 4.9 %, mainly due to an increase in production of iron and steel.

The **overall trend** in GHG emissions from *Industrial Processes and Other Product Use* is an increase in emissions of 26% from 1990 to 2017. Within this period, emissions fluctuated, with a minimum in 1993 and a maximum in 2008. **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 metal production resulting in 37% higher GHG emissions in 2017 compared to 1990 and (iv) a strong increase of HFC emissions in the period 1992 to 2017 from 5.6 to 1 725 kt CO_2 equivalents.

Trend 1990–2017 by sub-category

The largest increase in GHG emissions between 1990 and 2017 can be observed in the *metal industry* due to an increase in emissions from iron and steel production (+69%). In sub-categories *mineral industry* and *chemical industry*, emissions declined by 9.5% and 52% respectively during that period. Emissions of *fluorinated gases* increased by 32% since 1990, driven by increasing emissions of HFCs (+388% since 1995) used as cooling agents that replaced Ozone Depleting Substances (ODSs). Emissions from *solvent use* dropped by 68%, due to legal measures controlling the solvent content of products and their use.

2.3 Agriculture

In 2017, greenhouse gas emissions from *Agriculture* amounted to 7 308 kt CO_2 equivalent, which correspond to 8.9% of the total national emissions.

The **most important sub-categories** of this sector are *enteric fermentation* (57%) and *agricultural soils* (28%). The sector agriculture is the largest source for both N_2O and CH_4 emissions: in 2017 71% (8.3 kt N_2O) of total N_2O emissions and also 71% (188 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 64% and N_2O with 34%. CO_2 emissions account for 1.6% of the emissions from this sector.

From 2016 to 2017 GHG emissions decreased by 0.8%, mainly due to reduced emissions from agricultural soils. In 2017 Austria's crop production was significant lower compared to the previous year, because of the unfavourable growth conditions (drought period in May and June). The cereal harvest in 2017 was 15% lower compared to 2016, but also oil seeds, sugar beet and vegetable production slightly decreased compared to the previous year resulting in lower N_2O emissions from crop residues. Furthermore, in 2017 a smaller amount of mineral fertilizer was applied on agricultural soils.

The **overall trend** in GHG emissions from *Agriculture* shows a decrease of 10% from 1990 to 2017. The **main drivers** for this trend are decreasing livestock numbers and lower amounts of N-fertilizers applied on agricultural soils.

2.4 LULUCF

In 2017, net removals from the category LULUCF amounted to −4 906 kt CO_2 equivalents, which correspond to 6.0% of the national total GHG emissions (without LULUCF) in 2017 compared to 15% in the base year.

With regard to the **overall trend** of net removals from LULUCF, the removals decreased by 59% 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 affect the growth rates on the one hand (e.g. very low increment in 2003) and windthrows on the other, 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 −4 285 kt CO_2 equivalents in 2017. *Harvested Wood Products (4.G)* is the second largest sink category and contributed −1 690 kt CO_2 equivalents. In 2017, CH_4 and N_2O emissions together amounted to 161 kt CO_2 equivalents. Total net emissions arising from the other non-forest sub-sectors (excluding HWPs) amounted to 1 069 kt CO_2 equivalents in 2017.

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 activity which contributes most to GHG removals is forest management which amounts to −3 864 kt CO_2 equivalents in 2017 (including HWPs). Afforestation/reforestation (incl. HWPs) contribute to GHG removals as well (−2 142 kt CO_2 equivalents), whereas emissions from deforestation amount to 505 kt CO_2 in 2017.

2.5 Waste

In 2017, greenhouse gas emissions from *Waste* amounted to 1 484 kt CO_2 equivalent, which correspond to 1.8% of total national emissions.

The most important sub-category of the waste sector is *solid waste disposal*, which caused 75% of the emissions from this sector in 2017, followed by *waste water treatment and discharge* (13%) and *biological treatment of solid waste* (12%). The most important greenhouse gas is CH_4 with a share of 82% in emissions mainly from *waste disposal*, followed by N_2O with 18% and CO_2 with 0.1%.

From 2016 to 2017 GHG emissions continued to decrease (−4.7%) as a result of low waste volumes as well as decreasing carbon content of waste deposited in previous years.

The **overall trend** in GHG emissions from *waste* is decreasing, with a decrease of 62% from 1990 to 2017. 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 since the 1990s.

3 RECALCULATIONS

This chapter describes the changes 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_2019').

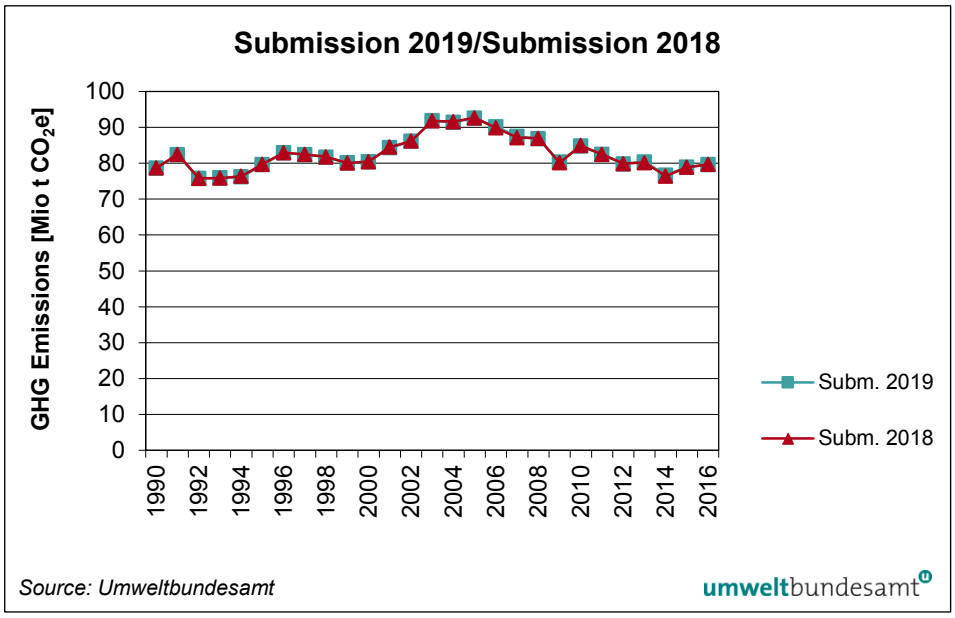
3.1 Background

The Austrian greenhouse gas inventory is subject to continuous improvement. An inventory improvement programme was established as part of the QMS, to grant transparency and 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 inventories. 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 0.03% (−20 kt CO_2e) lower than reported last year; the national total (excl. LULUCF) for 2016 is 0.10% (−77 kt CO_2e) lower than the value submitted last year.

Figure 3: Comparison Submission 2019/Submission 2018 (Recalculations).



National total emissions (excluding LULUCF) for **1990** have been slightly revised downwards since last years' submission (−20 kt CO_2e) mainly due to revised estimates submitted for Agriculture. New data on animal husbandry and manure management systems in Austria as well as methodological improvements have resulted in lower emissions for the early years of the time series.

Revised total emissions for **2016** are 0.10% lower (−77 kt CO_2e) than total emissions submitted last year for 2016, mainly due to revised energy balance data affecting emissions from sector *Energy* as well as methodological improvements implemented in the solvents model (*2.D.3.1 Solvent Use*). Notable revisions of sectoral emissions 2016 are also submitted for sector *Agriculture* (mainly *3.B Manure Management*) leading to higher sectoral emissions (in particular CH_4) compared to last year due to new activity data and methodological improvements as described above.

Table 5: Recalculation difference of Austria's GHG emissions compared to the previous submission.

	National Total GHG emissions without LULUCF			
	Submission 2019	**Submission 2018**	**Recalculation Difference**	
	[kt CO_2e]	**[kt CO_2e]**	**[kt CO_2e]**	**[%]**
1990	78 670	78 690	–20	–0.03%
1991	82 349	82 496	–147	–0.18%
1992	75 750	75 796	–45	–0.06%
1993	75 932	75 855	77	0.10%
1994	76 207	76 393	–187	–0.24%
1995	79 584	79 730	–146	–0.18%
1996	82 875	82 924	–50	–0.06%
1997	82 405	82 461	–57	–0.07%
1998	81 702	81 757	–55	–0.07%
1999	80 105	80 055	50	0.06%
2000	80 415	80 432	–17	–0.02%
2001	84 324	84 510	–186	–0.22%
2002	86 111	86 199	–88	–0.10%
2003	91 788	91 817	–29	–0.03%
2004	91 383	91 575	–192	–0.21%
2005	92 566	92 655	–88	–0.10%
2006	90 117	89 832	285	0.32%
2007	87 473	87 103	370	0.42%
2008	86 816	86 951	–135	–0.16%
2009	80 328	80 119	210	0.26%
2010	84 753	84 931	–178	–0.21%
2011	82 460	82 450	11	0.01%
2012	79 811	79 917	–106	–0.13%
2013	80 352	80 178	174	0.22%
2014	76 680	76 442	238	0.31%
2015	78 897	78 856	42	0.05%
2016	79 596	79 673	–77	–0.10%

Table 6: Recalculations per sector.

