umweltbundesamt
ENVIRONMENT AGENCY AUSTRIA

Austria's Annual Air Emission Inventory 1990—2020

Emissions of SO_2, NO_x, NMVOC, NH_3 and $PM_{2,5}$

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1 ZUSAMMENFASSUNG

Die aktuellen Ergebnisse der Österreichischen Luftschadstoff-Inventur zeigen 2020 gegenüber 2019 rückläufige Emissionen von NO_x, SO_2, NH_3 und $PM_{2,5}$ und einen Anstieg der NMVOC-Emissionen.

Die folgende Analyse bezieht sich auf die nationale Emissionsmenge inklusive Kraftstoffexport (berechnet auf Basis der verkauften Treibstoffmenge). Ab dem NEC-Bericht 2022 sind für das nationale Monitoring unter der NEC-Richtlinie (siehe Kapitel 3.2) die Emissionsmengen aus Kraftstoffexport nicht mehr von der Gesamtemissionsmenge abzuziehen.

- Die SO_2-Emissionen sind im Jahr 2020 gegenüber 2019 um 5,5 % gesunken, was vor allem auf die geringere Industrieproduktion aufgrund der Corona-Pandemie und den Kohleausstieg in der Stromproduktion zurückzuführen ist. Den größten Anteil an den SO_2-Emissionen nimmt die Eisen- und Stahlindustrie mit 41,4 % ein. Hier sanken die Emissionen gegenüber 2019 um 5,3 % bzw. 0,2 kt.
- Die NO_x-Emissionen sind verglichen mit 2019 im Jahr 2020 um ca. 14,1 % zurückgegangen. Hauptverantwortlich für die NO_x-Emissionen ist der Straßenverkehr. Für den rückläufigen Trend ist vor allem der pandemiebedingte Einbruch der Fahrleistung im Pkw-Verkehr verantwortlich.
- Von 2019 bis 2020 sind die NMVOC-Emissionen um 2,1 % angestiegen. Diese stammen überwiegend aus der Landwirtschaft, dem Lösemittelsektor und der Bereitstellung von Raumwärme und Warmwasser in Privathaushalten. Während die Emissionen 2020 aus der Landwirtschaft und den Privathaushalten leicht gesunken sind, zeigten sie im Lösemittelsektor aufgrund der pandemiebedingt gestiegenen Verwendung von Desinfektionsmitteln eine deutliche Zunahme von 13,1 %.
- Die NH_3-Emissionen stammen nahezu ausschließlich aus dem Sektor Landwirtschaft (93,9 %). Im Jahr 2020 sind sie um ca. 0,8 % gegenüber 2019 gesunken, wofür der niedrigere Rinderbestand im Jahr 2020 sowie die reduzierte Ausbringung von Harnstoffdünger verantwortlich waren.
- Von 2019 auf 2020 sind die $PM_{2,5}$-Emissionen um 5,4 % gesunken, hauptsächlich aufgrund der pandemiebedingten Reduktionen im Straßenverkehr.

Ab dem Jahr 2020 gelten entsprechend der EU-Emissionshöchstmengenrichtlinie (EU 2016/2284) bzw. dem Emissionsgesetz-Luft 2018 (EG-L 2018; BGBl. I Nr. 75/2018) neue Emissionsreduktionsverpflichtungen für die anthropogenen Emissionen von NO_x, SO_2, NMVOC, NH_3 und erstmals auch für Feinstaub ($PM_{2,5}$). Diese wurden im Jahr 2020 für die Luftschadstoffe NO_x, SO_2, NMVOC und $PM_{2,5}$ eingehalten. Die Emissionsmenge von NH_3 liegt hingegen um rund 5 %-Punkte darüber.

2 EINLEITUNG

Dieser Bericht beinhaltet eine Zusammenfassung des aktuellen Stands der Emissionen von Schwefeldioxid (SO_2), Stickstoffoxiden (NO_x), flüchtigen Kohlenwasserstoffen ohne Methan (NMVOC) und Ammoniak (NH_3) sowie der Feinstaubfraktion $PM_{2,5}$. Es werden die Emissionsdaten, die am 15. Februar 2022 an die Europäische Kommission übermittelt wurden, die wichtigsten Trends sowie die wesentlichen methodischen Änderungen gegenüber dem Vorjahr dargestellt.

- Annex 1 beinhaltet die Emissionen der Schadstoffe SO_2, NO_x, NH_3, NMVOC und $PM_{2,5}$ basierend auf dem inländischen Kraftstoffabsatz (Emissionen auf Basis „fuel sold").
- Annex 2 enthält die Emissionstrends dieser Schadstoffe abzüglich der Emissionsmengen aus preisbedingtem Kraftstoffexport in Fahrzeugen (Emissionen auf Basis „fuel used").

Die sektorale Gliederung der im Anhang präsentierten Überblickstabellen hält sich an die Berichtsnomenklatur (Nomenclature For Reporting, NFR) der United Nations Economic Commission for Europe (UNECE). Der vollständige Datensatz wurde in diesem Format an die Europäische Kommission übermittelt.

Der vorliegende Bericht wurde vom Umweltbundesamt auf Grundlage des Umweltkontrollgesetzes (BGBl. Nr. 152/1998) erstellt. Dem Umweltbundesamt wird in diesem Bundesgesetz in § 6 (2) Z. 19 unter anderem die Aufgabe übertragen, an der Erfüllung der Berichtspflichten an die Europäische Kommission gemäß Richtlinien und Entscheidungen der EU mitzuwirken. In § 6 (2) Z. 20 werden die Erstellung 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.

Das Umweltbundesamt führt jährlich die Berechnung der Österreichischen Luftschadstoff-Inventur (OLI) durch, die als Grundlage für die Erfüllung der nationalen und internationalen Berichtspflichten herangezogen wird. Die OLI wird erforderlichenfalls auch für zurückliegende Jahre aktualisiert, um eine konsistente Zeitreihe zur Verfügung zu haben. Die in diesem Bericht publizierten Emissionsdaten ersetzen somit die publizierten Daten und Zeitreihen vorhergehender Berichte.

Stand der Daten und das Berichtsformat der vorliegenden Publikation:

Tabelle 1: Datengrundlage des vorliegenden Berichts.

Inventur	Datenstand	Berichtsformat
OLI 2021	14. Februar 2022	NFR-Format der UNECE

3 EMISSIONSTRENDS

In folgender Tabelle werden die aktuellen Ergebnisse der Österreichischen Luftschadstoff-Inventur (OLI) für die Emissionen von SO_2, NO_x, NH_3, NMVOC und $PM_{2,5}$ dargestellt.

Diese sind im Jahr 2020 gegenüber 2019 vor allem pandemiebedingt rückläufig. Nur die Emissionen von NMVOC zeigen in diesem Jahr aufgrund der gestiegenen Verwendung von Desinfektionsmitteln einen Anstieg.

Tabelle 2: NEC-Emissionen Österreichs, 1990–2020. (Quelle: Umweltbundesamt).

	Emissionen Österreichs [Kilotonnen]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2,5}$**
1990	73,70	219,00	334,50	69,27	27,11
1995	46,81	199,32	247,93	68,01	25,59
2000	31,58	212,55	180,49	64,27	24,01
2001	32,46	223,20	174,99	64,12	24,29
2002	31,39	230,99	170,23	63,18	23,43
2003	31,18	241,98	166,21	63,36	23,29
2004	26,60	241,76	152,88	63,05	22,71
2005	25,94	247,80	156,84	63,06	22,55
2006	26,71	238,34	158,95	63,37	22,04
2007	23,34	231,37	154,89	64,73	21,20
2008	20,27	218,22	149,64	64,10	20,35
2009	14,75	204,40	136,91	65,53	19,22
2010	15,99	204,77	137,48	65,52	19,80
2011	15,18	196,37	132,52	64,94	18,65
2012	14,80	190,85	130,30	65,19	18,20
2013	14,37	190,01	124,48	65,15	17,60
2014	14,53	182,27	117,79	65,85	16,06
2015	14,13	179,15	112,81	66,64	15,82
2016	13,29	171,84	111,48	67,56	15,42
2017	12,81	162,90	112,13	68,29	15,21
2018	11,59	151,78	108,83	67,05	14,18
2019	11,16	144,55	108,50	65,96	14,01
2020	10,54	124,10	110,83	65,42	13,25