	Submission 2019		Submission 2018		Recalculation Difference	
THG	**1990**	**2016**	**1990**	**2016**	**1990**	**2016**
	[Mt CO_2e]		**[Mt CO_2e]**		**[Mt CO_2e]**	
Total	**79.67**	**79.60**	**78.69**	**79.67**	**–0.02**	**–0.08**
Energy	52.95	54.28	52.91	54.34	0.03	–0.06
IPPU	13.66	16.39	13.66	16.47	0.00	–0.07
Agriculture	8.14	7.37	8.19	7.29	–0.05	0.08
Waste	3.93	1.56	3.93	1.58	0.00	–0.02

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 CH_4 in 2016 were revised upwards, whereas emissions of CO_2, N_2O and fluorinated compounds were revised downwards.

Revisions for CH_4 and N_2O are mainly driven by improvements in sector Agriculture. Revised N_2O is attributable mainly to revised data from source category animal manure applied to soils (*3.D.1.2.a*). These revisions were on the one hand due to updated activity data as a new study on the agricultural practice in Austria has been carried out. On the other hand improvements of the N-flow model have been implemented in the national calculation model.

Revisions of CH_4 are due to revised estimates in subcategory 3.*B Manure Management* (strongest impact for cattle). As described above, new data on agricultural practices was taken from a comprehensive national survey. Furthermore, methodological improvements in this sector (application of Tier 2 methodology for sheep, goats, poultry and deer) have been carried out.

Table 7: Recalculations per gas.

	1990 (Base year)	2016
	Recalculation Difference [%]	
Total	**–0.03%**	**–0.10%**
CO_2	0.05%	–0.13%
CH_4	–0.41%	0.77%
N_2O	–0.18%	–0.87%
HFC, PFC, SF_6, NF_3	0.00%	–0.40%

without emissions from LULUCF

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 1990–2016 will be given in Austria's National Inventory Report 2019.

3.3.1 Energy

3.3.1.1 Stationary sources

The energy balance was revised by Statistik Austria for the years 1990 to 2016 with the following main implications on energy consumption and CO_2 emissions:

- Natural gas gross inland consumption 2003 and 2004 has been revised downwards by –1.0 to –1.2 PJ which leads to –54 to –66 kt of CO_2 emissions. Natural gas gross inland consumption 2015 to 2016 has been revised downwards by –0.2 and –2.7 PJ, which leads to –149 kt lower CO_2 emissions in 2016. Natural gas consumption of the oil refinery has been revised downwards for the period 2012 to 2016 by –2.1 PJ to –5.0 PJ (–3.4 PJ in 2016) and has been mainly shifted to the final energy consumption. For the years 2013 to 2016 between –0.1 to –2.1 PJ (2016: –0.1 PJ) of natural gas has been shifted from power plants to final energy consumption. As a result, natural gas final energy consumption for the period 2011–2016 has been revised by +1.1 to +6.2 PJ (2016: +1.4 PJ). Natural gas consumption of private households (*1.A.4.b*) 2005 to 2016 has been strongly revised upwards (e.g, +19.7 PJ or +1091 kt CO_2 in 2005 and +9.8 PJ or +541 kt CO_2 in 2016) which has been mainly shifted from the commercial sector (*1.A.4.a*) but for 2012 to 2016 also from the industrial sector (*1.A.2*) and the oil refinery (*1.A.1.b*).
- For liquid fuels minor revisions have been made for the period 1990 to 2004, mostly because data from the Eurostat/JQ has been replaced by data from the national energy balance. Total effects of this revision imply +30 kt CO_2 from liquid fuels in 1990 and +13 kt CO_2 in 2004 with a maximum of +129 kt CO_2 in 2003. Gasoil gross inland consumption 2006 to 2016 has been revised between +4,7 PJ and –2.6 PJ (2016: –2.6 PJ), which mostly affects CRF category *1.A.4 Other sectors* and for the years 2014 and 2015 also category CRF *1.A.2 Manufacturing industries and construction* (+3.4 PJ and +1.9 PJ). Total revisions of liquid fuels consumption 2005 to 2016 are between –1.7 PJ and +6 PJ (2016: +1.3 PJ) or –116 kt CO_2 and +519 kt CO_2 (2016: +43 kt CO_2) with a maximum in the year 2007.

  As CO_2 emissions from the oil refinery (*1.A.1.b*) are taken from the ETS and natural gas consumption has been revised downwards for 2012 to 2016, CO_2 emissions from liquid fuels have been revised between +114 and +279 kt CO_2 for those years (2016: +191 kt CO_2).
- For solid fuels minor revisions of gross inland consumption have been made for the years 1999 (+0.4 PJ) and 2003 to 2016 (between –1.4 PJ and +2.5 PJ). CO_2 emissions 2005 to 2016 from solid fuels have been revised between –98 kt and –11 kt (2016: –11 kt CO_2), which mainly affected category *1.A.4 Other sectors*. Furthermore, CO_2 emissions 2005 to 2016 (between –57 kt and +10 kt) of iron and steel industries (*1.A.2.a*) been shifted from or to process related blast furnace emissions (*2.C.1.a*) which is due to the revision of the energy balance.
- For ‘other fuels’ the major revision of the energy balance took place for the years 2005 to 2016, mainly for industrial waste. A major revision of 2016 was the reallocation of industrial waste (–4.2 PJ) to municipal solid waste (+2.6 PJ). Total revisions of industrial waste and MSW resulted in 76 kt lower CO_2 emissions from ‘other fuels’ in category public electricity and heat production (*1.A.1.a*) and +94 kt in the chemicals industry category (*1.A.2.c*) the year 2016.

Other methodological improvements

- For the years 2013 to 2017, ETS activity data and CO_2 emissions of special liquid waste fuels from non-ferrous metals industries (*1.A.2.b*) have been included in the inventory which resulted in changes between 12 and 14 kt CO_2.

3.3.1.2 Mobile sources

Update of activity data

1.A.3.a Aviation

A small error in the calculation of IFR flights with kerosene for 2016 was corrected.

Revision 2016: –0.01 kt CO_2e

Update/Improvement of methodology

1.A.3.b Road transport

Using the most recent version of the emission calculation model NEMO of Graz University of Technology, updates and improvements of methodology and activity data always result in recalculations of all emission components. This year's emission increase is due to a recalculation of inland diesel consumption and the introduction of a new emission source:

- Domestic diesel consumption has increased as a result of a methodological update for the use of mobile agricultural machinery (NRMM). In the model GEORG of the Graz University of Technology, the growth indicator "grain harvest" was re-analysed and an improved method for the time series 2005–2016 implemented.
- In domestic road transport, a slight emission increase occurs due to an update of the default probabilities for PC, LDV and HDV based on stock data after their year of first registration by Statistics Austria, valid in the NEMO model from 2010 onwards.

According to the bottom-up /op-down methodology for the calculation of domestic fuel consumption and fuel export, an increased use of domestic diesel always results in a reduction of the quantities handled in fuel export. As fuel export is mainly characterised by truck traffic, the emission reduction is strongly reflected in subsector 1.A.3.b.3 Heavy duty trucks and buses.

- In a next step emissions have been increased due to adding a new emission source. According to the 2006 IPCC GLs (volume 2, chapter 3, section 'CO_2 emissions from biofuels' in page 3.17): "it is important to assess the biofuel origin so as to identify and separate fossil from biogenic feedstocks". In other words, a part of the carbon of biofuels (and the associated CO_2 emissions) may have a fossil origin. Following, the CO_2 from fossil methanol in the production of biodiesel (FAME) has been accounted for in this year's submission and leads to an increase in emissions in every vehicle sub-category, where blended or pure biodiesel is used.

The mentioned improvements lead to an overall increase of emissions for *Road transport* (+30.6 kt CO_2e) for the year 2016.

Mobile Combustion (NRMM)

The CO_2 from fossil methanol in the production of biodiesel (FAME) has been accounted for in this year's submission and leads to an increase in emissions in every off-road sub-category (mobile machinery in the industry, residential, agriculture and forestry sector, railways and navigation.

1.A.4.c.2 Mobile Combustion (NRMM) in agriculture

In the model GEORG of the Graz University of Technology, the growth indicator "grain harvest" was reanalysed and an improved method for the time series 2005–2016 implemented.

The mentioned improvements lead to an overall increase of emissions (+44 kt CO_2e) for the year 2016.

3.3.1.3 Fugitive Emissions

1.B.2.a.4 Refining/Storage

Recalculations in CH_4 emissions in the category *1.B.2.a.4* (Refining/Storage) for the years 2005–2016 are due to revision of the energy balance by Statistik Austria. This revision leads to a decrease of 0.00002 kt CH_4 (–0.01%; –0.0004 kt CO_2e) in 2016.

3.3.2 Industrial Processes and Other Product Use

Update of activity data

2.B.1 Ammonia Production

Due to updated data of urea used in traffic (see below, *2.D.3*) from 2006–2015, the CO_2 emissions in sector 2.B.1 also changed to –0.9 kt CO_2e in 2016.

2.C.1.a Steel Basic Oxygen Furnace Steel Plant

Due to recalculations in the IEA Joint Questionnaire the time series from 2005 changed. This results in +6.5 kt CO_2 in 2016

2.D.1 Lubricant Use: Due to recalculations in the IEA Joint Questionnaire the time series changed from 2005 onwards. This results in a decrease of 0.14 kt CO_2e in 2005, 0.28 kt CO_2e in 2006, 1.07 kt CO_2e, 0.36 kt CO_2e in 2007, 1.09 kt CO_2e in 2011, 13.3 kt CO_2e in 2012, 0.23 kt CO_2e in 2014, 0.77 kt CO_2e in 2015, and 0.03 kt CO_2e in 2016, as well as an increase of 2.9 kt CO_2e in 2009, 3.7 kt CO_2e in 2010, and 1.5 kt CO_2e in 2013.

2.F.1. Refrigeration and Air Conditioning

Emissions of R134a in Transport Refrigeration were recalculated. As R134a used in Transport refrigeration is bought from the same importers that supply companies in commercial and Industrial refrigeration, the decrease in R136a

in Transport Refrigeration means that more cooling agent is used in Commercial and Industrial Refrigeration. This led to an increase of emissions of between 4.6–5.1 kt CO_2e between 2013 and 2015, and 10.9 kt CO_2e in 2016, compared to the last inventory.

2.F.1.d Transport Refrigeration

As new data obtained from the companies in question became available, use of R134a and R404a were re-evaluated. This led to a decrease of emissions of between 3–9.1 kt CO_2e between 2013 and 2015, and of 11.9 kt CO_2e in 2016, compared to the last submission.

2.F.1.f Stationary Air Conditioning

New data became available on the refrigerants used, filling amounts and numbers of imported equipment. Information on R32 had not been available, which has been used increasingly in recent years. A transcription error could also be found, which affected emissions reaching back to 2002. Taking the new information into account, this led to a decrease in emissions of 7.4 kt CO_2e in 2016, compared to the last submission, and an increase of emissions between 0.6–7.9 kt CO_2e between 2002 and 2014. The decrease of the last two years is mainly due to updated numbers of the amount of R32 used in equipment, which had been underestimated. Due to the lower GWP of this particular refrigerant, total emissions decreased.

Improvements of methodologies and emission factors

2.D.3.a Solvent Use

The old model was updated with reports on actual NMVOC emissions based on solvents used/emitted, reported under directive 1999/13/EC (VOC Solvents Directive) The data obtained was then allocated to the relevant SNAPs. Data on the number of employees per company were obtained as well as statistical data on the total amount of employees per economical sector, and total activity and emission data per sector (SNAP) was thus calculated (bottom – up approach). For the top down sum, the statistical data used for estimating the overall solvent use in Austria was re-evaluated for the years 2000 onwards: import-export/production statistics were screened for further items that weren't considered, but should have been considered, as well as for items that used to be considered, but might qualify as non-solvent uses. In addition, further non-solvent uses were evaluated by the Institute for Industrial Ecology (IIÖ).

Both changes (cumulated with other minor methodological changes as explained above) resulted in a decrease of the top down value for overall solvent consumption. Domestic solvent uses were also amended, using information obtained on paints and varnishes, and products statistics that werecross referenced with average solvent contents, obtained from Germany.
This led to a decrease of emissions in sector 2.D. of up to –61.1 kt CO_2e between 2000 and 2015 and 60.1 kt in 2016.

3.3.3 Agriculture

Update of activity data

3.B Manure Management, 3.D Agricultural Soils

AWMS data

The research project 'Animal husbandry and manure management systems in Austria (TIHALO I, AMON et al. 2007)' has been followed-up by a new investigation (TIHALO II, PÖLLINGER et al. 2018[16]). In this project, as in its predecessor, a comprehensive survey on the agricultural practices in Austria has been carried out. The results of this study (data on livestock feeding, management systems and practices, application techniques) were used as the basis for the calculation of Austria's emission inventory in submission 2019 resulting in revisions for CH_4 and N_2O emissions in all animal related emission sources.

Although the biggest revisions were recorded in Austria's ammonia inventory, there are some inventory updates with significant impacts to Austria's GHG inventory, e.g.:

- Increased share of liquid systems (cattle)
- Introduction of the system 'deep litter < 1 month'
- Improved calculations for the non-key animals sheep, goats and poultry

Livestock data

In response to a recommendation of the NEC Review 2018, Austria splitted the piglets numbers < 20 kg into suckling piglets < 8 kg and weaned piglets 8–20 kg. The share of suckling and weaned piglets was calculated on the basis of daily weight gain and official livestock data (STATISTIK AUSTRIA 2018[17]). This approach was accepted by the NEC Review 2018 and applied for all inventory years.

3.D.a.1 Mineral fertilizer application

Total mineral fertilizer application data for the years 1990–1995 was corrected. This was a result of inventory improvements carried out within the NH_3 calculations (switch to Tier 2 methodology taking into account the different mineral fertilizer types) including the evaluation of historic fertilizer statistics.

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

As already described, up-to-date information on the agricultural practice in Austria taken from (PÖLLINGER et al. 2018) was implemented resulting in revised emissions (+0.05 kt N_2O in 2016).

[16] PÖLLINGER et al. (2018): Erhebung zum Wirtschaftsdüngermanagement aus der landwirtschaftlichen Tierhaltung in Österreich. Surveys on manure management from agricultural livstock farmings in Austria. Abschlussbericht TIHALO II. Projekt Nr./Wissenschaftliche Tätigkeit Nr. 3662. PÖLLINGER, A.; BRETTSCHUH, S.; LACKNER, L.; STICKLER, Y.; ZENTNER, A.; HBLFA Raumberg Gumpenstein & Bundesanstalt für Agrarwirtschaft, Wien. Bundesministerium für Nachhaltigkeit und Tourismus (BMNT), Wien 2018.

[17] STATISTIK AUSTRIA (2018): Derivation of suckling and weaned piglets numbers on the basis of daily weight gain and official livestock data of piglets < 20 kg. E-mail with expert judgement received on June 18th, 2018.

3.G Liming

The cropland and grassland areas for the years 2014, 2015 and 2016 were slightly revised according to the final results of the farm structure survey 2016 resulting in lower CO_2 emissions for the respective years (–0.1 kt CO_2 for 2016).

3.H Urea Application

Revised data on urea consumption for 1990 and 1991 resulted in slightly lower CO_2 emissions for the respective years (–0.04 kt CO_2 for 1990; –0.4 kt CO_2 for 1991).

Improvements of methodologies and emission factors

3.B Manure Management (CH_4)

Main reason for changed CH_4 emissions is the implementation of TIHALO II study results (e.g. increased share of liquid systems). Additionally, CH_4 calculations for sheep, goats, horses, poultry and deer were improved by applying the IPCC Tier 2 methodology.

The improvements resulted in revised emissions for all reporting years (+4.0 kt CH_4 in 2016).

3.B Manure Management (N_2O)

Austria's agriculture model is based on the N-flow concept. Thus, revisions within Austria's air emission inventory affect calculation results in Austria's GHG inventory.

Main reason for changed N_2O emissions is the implementation of TIHALO II study results (e.g. increased share of liquid systems) including the improvements carried out within Austria's NH_3 and NO_x inventory.

As a consequence, direct and indirect N_2O-emissions from manure management were revised upwards for the whole time series (+0.03 kt N_2O in 2016).