3.1 Beschreibung der Emissionstrends ab 1990

3.1.1 SO_2-Emissionen

2020 betrugen die SO_2-Emissionen 10,5 kt. Seit 1990 (73,7 kt) konnten die SO_2-Emissionen um 85,7 % reduziert werden. Seit 2005 sind sie um 59,4 % zurückgegangen. Das ist vorwiegend auf die Absenkung des Schwefelanteils in Mineralölprodukten und Treibstoffen (gemäß Kraftstoffverordnung), den Einbau von Entschwefelungsanlagen in Kraftwerken in den 1980er- und 1990er-Jahren (gemäß Luftreinhaltegesetz für Kesselanlagen) sowie auf die verstärkte Nutzung schwefelärmerer Brennstoffe, wie z. B. Erdgas, zurückzuführen.

Von 2019 auf 2020 sind die SO_2-Emissionen um 0,6 kt (-5,5 %) gesunken. Vor allem in der Eisen- und Stahlindustrie (1.A.2.a), die mit 41,4 % den größten Anteil an den SO_2-Emissionen einnimmt, sanken die Emissionen gegenüber 2019 um 5,3 % bzw. 0,2 kt. Dies ist vor allem auf den durch die Corona-Pandemie bedingten Produktionseinbruch zurückzuführen. Auch im Sektor Öffentliche Elektrizitäts- und Wärmeerzeugung (1.A.1.a) und in der Erdölraffinerie (1.A.1.b) gingen die SO_2-Emissionen im Vergleich zum Vorjahr zurück. Wirkung zeigt hier unter anderem der Ausstieg aus der Verwendung von Kohle. Anfang 2020 hat das letzte Kohlekraftwerk Österreichs in Mellach in Graz-Umgebung den Betrieb eingestellt.

3.1.2 NO_X-Emissionen

Für das Jahr 2020 wurde ein Ausstoß von rund 124,1 kt NO_x berechnet. Im Jahr 1990 betrugen die NO_x-Emissionen 219,0 kt. Seither gingen sie um rund 43,3 % zurück.

Der Rückgang der NO_x-Emissionen am Beginn der 1990er-Jahre ist überwiegend auf Maßnahmen im Bereich der Personenkraftwagen (1.A.3.b) sowie Minderungsmaßnahmen bei den großen Kohle- und Ölkraftwerken (1.A.1.a) und der Chemischen Industrie (2.B.10.a) zurückzuführen. Die Wirtschaftskrise war hauptverantwortlich für die Reduktion der NO_x-Emissionen von 2008 auf 2009.

Der überwiegende Anteil der nationalen NO_x-Emissionen entsteht bei der Verbrennung von Brenn- und Kraftstoffen, wobei der größte Anteil an den NO_x-Emissionen im Jahr 2020 mit 46,5 % auf den Straßenverkehr entfiel. In den Jahren 2003 bis 2005 erreichten die NO_x-Emissionen des Straßenverkehrs einen Höchstwert und gehen seither kontinuierlich zurück. Seit 2005 konnte eine Emissionsreduktion um rund 49,9 % erzielt werden. Hauptsächlich die Emissionen des Schwerverkehrs gingen durch Fortschritte in der Abgasnachbehandlung schwerer Nutzfahrzeuge (Lkw und Busse) zurück.

Von 2019 auf 2020 kam es pandemiebedingt zu einem starken Rückgang der nationalen NO_x-Emissionen mit einer Reduktion um 20,4 kt oder -14,1 %. Hierfür hauptverantwortlich ist vor allem der Einbruch der Fahrleistung im Pkw-Verkehr (1.A.3.b.1) um -11,7 kt.

3.1.3 NMVOC-Emissionen

Die NMVOC-Emissionen betrugen im Jahr 2020 110,8 kt und im Jahr 1990 334,5 kt. Das entspricht einer Reduktion um 66,9 %. Seit 2005 konnten die NMVOC-Emissionen um 29,3 % reduziert werden. Von 2019 auf 2020 sind sie um 2,3 kt (+2,1 %) gestiegen.

Seit 1990 konnten die größten Reduktionen im Verkehrssektor erzielt werden, im Wesentlichen durch den verstärkten Einsatz von Katalysatoren und Diesel-Kfz. Aktuell nimmt der Straßenverkehr (1.A.3.b.) nur mehr einen geringen Anteil von 3,7 % an den gesamten NMVOC-Emissionen ein.