3.D Agricultural Soils (N_2O)

3.D.a.2.a Animal manure applied to soils

The consideration of N_2 losses and improved NO_x calculations in sector manure management within Austria's NEC inventory resulted in smaller N amounts available for application. As a consequence lower N_2O emissions resulted for the whole time series (–0.14 kt N_2O in 2016).

3.D.a.2.c Other Organic Fertilizers Applied to Soils

N_2O emissions from other organic fertilizers applied to soils were updated on the basis of available raw material balances for the years 2015 and 2016 (E-Control 2018). Including the impact of the new AWMS data (PÖLLINGER et al. 2018), the N_2O emissions of this source category were slightly revised upwards in all reporting years (+0.02 kt N_2O in 2016).

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

Amounts of N volatilizing and leaching with manure application decreased slightly. Main reasons are improvements in Austria's NEC inventory, especially the consideration of N_2 losses and improved NO_x calculations in sector 3.B Manure management, resulting in smaller N amounts available for application (–0.03 kt N_2O in 2016).

3.3.4 LULUCF

Revisions of the data series for LULUCF are due to the following changes:

4.A Forest land

No revisions of the time series.

4.B Cropland

The improvements of the assessment of soil C stock changes in cropland remaining cropland which were started last year were continued. The methodological regime for separating the cropland into the different tillage and input types was further adjusted by an additional IACS assessment for one more year, namely for 2002.

The 2014, 2015 and 2016 values of the cropland areas and the LUC areas between grassland and cropland of 2015 and 2016 had to be updated according to the most recent agricultural statistics which has an impact on the C stock changes in these years.

All the recalculations in the cropland category led to changes in the time series of annual emissions/removals of this subcategory in the range of –122 to 120 kt CO_2e per year.

4.C Grassland

The 2014, 2015 and 2016 values of the grassland areas and the LUC areas between grassland and cropland of 2015 and 2016 had to be updated according to the most recent agricultural statistics which has an impact on the C stock changes in these years.

All the recalculations in the grassland category increased the annual emissions of this subcategory by 0.14 to 0.45 kt CO_2e per year in the period 2014−2016.

4.D Wetlands

No revisions of the time series.

4.E Settlements

The emission factor for annual settlement biomass was also adjusted for the improved information on the sealed share of settlement area introduced a few years ago (the emission factor for perennial settlement biomass was already adjusted then).

In addition, the shares of cropland and grassland areas converted to settlement and contributing to the settlement area increase were slightly adjusted which leads to different C stock changes in the settlement category,

All the recalculations in the settlement category led to changes in the time series of annual emissions/removals of this subcategory in the range of –7.1 to +17.1 kt CO_2e per year.

4.F Other lands

No revisions of the time series.

4.G HWPs

The HWP production figures for 2016 were updated in the most recent FAO statistic. Consequently, the removal figures for this year had to be updated accordingly.

The recalculations in the HWP category led to a change in the annual removals of this subcategory for 2016 by –98.1 kt CO_2e per year.

LULUCF KP estimates

The HWP production figures for 2016 were updated in the most recent FAO statistics. Consequently, the removal figures for this year had to be updated accordingly and led to a change in the annual removals of forest management for the year 2016 by –96 kt CO_2e per year.

3.3.5 Waste

Update of activity data

5.A Solid Waste Disposal

Methane emissions for the years 2013–2016 have been revised, due to an update of recovered methane amounts in landfill gas. The data gained through a study by Umweltbundesamt[18], shows higher recovered methane amounts than previously assumed, which leads to lower CH_4 emissions.

5.D Wastewater Treatment and Discharge

Due to new data available on the N-load in waste water for the year 2016 and a lower denitrification rate the N_2O emissions were revised. Furthermore, new data was available for the connection rate to the sewer system for the year 2016, which led to slightly higher emissions of methane and N_2O in 2016 (and 2015 due to interpolation).

[18] Umweltbundesamt (2019) Lampert, C., Thaler P., Deponiegaserfassung 2013−2017

4 NATIONAL INVENTORY SYSTEM

The regulations under the UNFCCC and the Kyoto Protocol define the standard for national emission inventories related to transparency, consistency, comparability, completeness and accuracy (TACCC). Above this, each Party shall have in place a national system[19] 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[20], in Austria's NIR 2018[21] and in the NISA Implementation Report[22].

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[23]), which defines the main responsibility for inventory preparation and identifies the Umweltbundesamt as the single national entity with the overall responsibility for inventory preparation. To comply with the stringent 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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[19] 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

[20] 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.

[21] Umweltbundesamt (2018): Austria's National Inventory Report 2018, Submission under the United Nations Framework Convention on Climate Change and under the Kyoto Protocol. Reports, Bd. REP-0640 . Umweltbundesamt, Vienna.

[22] Umweltbundesamt (2005): NISA National Inventory System Austria, Implementation Report, REP-0004; Umweltbundesamt, Vienna. http://www.umweltbundesamt.at/umweltkontrolle/

[23] „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
Dr. Klaus Radunsky (Head of Inspection Body), DI Michael Anderl (Deputy)
Spittelauer Lände 5
1090 Wien, Austria

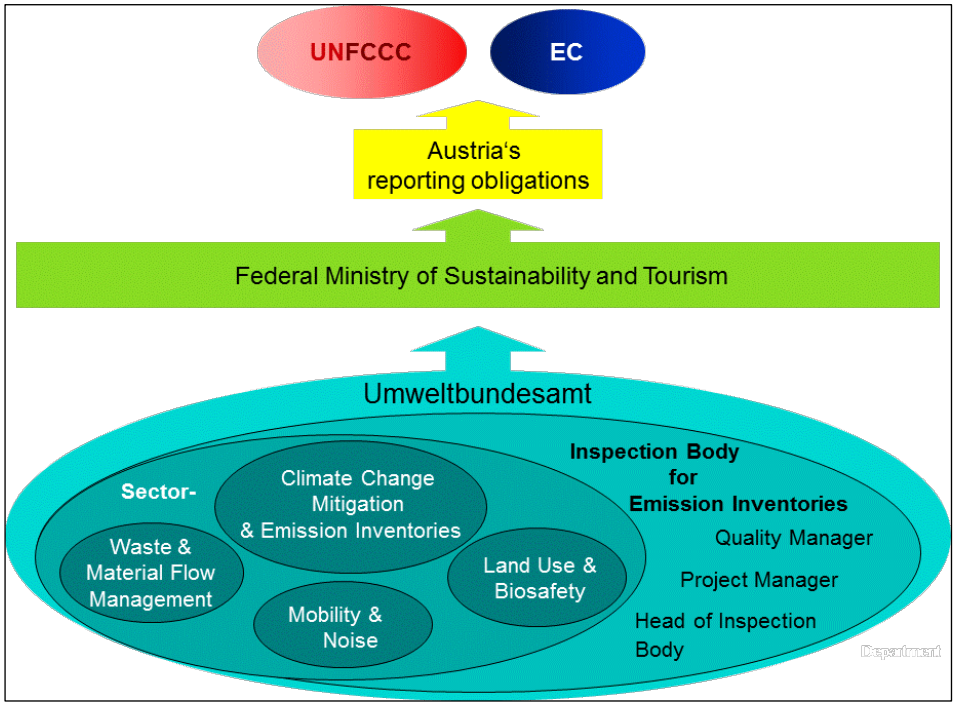

Figure 4: Responsibilities within the Austrian National Inventory System Austria.

The personnel of the Inspection Body for Emission Inventories (IBE) is made up of staff from various organisational units of the Umweltbundesamt (Environment Agency Austria), who in the course of their inspection activity for the IBE are assigned to the IBE and therefore under the head of the inspection body. The head of the inspection body supervises the project manager, who is responsible for coordinating the IBE staff when carrying out their inspections.

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 Single National Entity responsible for inventory preparation including QA/QC.

LEGAL ARRANGEMENT: ENVIRONMENTAL CONTROL ACT[24]

- § 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 Sustainability and Tourism (BMNT)
- Agricultural statistics (public)
- Transport statistics (public)
  Procedural arrangement:
  - close cooperation Umweltbundesamt – Statistic 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

[24] „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 Sustainability and Tourism (BMNT)

As of 8 January 2018 BMNT (previously Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW)) 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 aimed 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.
  - EDM was set up by Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, BMLFUW and operated by Umweltbundesamt

3. Austrian Research Centre for Forests (BFW)

- National Forest inventory
  - **Contract on a regular interval** with the Federal Ministry of Sustainability and Tourism (BMNT)
- 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*: 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 8: 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 growth rates of transport performance on Austrian roads from Austrian Ministry for Transport, Technology and Innovation • Flight movements from AustroControl

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
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)

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[25]
- EMEP/EEA air pollutant emission inventory guidebooks[26]
- Handbook emission factors for road transport (HBEFA), Version 3.2 (KELLER, M./WÜTHRICH, P. 2014)
- 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

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 inspection body (ID No. 0241) in accordance with the

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

[26] Prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections (TFEIP) and published by the European Environment Agency (EEA). Latest update: http://www.eea.europa.eu/publications/emep-eea-guidebook-2016

Austrian Accreditation Law (AkkG)[27] by decree of Accreditation Austria[28]. 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 and 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 grant 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 2018, some aspects and improvements compared to the previous submission are described below (QMS activities and improvements 2018).