Im Lösemittelsektor (2.D.3) konnten die Reduktionen aufgrund diverser gesetzlicher Regelungen (Lösungsmittelverordnung sowie VOC-Anlagen-Verordnung) erzielt werden. 2020 verursachte dieser Sektor rund 33,2 % der NMVOC-Emissionen. Gegenüber dem Vorjahr haben die Emissionen um 13,1 % zugenommen, was auf die gestiegene Verwendung von Desinfektionsmitteln aufgrund der Pandemie zurückgeführt wird.

Einen wesentlichen Anteil an den NMVOC-Emissionen hatte 2020 auch der Sektor Landwirtschaft (3) mit 32,5 % inne, wobei die Emissionsberechnung für diesen Sektor mit erheblichen Unsicherheiten verbunden ist. Hier stammen die NMVOC-Emissionen vorwiegend aus dem Wirtschaftsdüngermanagement (3.B) und zu einem geringeren Anteil aus Landwirtschaftlichen Böden (3.D). Bedingt durch den reduzierten Rinderbestand sanken die Emissionen in diesem Sektor im Vergleich zu 2019 um 0,5 % (0,2 kt).

Die Bereitstellung von Raumwärme und Warmwasser in Privathaushalten (Hausbrand 1.A.4.b.1.) nimmt 2020 einen Anteil von 20,6 % der NMVOC-Emissionen ein und verändert sich trotz geringfügig kühlerer Witterung 2020 bei annähernd konstantem Biomasseeinsatz kaum (-0,04 %). Vor allem veraltete Holzfeuerungsanlagen („Allesbrenner") sind hier weiterhin hauptverantwortlich für die relativ hohen Emissionen.

3.1.4 NH_3-Emissionen

Für das Jahr 2020 wurde eine Emissionsmenge von rund 65,4 kt NH_3 berechnet. Von 1990 bis 2020 nahmen die NH_3-Emissionen um 5,6 % ab. Seit 2005 ist allerdings ein Anstieg um 3,7 % zu verzeichnen.

Die Landwirtschaft ist mit einem Anteil von 93,9 % Hauptverursacher der österreichischen Ammoniak-Emissionen im Jahr 2020. Innerhalb des Sektors entstanden 2020 etwa 50 % der Emissionen aus landwirtschaftlichen Böden (3.D) und rund 50 % aus dem Wirtschaftsdüngermanagement (3.B). Die Emissionen aus der Landwirtschaft gingen seit 1990 um 7,7 % zurück. Neben dem rückläufigen Viehbestand wirkt sich die effizientere Fütterung der Tiere sowie der verstärkte Einsatz bodennaher Wirtschaftsdüngerausbringungstechniken (u. a. Schleppschlauch, Schleppschuh, rasche Einarbeitung von Gülle und Mist) günstig auf das Emissionsniveau aus.

Im Vergleich zu 2019 sanken die gesamten NH_3-Emissionen um 0,5 kt (-0,8 %). Hauptgründe sind der niedrigere Rinderbestand (Milchkühe: +0,1 %; andere Rinder: -1,8 %; Rinder insgesamt: -1,3 %) sowie die reduzierte Ausbringung von Harnstoffdünger (trotz insgesamt steigender Mineraldüngerzahlen) im Jahr 2020.

3.1.5 $PM_{2,5}$-Emissionen

Seit 1990 nahmen die $PM_{2,5}$-Emissionen um 51,1 % ab. Die Abnahme seit 2005 beträgt -41,2 %. Größere Abnahmen seit 1990 gab es beim Hausbrand (1.A.4.b.1) wegen des stark reduzierten Kohleverbrauchs und beim Straßenverkehr (1.A.3.b) durch Verbesserungen der Antriebs- und Abgasnachbehandlungstechnologien (z. B. Partikelfilter).

Von 2019 auf 2020 sind die $PM_{2,5}$-Emissionen um 0,8 kt (-5,4 %) gesunken, hauptsächlich aufgrund des pandemiebedingt geringeren Verkehrsaufkommens (1A3).