The Quality Manual can be downloaded at:
http://www.umweltbundesamt.at/umweltsituation/luft/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). 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 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.

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

[28] 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

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)
- Amon and Hörtenhuber 2018 (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 2018

In 2018 the number of experts involved in inventory work was again increased. As a consequence each key position is double staffed now. Three generalists with long-term experience and five inventory support members supplement the team.

To further strengthen the technical competence of the inventory team five IBE sector experts studied the 'Basic Course for reviewers' in 2018. Meanwhile 12 out of 14 active sector experts have passed the exams for this course (for one or even more sectors). Furthermore two team members passed tests for additional modules for the 'Technical Analysis of Biennial Update Reports' (BURs).

Within the framework of a stakeholder meeting external Austrian agricultural experts reviewed calculation results, assumptions and parameters used in the revised Austrian inventory model for sector agriculture.

4.4 Changes in the national inventory system

The national inventory system is unchanged compared to the description given in this chapter (4) and in the Austrian Initial Report under the Kyoto Protocol[29].

[29] 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 2018:

Table 9: Changes to the national registry of Austria in 2018.

Reporting Item	Description
15/CMP.1 annex II.E paragraph 32.(a) Change of name or contact	Neither the name and contact of the registry administrator as an institution nor the name of the registry administrator and the alternate registry administrator has changed.
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	Note: This part of the chapter contains information of the Union Registry from the European Commission. It shall be provided by DG Climate, B2 − ETS Implementation & IT and was not available to Austria at the time of preparation of this report. This applies also to the database model which shall be provided as Annex A.
15/CMP.1 annex II.E paragraph 32.(d) Change regarding conformance to technical standards	Note: This part of the chapter contains information of the Union Registry from the European Commission. It shall be provided by DG Climate, B2 − ETS Implementation & IT and was not available to Austria at the time of preparation of this report. This applies also to the list of changes, which shall be provided as Annex B, as well as the information to Annex H testing.
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	Note: This part of the chapter contains information of the Union Registry from the European Commission. It shall be provided by DG Climate, B2 − ETS Implementation & IT and was not available to Austria at the time of preparation of this report.
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.
15/CMP.1 annex II.E paragraph 32.(h) Change of Internet address	No change of the registry internet address occurred during the reporting 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.

Reporting Item	Description
15/CMP.1 annex II.E paragraph 32.(j) Change regarding test results	Note: This part of the chapter contains information of the Union Registry from the European Commission. It shall be provided by DG Climate, B2 − ETS Implementation & IT and was not available to Austria at the time of preparation of this report. This applies also to the list of changes, which shall be provided as Annex B, as well as the information to Annex H testing.

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_2019'). Emission trends 1990–2017 (Article 7(1) e) are described in Chapter 2. Changes to the national system and the national registry are presented in Chapter 4 (Article 7(1) n) and Chapter 5 (Article 7(1) o). Article 7(1) p-information is given in Chapter 4.1.3 (QA/QC Plan) and the respective MMR IR reporting template ('MMR-IRArticle14_Uncertainty_AT_2019').

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, for the year 2017 is reported as a separate file ('Annex_II_AT_Indicators_2019') 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 2018 is reported as a separate file ('SEF_AT_CP2_2018_20190108') in xls 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 2018 has been reported as XML file in the directory 'Concluded transfers 2018' 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 ('AT_Art-7-1-i_Mechanisms_2019') 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.

In 2018 Austria was reviewed by the UNFCCC. Results of this review – conducted as a desk review – are not published yet, but a draft of the review report was provided to Austria for consideration and comment on 20 November 2018. Information on the implementation of the recommendations made is provided in the template 'MMR-IRArticle9_recommendations_AT_2019'.

The initial check of ESD emissions under Art. 19(2) of Regulation EU No 525/2012 in 2018 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 2017 is reported as a separate file ('MMR-IRArticle10_ETS_AT_2019').

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 2018.

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 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 2017 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 2017 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

BMNT ..... Bundesministerium für Nachhaltigkeit und Tourismus
Federal Ministry of Sustainability and Tourism

BMWA..... Bundesministerium für Wirtschaft und Arbeit
Federal Ministry for Economic Affairs and Labour (renamed as BMWFJ)

BMWFJ ..... Bundesministerium für Wirtschaft, Familie und Jugend
Federal Ministry of Economy, Family and Youth (formerly called BMWA)

CDR ..... Central Data Repository

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

GHG..... Greenhouse Gas

GLOBEMI..... Globale Modellbildung für Emissions- und Verbrauchsszenarien im Verkehrssektor
(Global Modelling for Emission- and Fuel consumption Scenarios of the Transport Sector) see (HAUSBERGER 1998)

GWP ..... Global Warming Potential

IBE ..... Inspection Body for Emission Inventories

IPCC ..... Intergovernmental Panel on Climate Change

IEA ..... International Energy Agency

ISO ..... International Standards Organisation

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

LULUCF ..... Land Use, Land-Use Change and Forestry – IPCC CRF Category 5

MMR ..... Monitoring Mechanism Regulation

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

NEMO ..... Network Emission Model

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
Total Emissions/Removals with LULUCF	**66 682**	**63 996**	**81 907**	**84 948**	**81 976**	**82 554**	**75 796**	**78 889**	**76 369**	**74 344**	**75 835**	**71 956**	**74 346**	**75 217**	**77 355**
Total Emissions without LULUCF	**78 670**	**80 415**	**92 566**	**90 117**	**87 473**	**86 816**	**80 328**	**84 753**	**82 460**	**79 811**	**80 352**	**76 680**	**78 897**	**79 596**	**82 261**
1. Energy	**52 946**	**55 403**	**67 138**	**64 162**	**60 935**	**59 930**	**56 882**	**59 563**	**57 283**	**55 188**	**55 520**	**51 696**	**53 409**	**54 279**	**56 272**
A. Fuel Combustion (Sectoral Approach)	52 244	54 907	66 701	63 696	60 464	59 498	56 402	59 095	56 822	54 714	55 049	51 257	52 985	53 887	55 845
1. Energy Industries	14 100	12 397	16 397	15 230	14 018	13 829	12 852	14 028	13 777	12 400	11 320	9 641	10 792	10 563	11 195
2. Manufacturing Industries and Construction	9 900	10 085	11 708	11 366	11 054	11 383	10 820	11 393	11 299	11 154	11 230	10 852	10 457	10 558	11 052
3. Transport	13 975	18 818	24 944	23 674	23 892	22 414	21 753	22 568	21 912	21 730	22 911	22 206	22 676	23 519	24 266
4. Other Sectors	14 234	13 566	13 607	13 382	11 454	11 824	10 930	11 059	9 785	9 381	9 539	8 509	9 011	9 196	9 281
5. Other	36	42	45	45	46	46	47	47	48	48	49	50	50	51	51
B. Fugitive Emissions from Fuels	702	496	437	465	472	432	480	468	461	474	472	438	424	392	427
1. Solid Fuels	333	27	0	0	–	–	–	–	–	–	–	–	–	–	–
2. Oil and Natural Gas	369	469	437	465	472	432	480	468	461	474	472	438	424	392	427
C. CO_2Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes and Other Product Use	**13 662**	**14 610**	**15 600**	**16 257**	**16 912**	**17 249**	**13 922**	**15 930**	**15 970**	**15 571**	**15 902**	**16 017**	**16 602**	**16 395**	**17 197**
A. Mineral Industry	3 092	2 733	2 889	3 053	3 266	3 276	2 715	2 661	2 779	2 704	2 720	2 722	2 740	2 788	2 800
B. Chemical Industry	1 555	1 624	943	983	909	1012	793	785	788	762	700	815	793	806	746
C. Metal Industry	8 177	8 480	9 595	10 070	10 533	10 736	8 415	10 266	10 298	9 954	10 311	10 256	10 806	10 443	11 207
D. Non-Energy Products from Fuels and Solvent Use	349	198	177	192	195	190	167	170	166	157	160	141	144	145	148