Der Hausbrand (1.A.4.b.1) nimmt 2020 mit rund 44,0 % den größten Anteil an den gesamten $PM_{2,5}$-Emissionen ein. Der Rückgang um 0,5 % zwischen 2019 und 2020 ergibt sich trotz der geringfügig kühleren Witterung 2020 durch den annähernd konstanten Biomasseeinsatz in den Heizungen. Zum Teil kann der insgesamt sinkende Trend der $PM_{2,5}$-Emissionen seit 2005 auch auf Effizienzverbesserungen durch thermische Sanierung und auf die Umstellung auf moderne Biomasseheizungen (Verbesserung der Verbrennungstechnologie) zurückgeführt werden.

3.2 Emissionsreduktionsverpflichtungen ab 2020

Seit dem Jahr 2020 gelten neue Emissionsreduktionsverpflichtungen für die anthropogenen Emissionen von NO_x, SO_2, NMVOC, NH_3 und erstmals auch für Feinstaub ($PM_{2,5}$). Sie sind in der EU-Richtlinie über die Reduktion der nationalen Emissionen bestimmter Luftschadstoffe (kurz NEC-Richtlinie)[1] bzw. dem Emissionsgesetz-Luft 2018[2] festgelegt und gelten von 2020 bis 2029 und ab 2030. Die Mitgliedstaaten sind verpflichtet, diesen Emissionsreduktionsverpflichtungen

[1] Richtlinie (EU) 2016/2284 des Europäischen Parlaments und des Rates vom 14. Dezember 2016 über die Reduktion der nationalen Emissionen bestimmter Luftschadstoffe, zur Änderung der Richtlinie 2003/35/EG und zur Aufhebung der Richtlinie 2001/81/EG, Anhang II. Nach der englischen Bezeichnung *National Emission Reduction Commitments Directive* bzw. der Bezeichnung der Vorgängerrichtlinie (*National Emission Ceilings Directive*) wird sie auch kurz NEC-Richtlinie genannt.

[2] Emissionsgesetz-Luft 2018 (EG-L 2018; BGBl. I Nr. 75/2018): Bundesgesetz über nationale Emissionsreduktionsverpflichtungen für bestimmte Luftschadstoffe (Emissionsgesetz-Luft 2018 – EG-L 2018)

jährlich nachzukommen und die Emissionen dieser fünf Schadstoffe entsprechend zu begrenzen.

Im Gegensatz zu den bis zum Berichtsjahr 2021 geltenden absoluten Emissionshöchstmengen für die Jahre 2010 bis 2019 sind die NEC-Ziele ab 2020 als Relativwerte festgelegt. Basisjahr für die Berechnungen der Emissionsreduktionsverpflichtungen ist das Jahr 2005.

In folgender Tabelle sind die ab 2020 geltenden Emissionsreduktionsverpflichtungen Österreichs dargestellt.

Tabelle 3: Nationale Emissionsreduktionsverpflichtungen gemäß NEC-Richtlinie für Österreich (Quelle: EG - L 2018, BGBl. I Nr. 75/2018).

	Nationale Emissionsreduktionsverpflichtungen gemäß NEC-Richtlinie	
Luftschadstoff	**Reduktion gegenüber 2005 in jedem Jahr zwischen 2020 und 2029**	**Reduktion gegenüber 2005 in jedem Jahr ab 2030**
NO_x	-37 %	-69 %
SO_2	-26 %	-41 %
NMVOC	-21 %	-36 %
NH_3	-1 %	-12 %
$PM_{2,5}$	-20 %	-46 %

Während für den Zielevergleich der Jahre 2010 bis 2019 die Emissionsmengen ohne Kraftstoffexport galten, werden für den Zielezeitraum ab 2020 die Gesamtemissionen Österreichs inklusive Kraftstoffexport (berechnet auf Basis der verkauften Treibstoffmenge) herangezogen. Dies ist in den Leitlinien für die Inventurberichterstattung[3] begründet. Dort ist vorgesehen, dass die Beurteilung der Zielerreichung grundsätzlich anhand der auf Basis der verkauften Treibstoffmenge berechneten Inventurdaten erfolgt. Jene Staaten, deren Verpflichtungen auf Basis der verbrauchten Treibstoffe festgelegt wurden, können allerdings auch die auf Basis der verbrauchten Treibstoffmengen berechneten Inventurdaten als Grundlage für die Beurteilung der Zielerreichung wählen. Die Festlegung der ab 2010 geltenden Emissionshöchstmengen erfolgte in den späten 1990er-Jahren; damals war die Problematik des Kraftstoffexports im Fahrzeugtank noch nicht einmal erkannt worden. Die Festlegung der Emissionsreduktionsverpflichtungen für 2020 und 2030 basiert jedoch schon auf Modellrechnungen im Auftrag der Europäischen Kommission, bei denen der Kraftstoffexport in die österreichischen Daten eingerechnet wurde.