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
E. Electronics Industry	134	420	352	370	391	371	114	150	119	101	90	97	107	92	92
F. Product Uses as Substitutes for ODS	NO	709	1 143	1 149	1 189	1 240	1 308	1 484	1 412	1 490	1 518	1 585	1 613	1 630	1 720
G. Other Product Manufacture and Use	355	446	500	441	428	424	410	414	409	403	404	401	399	491	484
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**8 137**	**7 438**	**7 037**	**7 027**	**7 082**	**7 206**	**7 240**	**7 103**	**7 164**	**7 110**	**7 106**	**7 246**	**7 249**	**7 365**	**7 308**
A. Enteric Fermentation	4 821	4 387	4 147	4 135	4 151	4 145	4 200	4 190	4 137	4 110	4 117	4 136	4 131	4 147	4 156
B. Manure Management	986	908	864	874	894	896	921	932	930	935	946	960	972	985	1 002
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	2 234	2 043	1 922	1 913	1 928	2 058	2 007	1 873	1 991	1 956	1 934	2 037	2 034	2 117	2 034
E. Prescribed Burning of Savannas	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
G. Liming	90	90	91	90	89	88	88	88	87	87	86	86	85	85	84
H. Urea application	4	8	12	15	18	17	22	20	18	22	22	25	26	31	30
I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Land Use, Land-Use Change and Forestry	**-11 988**	**-16 419**	**-10 659**	**-5 169**	**-5 497**	**-4 262**	**-4 532**	**-5 864**	**-6 091**	**-5 467**	**-4 517**	**-4 724**	**-4 551**	**-4 379**	**-4 906**
A. Forest Land	-10 862	-15 975	-8 774	-2 959	-1 931	-1 036	-4 474	-4 441	-4 408	-4 375	-4 342	-4 309	-4 302	-4 295	-4 288
B. Cropland	190	-36	-155	-144	-199	-182	-212	-217	-223	-231	-215	-187	-92	-27	26
C. Grassland	650	472	679	678	677	672	378	377	376	375	376	377	375	357	340
D. Wetlands	42	36	47	37	39	51	68	69	73	70	101	71	59	77	67

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
E. Settlements	642	579	659	656	633	668	574	549	531	541	500	503	475	462	456
F. Other Land	457	380	333	324	316	307	222	214	206	197	189	181	177	173	170
G. Harvested Wood Products	-3 122	-1 889	-3 461	-3 776	-5 046	-4 756	-1 102	-2 427	-2 659	-2 058	-1 141	-1 375	-1 257	-1 140	-1 690
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Waste	**3 925**	**2 963**	**2 791**	**2 671**	**2 543**	**2 431**	**2 285**	**2 158**	**2 043**	**1 942**	**1 824**	**1 721**	**1 638**	**1 557**	**1 484**
A. Solid Waste Disposal on Land	3 644	2 667	2 438	2 314	2 184	2 074	1 929	1 803	1 686	1 583	1 472	1 364	1 275	1 186	1 114
B. Biological Treatment of Solid Waste	36	83	151	157	162	164	165	167	170	174	166	172	175	180	178
C. Incineration and Open Burning of Waste	28	12	12	10	8	6	4	2	2	2	2	2	2	2	2
D. Waste Water Treatment and Discharge	217	201	189	190	189	187	187	186	185	184	183	183	185	189	190
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:															
International bunkers	**950**	**1 793**	**2 069**	**2 148**	**2 281**	**2 281**	**1 978**	**2 148**	**2 259**	**2 164**	**2 070**	**2 067**	**2 206**	**2 407**	**2 330**
Aviation	896	1 713	1 980	2 070	2 199	2 205	1 913	2 071	2 191	2 095	1 996	1 998	2 149	2 344	2 265
Navigation	55	80	89	78	83	76	65	77	67	69	74	69	57	62	65
Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	**10 403**	**12 758**	**15 020**	**16 751**	**18 155**	**18 917**	**19 770**	**21 774**	**21 427**	**22 545**	**23 806**	**22 292**	**22 597**	**22 494**	**22 439**
CO_2 captured	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Long-term storage of C in waste disposal sites	**22 779**	**27 614**	**29 341**	**29 518**	**29 679**	**29 794**	**29 862**	**29 926**	**29 998**	**30 042**	**30 090**	**30 135**	**30 170**	**30 205**	**30 244**

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
Total Emissions/Removals with LULUCF	**50 166**	**49 735**	**68 579**	**71 735**	**68 816**	**69 307**	**63033**	**66 206**	**63 893**	**61 952**	**63 486**	**59 585**	**62 022**	**62 775**	**64 910**
Total Emissions without LULUCF	**62 323**	**66 313**	**79 395**	**77 061**	**74 469**	**73 727**	**67 724**	**72 228**	**70 143**	**67 577**	**68 161**	**64 467**	**66 733**	**67 315**	**69 979**
1. Energy	**51 329**	**54 151**	**65 980**	**62 977**	**59 758**	**58 762**	**55 726**	**58 345**	**56 097**	**53 992**	**54 267**	**50 529**	**52 233**	**53 100**	**55 061**
A. Fuel Combustion (Sectoral Approach)	51 227	53 986	65 820	62 797	59 573	58 600	55 521	58 162	55 918	53 809	54 076	50 361	52 071	52 968	54 923
1. Energy Industries	14 049	12 342	16 312	15 131	13 912	13 716	12 735	13 891	13 637	12 259	11 183	9 513	10 658	10 432	11 066
2. Manufacturing Industries and Construction	9 817	9 949	11 542	11 193	10 876	11 210	10 654	11 231	11 137	10 991	11 066	10 689	10 302	10 407	10 900
3. Transport	13 777	18 645	24 759	23 492	23 707	22 235	21 575	22 380	21 727	21 541	22 708	22 003	22 468	23 306	24 046
4. Other Sectors	13 548	13 009	13 163	12 937	11 034	11 395	10 511	10 613	9 370	8 970	9 071	8 107	8 594	8 774	8 861
5. Other	35	41	44	44	45	45	46	46	47	47	48	49	49	50	50
B. Fugitive Emissions from Fuels	102	165	160	180	185	162	205	184	180	184	191	169	162	131	138
1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	102	165	160	180	185	162	205	184	180	184	191	169	162	131	138
C. CO_2 Transport and Storage	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**	**13 300**	**13 969**	**14 596**	**14 853**	**11 884**	**13 774**	**13 938**	**13 474**	**13 784**	**13 825**	**14 386**	**14 097**	**14 801**
A. Mineral Industry	3 092	2 733	2 889	3 053	3 266	3 276	2 715	2 661	2 779	2 704	2 720	2 722	2 740	2 788	2 800
B. Chemical Industry	644	674	644	666	601	652	588	678	695	665	603	721	699	724	661
C. Metal Industry	6 786	8 445	9 590	10 057	10 533	10 735	8 414	10 266	10 298	9 949	10 302	10 241	10 804	10 441	11 192
D. Non-Energy Products from Fuels and Solvent Use	349	198	177	192	195	190	167	170	166	157	160	141	144	145	148

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
E. Electronics Industry															
F. Product Uses as Substitutes for ODS															
G. Other Product Manufacture and Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**94**	**99**	**103**	**105**	**107**	**105**	**110**	**107**	**106**	**108**	**108**	**111**	**112**	**116**	**114**
A. Enteric Fermentation															
B. Manure Management															
C. Rice Cultivation															
D. Agricultural Soils															
E. Prescribed Burning of Savannas															
F. Field Burning of Agricultural Residues															
G. Liming	90	90	91	90	89	88	88	88	87	87	86	86	85	85	84
H. Urea application	4	8	12	15	18	17	22	20	18	22	22	25	26	31	30
I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Land Use, Land-Use Change and Forestry	**-12 157**	**-16 578**	**-10 815**	**-5 326**	**-5 653**	**-4 420**	**-4 691**	**-6 022**	**-6 249**	**-5 626**	**-4 675**	**-4 882**	**-4 711**	**-4 540**	**-5 069**
A. Forest Land	-10 892	-15 999	-8 797	-2 982	-1 954	-1 060	-4 498	-4 465	-4 432	-4 399	-4 366	-4 333	-4 326	-4 320	-4 313
B. Cropland	176	-49	-168	-158	-214	-199	-229	-234	-240	-248	-233	-206	-113	-51	-0
C. Grassland	626	448	655	654	653	648	354	353	352	351	352	354	351	334	316
D. Wetlands	42	36	47	37	39	51	68	69	73	70	101	71	59	77	67

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
E. Settlements	570	509	589	587	565	599	504	479	460	470	430	433	406	394	389
F. Other Land	444	366	320	312	304	296	211	204	196	188	181	173	170	166	162
G. Harvested Wood Products	-3 122	-1 889	-3 461	-3 776	-5 046	-4 756	-1 102	-2 427	-2 659	-2 058	-1 141	-1 375	-1 257	-1 140	-1 690
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Waste	**28**	**12**	**12**	**10**	**8**	**6**	**4**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Biological Treatment of Solid Waste															
C. Incineration and Open Burning of Waste	28	12	12	10	8	6	4	2	2	2	2	2	2	2	2
D. Waste Water Treatment and Discharge															
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items:															
International bunkers	**935**	**1 768**	**2 040**	**2 119**	**2 251**	**2 252**	**1 953**	**2 120**	**2 231**	**2 137**	**2 044**	**2 041**	**2 180**	**2 383**	**2 306**
Aviation	886	1 696	1 960	2 049	2 176	2 182	1 893	2 050	2 168	2 073	1 975	1 977	2 127	2 325	2 246
Navigation	49	72	80	70	75	70	60	71	62	64	69	64	53	58	60
Multilateral operations	**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
Total Emissions/Removals with LULUCF	**415.49**	**336.78**	**310.87**	**306.87**	**302.64**	**297.67**	**294.81**	**291.19**	**283.36**	**278.90**	**276.61**	**270.97**	**268.07**	**265.66**	**264.86**
Total Emissions without LULUCF	**414.52**	**335.82**	**309.91**	**305.91**	**301.69**	**296.71**	**293.85**	**290.23**	**282.41**	**277.94**	**275.65**	**270.01**	**267.11**	**264.70**	**263.90**
1. Energy	**47.36**	**29.76**	**23.82**	**24.38**	**24.01**	**23.53**	**23.67**	**25.13**	**23.97**	**24.44**	**25.93**	**23.38**	**23.73**	**23.74**	**24.97**
A. Fuel Combustion (Sectoral Approach)	23.37	16.49	12.74	12.98	12.53	12.72	12.66	13.76	12.71	12.80	14.71	12.60	13.22	13.32	13.41
1. Energy Industries	0.34	0.40	0.62	0.72	0.77	0.84	0.91	1.03	1.03	1.06	1.02	0.98	1.04	1.05	1.04
2. Manufacturing Industries and Construction	0.54	0.65	0.84	0.87	0.94	0.91	0.87	0.88	0.89	0.90	0.92	0.93	0.88	0.86	0.89
3. Transport	2.74	1.17	0.96	0.86	0.79	0.70	0.65	0.61	0.57	0.53	0.50	0.47	0.46	0.44	0.42
4. Other Sectors	19.75	14.27	10.32	10.53	10.04	10.27	10.22	11.24	10.22	10.32	12.26	10.22	10.84	10.97	11.06
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
B. Fugitive Emissions from Fuels	23.99	13.27	11.08	11.40	11.48	10.80	11.01	11.37	11.26	11.63	11.22	10.78	10.51	10.42	11.55
1. Solid Fuels	13.33	1.09	0.01	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	10.66	12.18	11.08	11.39	11.48	10.80	11.01	11.37	11.26	11.63	11.22	10.78	10.51	10.42	11.55
C. CO_2 Transport and Storage															
2. Industrial Processes and Other Product Use	**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**
A. Mineral Industry															
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
C. Metal Industry	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
D. Non-Energy Products from Fuels and Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Electronics Industry															
F. Product Uses as Substitutes for ODS															
G. Other Product Manufacture and Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**214.63**	**194.05**	**183.01**	**182.89**	**184.17**	**184.13**	**187.00**	**186.99**	**185.01**	**184.18**	**184.89**	**186.14**	**186.32**	**187.40**	**188.32**
A. Enteric Fermentation	192.82	175.47	165.86	165.38	166.06	165.81	167.99	167.59	165.50	164.41	164.69	165.45	165.23	165.87	166.26
B. Manure Management	21.76	18.54	17.10	17.46	18.06	18.27	18.98	19.37	19.48	19.75	20.17	20.66	21.06	21.51	22.04
C. Rice Cultivation	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
E. Prescribed Burning of Savannas	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	NA
G. Liming															
H. Urea application															
I. Other carbon-containing fertilizers															
J. Other	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**
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
B. Cropland	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	NO,IE	NO,IE	NO,IE	NO,IE

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
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
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	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
G. Harvested Wood Products															
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Waste	**151.13**	**110.61**	**101.63**	**96.73**	**91.61**	**87.17**	**81.34**	**76.24**	**71.55**	**67.45**	**62.87**	**58.62**	**55.19**	**51.70**	**48.75**
A. Solid Waste Disposal on Land	145.76	106.67	97.51	92.55	87.36	82.94	77.16	72.10	67.45	63.30	58.89	54.55	51.01	47.45	44.56
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
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
D. Waste Water Treatment and Discharge	4.85	2.68	1.64	1.48	1.39	1.29	1.20	1.10	1.05	1.00	0.96	0.92	0.93	0.94	0.95
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items:															
International bunkers	**0.02**	**0.03**	**0.04**	**0.04**	**0.05**	**0.05**	**0.04**	**0.04**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.02**	**0.02**
Aviation	0.01	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.05	0.02	0.01
Navigation	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
Multilateral operations	**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
Total Emissions/Removals with LULUCF	**15.01**	**14.95**	**12.49**	**12.51**	**12.55**	**13.16**	**12.42**	**11.75**	**12.06**	**11.94**	**11.92**	**12.19**	**12.20**	**12.48**	**12.23**
Total Emissions without LULUCF	**14.53**	**14.50**	**12.05**	**12.06**	**12.10**	**12.71**	**11.97**	**11.29**	**11.61**	**11.48**	**11.46**	**11.74**	**11.74**	**12.02**	**11.76**
1. Energy	**1.45**	**1.70**	**1.89**	**1.93**	**1.94**	**1.95**	**1.89**	**1.98**	**1.97**	**1.96**	**2.03**	**1.95**	**1.97**	**1.96**	**1.96**
A. Fuel Combustion (Sectoral Approach)	1.45	1.70	1.89	1.93	1.94	1.95	1.89	1.98	1.97	1.96	2.03	1.95	1.96	1.97	1.97
1. Energy Industries	0.14	0.15	0.23	0.27	0.29	0.31	0.32	0.37	0.38	0.38	0.37	0.35	0.36	0.35	0.35
2. Manufacturing Industries and Construction	0.23	0.40	0.49	0.51	0.52	0.51	0.48	0.47	0.47	0.47	0.47	0.47	0.44	0.43	0.44
3. Transport	0.43	0.48	0.54	0.54	0.55	0.54	0.54	0.58	0.58	0.59	0.64	0.64	0.66	0.68	0.70
4. Other Sectors	0.64	0.67	0.62	0.61	0.57	0.58	0.55	0.55	0.54	0.51	0.54	0.49	0.49	0.50	0.48
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
B. Fugitive Emissions from Fuels	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
2. Oil and Natural Gas	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
2. Industrial Processes and Other Product Use	**3.69**	**3.82**	**1.44**	**1.43**	**1.39**	**1.56**	**1.00**	**0.69**	**0.63**	**0.62**	**0.62**	**0.61**	**0.61**	**0.57**	**0.57**
A. Mineral Industry															
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
C. Metal Industry	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

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
E. Electronics Industry															
F. Product Uses as Substitutes for ODS															
G. Other Product Manufacture and Use	0.75	0.75	0.56	0.53	0.52	0.51	0.47	0.48	0.47	0.45	0.46	0.45	0.45	0.45	0.44
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**8.98**	**8.35**	**7.92**	**7.89**	**7.96**	**8.38**	**8.24**	**7.79**	**8.17**	**8.04**	**7.97**	**8.33**	**8.32**	**8.60**	**8.34**
A. Enteric Fermentation															
B. Manure Management	1.48	1.49	1.47	1.47	1.49	1.47	1.50	1.50	1.49	1.48	1.48	1.49	1.49	1.50	1.51
C. Rice Cultivation															
D. Agricultural Soils	7.50	6.86	6.45	6.42	6.47	6.91	6.74	6.29	6.68	6.56	6.49	6.84	6.82	7.10	6.82
E. Prescribed Burning of Savannas	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
G. Liming															
H. Urea application															
I. Other carbon-containing fertilizers															
J. Other	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**	**0.45**	**0.44**	**0.44**	**0.45**	**0.45**	**0.45**	**0.45**	**0.45**	**0.45**	**0.45**	**0.45**	**0.46**	**0.46**	**0.47**
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
B. Cropland	0.05	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09
C. Grassland	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

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
E. Settlements	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.22
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
G. Harvested Wood Products															
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Waste	**0.40**	**0.62**	**0.80**	**0.81**	**0.82**	**0.82**	**0.83**	**0.84**	**0.84**	**0.85**	**0.84**	**0.85**	**0.86**	**0.88**	**0.88**
A. Solid Waste Disposal on Land															
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
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
D. Waste Water Treatment and Discharge	0.32	0.45	0.50	0.51	0.52	0.52	0.53	0.53	0.53	0.53	0.53	0.54	0.54	0.55	0.56
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items:															
International bunkers	**0.05**	**0.08**	**0.09**	**0.09**	**0.10**	**0.10**	**0.08**	**0.09**	**0.09**	**0.09**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**
Aviation	0.03	0.06	0.07	0.07	0.07	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06
Navigation	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
Multilateral operations	**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
Emissions of HFCs – kt CO_2 equivalent	**2.44**	**713.63**	**1 148.33**	**1 155.23**	**1 198.41**	**1 249.71**	**1 310.44**	**1 485.66**	**1 413.93**	**1 492.36**	**1 519.63**	**1 586.61**	**1 615.86**	**1 632.20**	**1 724.77**
HFC-23 (t)	0.00	0.03	6.40	4.93	6.13	12.78	12.78	12.78	12.74	12.74	12.78	12.78	12.78	12.78	12.78
HFC-32 (t)	0.00	3.83	13.22	14.42	16.94	18.51	22.24	26.69	33.16	37.08	39.21	40.35	44.43	42.75	50.56
HFC-43-10mee / act (t)	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
HFC-125 (t)	0.00	91.10	242.00	266.10	282.07	309.34	345.86	410.69	396.87	423.98	432.21	451.04	466.62	449.33	512.03
HFC-134a (t)	0.00	430.52	586.58	539.20	557.47	564.31	560.82	602.72	624.38	664.08	685.34	713.05	730.39	778.97	766.06
HFC-143a (t)	0.00	106.44	260.35	287.13	291.46	320.48	346.50	410.12	338.49	348.62	344.30	363.73	355.33	341.83	374.47
HFC-152a (t)	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
HFC-227ea (t)	0.00	0.01	1.00	2.02	0.34	0.01	0.00	0.00	2.38	0.00	0.00	0.05	0.43	0.97	1.02
HFC-245fa (t)	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
HFC-365mfc (t)	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
Unspecified mix of listed HFCs (kt CO_2 equivalent)	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
Emissions of PFCs (kt CO_2 equivalent)	**1 182.79**	**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**
CF_4 (t)	1 014.74	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 (t)	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
C_3F_8 (t)	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
C_4F_{10} (t)	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} (t)	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
Unspecified mix of listed PFCs (kt CO_2 equivalent)	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
Emissions of SF_6 (kt CO_2 equivalent)	**470.61**	**574.53**	**493.63**	**453.46**	**367.01**	**373.43**	**341.68**	**335.87**	**307.35**	**311.88**	**304.87**	**313.13**	**309.55**	**392.84**	**399.03**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
SF_6 (t)	20.64	25.20	21.65	19.89	16.10	16.38	14.99	14.73	13.48	13.68	13.37	13.73	13.58	17.23	17.50
Emissions of NF_3 (kt CO_2 equivalent)	**0.00**	**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**
NF_3 (t)	0.00	0.61	1.64	1.90	3.45	3.11	0.26	0.24	0.24	0.50	0.57	0.61	0.78	0.36	0.70

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[30].

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, 2005–2017.

No	Indicator	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Priority Indicators															
1	Total CO_2 intensity of GDP [t CO_2/Mio Euro]	318	261	286	269	250	244	233	244	230	220	222	209	214	211	214
2	Energy related CO_2 intensity of GDP [t CO_2/Mio Euro]	262	212	237	219	200	194	191	197	184	175	176	163	167	166	168
3	Specific CO_2 emissions of passenger cars [g CO_2/km]	209	198	191	185	183	179	174	173	172	170	170	168	167	167	167
4	Energy related CO_2 intensity of industry [t/Mio Euro]	289	233	243	223	206	208	227	233	217	213	214	207	200	197	197
5	Specific CO_2 emissions of households [t CO_2/dwelling]	3.4	2.8	2.5	2.4	2.1	2.1	2.0	2.2	1.9	1.8	1.9	1.6	1.7	1.7	1.8
6	CO_2 intensity of the commercial and institutional sector [t CO_2/Mio Euro]	21	20	21	22	16	16	14	10	8.5	7.3	7.1	6.4	6.7	6.1	6.1
7	Specific CO_2 emissions of public and autoproducer power plants [t CO_2/TJ]	168	129	129	126	121	111	102	105	108	103	108	108	104	94	99
	Additional Priority Indicators															
1	Freight transport on road [g CO_2/ton-km]	111	79	73	72	70	70	69	68	70	69	67	67	67	70	70
2	Total CO_2 intensity – iron and steel industry [t CO_2/Mio Euro]	2 320	1 454	1 966	2 033	1 949	1 906	3 560	3 473	3 506	3 131	3 365	3 126	3 025	2 748	2 758
3	Energy related CO_2 intensity – chemical industry [t CO_2/Mio Euro]	569	406	406	365	315	392	431	409	367	364	352	334	337	333	351
4	Energy related CO_2 intensity – glass, pottery and building materials industry [t CO_2/Mio Euro]	609	528	552	567	597	648	686	626	623	637	626	618	612	600	577

[30] 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
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
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
Supplementary Indicators																
1	Specific diesel related CO_2 emissions of passenger cars [g CO_2/ km]	189	185	181	174	174	174	170	169	168	167	168	166	165	167	168
2	Specific petrol related CO_2 emissions of passenger cars [g CO_2/ km]	213	208	204	202	198	186	181	180	177	174	174	172	170	168	167
3	Passenger transport on road [g CO_2/passenger-km]	153	161	160	156	155	152	149	148	147	146	146	145	144	145	146
4	Passenger transport by air [kg CO_2/passenger]	234	126	111	110	109	99	96	81	93	86	88	85	93	92	83
5	Energy related CO_2 intensity – food, drink and tobacco industry [t CO_2/Mio Euro]	182	156	161	151	123	137	154	153	160	147	146	151	152	156	151
6	Energy related CO_2 intensity – paper and printing industry [t CO_2/Mio Euro]	897	693	621	548	511	531	604	624	575	512	481	434	457	411	429
7	Specific CO_2 emissions of households for space heating [t CO_2/m²]	37	29	25	24	21	21	20	22	19	18	18	16	17	17	17
8	Specific CO_2 emissions of commercial and institutional sector for space heating [kg CO_2/m²]	22	24	25	26	19	20	16	12	10	8.2	7.8	7.0	7.4	6.7	6.7
9	Specific CO_2 emissions of public power plants [t CO_2/TJ]	166	133	115	110	102	94	84	84	87	81	78	72	75	70	72
10	Specific CO_2 emissions of autoproducer plants [t CO_2/TJ]	172	118	178	176	176	161	158	167	168	156	172	181	168	149	160
11	Carbon intensity of total power generation [t CO_2/TJ]	69	48	61	60	56	51	45	51	54	43	43	39	43	38	41
12	Carbon intensity of transport [t CO_2/TJ]	66	64	65	63	62	60	60	60	60	61	61	60	59	60	61
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	0.3	0.4
14	Carbon intensity in Industry [kt CO_2 /PJ]	46	40	38	37	35	37	36	36	35	35	34	33	32	32	32
15	Carbon intensity Households [kt CO_2 /PJ]	41	35	32	32	30	30	28	28	27	26	25	24	24	25	25

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In "Austria's Annual Greenhouse Gas Inventory 1990–2017" the Umweltbundesamt presents updated figures of greenhouse gas (GHG) emissions in Austria including the first five years of the second commitment period under the Kyoto-Protocol. In 2017 GHG emissions amounted to 82.3 million tonnes of CO_2 equivalents. This corresponds to a 4.6% increase against 1990 and a 3.3% increase compared to 2016. Key drivers for the development 2016–2017 were the higher fossil fuel sales, in particular diesel, increasing emissions from road transport as well as the increased use of natural gas for power generation and higher steel production.

GHG emissions according to Article 2(1) of Decision No. 406/2009/EC ("Effort Sharing Decision") amounted to 51.7 Mt CO_2 equivalents in 2017 and were thus 2.1 Mt CO_2 equivalents above the annual emission allocation for 2017. 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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