Die Emissionen von NO_x und NMVOC aus Tätigkeiten, die unter die Kategorien 3B (Düngewirtschaft) und 3D (landwirtschaftliche Böden) fallen, sind im

[3] Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution; ECE/EB.AIR/125. Diese Leitlinien sind auch unter der NEC-Richtlinie anzuwenden.

Rahmen der Reduktionsverpflichtungen nicht zu berücksichtigen und sind daher im Zielvergleich von den jeweiligen Gesamtemissionen abzuziehen.

Entsprechend Artikel 5 der NEC-Richtlinie werden den Mitgliedsstaaten gewisse Flexibilitätsregelungen und Anpassungsmöglichkeiten eingeräumt. Diese werden von Österreich im vorliegenden Bericht nicht angewandt.

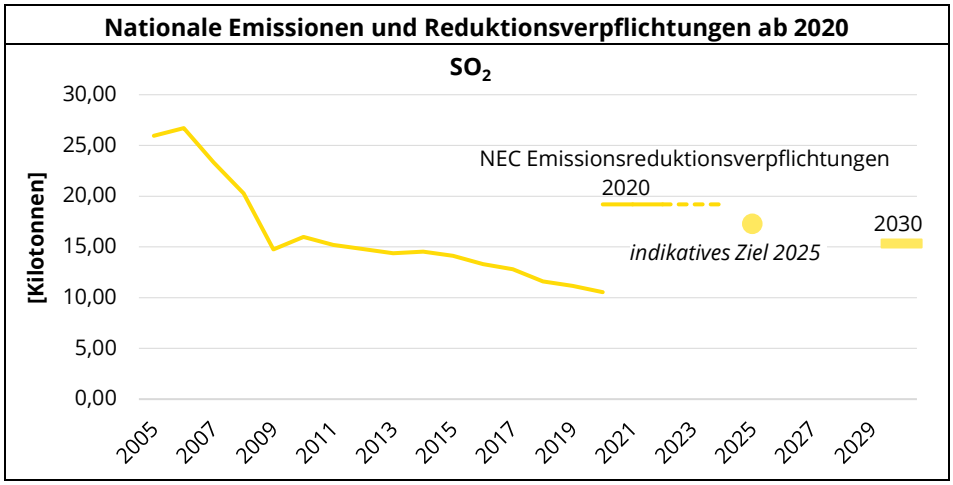
Auf Basis der NEC-Emissionsberichterstattung 2022 stellt sich der Zielvergleich wie folgt dar:

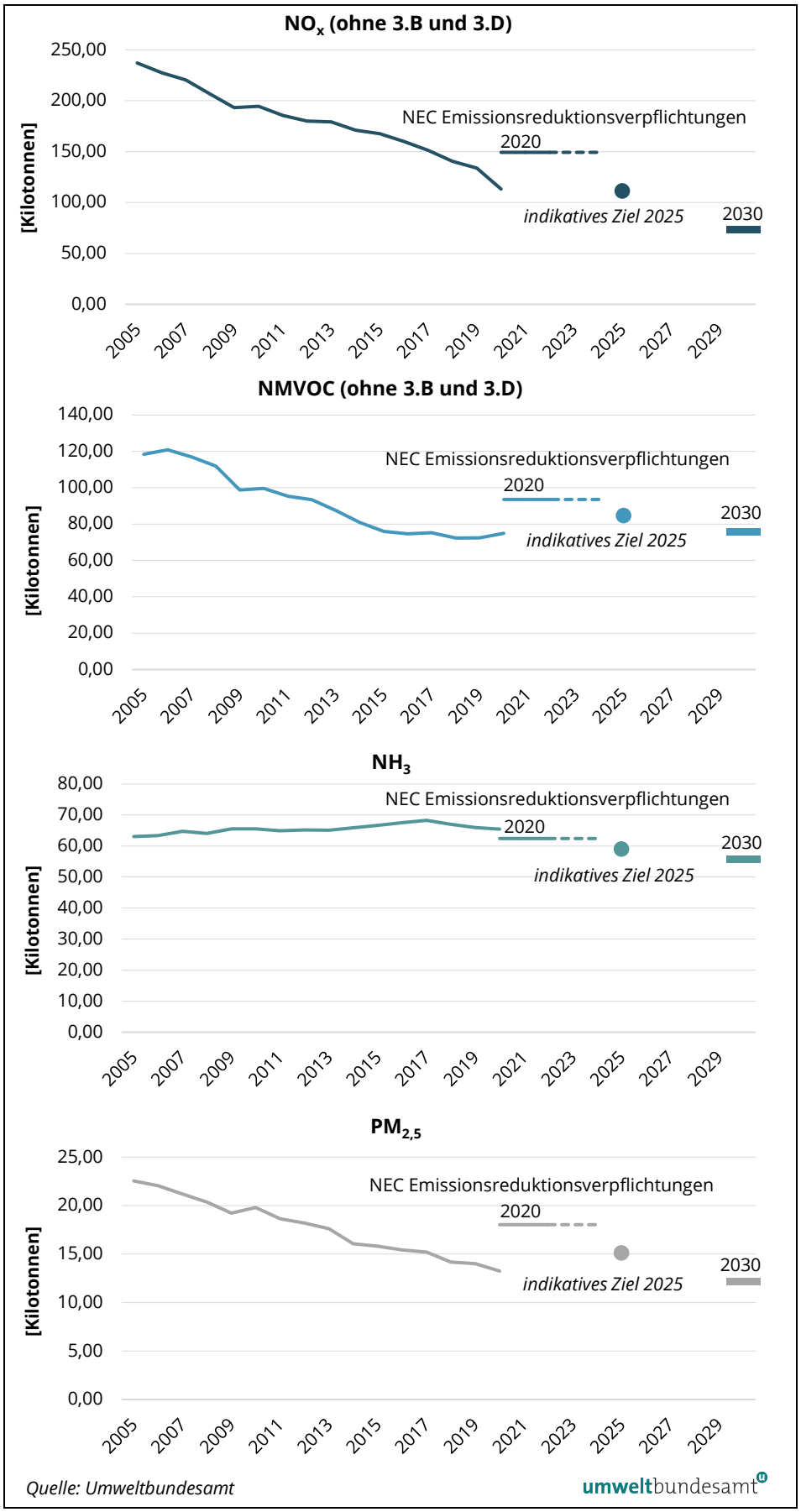
- Für die Luftschadstoffe NO_x, SO_2, NMVOC und $PM_{2,5}$ werden die Emissionsreduktionsverpflichtungen für das Jahr 2020 eingehalten.
- Für Ammoniak (NH_3) wird das Reduktionsziel für das Jahr 2020 nicht erreicht (+3,7 % anstatt -1 % verglichen mit dem Basisjahr 2005).

Tabelle 4: Emissionen und prozentuelle Änderung von 2005 bis 2020 (Quelle: Umweltbundesamt).

	2005	2020	2005–2020
NO_x (ohne 3.B und 3.D)	237,04	113,24	-52,2 %
NMVOC (ohne 3.B und 3.D)	118,41	74,86	-36,8 %
SO_2	25,94	10,54	-59,4 %
NH_3	63,06	65,42	+3,7 %
$PM_{2,5}$	22,55	13,25	-41,2 %

Abbildung 1: Gegenüberstellung der Emissionen und der Emissionsreduktionsverpflichtungen ab 2020 (Quelle: Umweltbundesamt).





Quelle: Umweltbundesamt

umweltbundesamt

3.3 Kraftstoffexport

Die Emissionsberechnungen für den Straßenverkehr basieren auf der in Österreich verkauften Treibstoffmenge. Allerdings wird nicht die gesamte Menge davon in Österreich verfahren, sondern ein Teil wird in den Fahrzeugtanks über die Landesgrenzen hinaus exportiert. Dieser Effekt wird „Kraftstoffexport" genannt.

Gründe für diesen Effekt sind strukturelle Gegebenheiten (Binnenland mit hohem Exportanteil in der Wirtschaft) sowie Unterschiede im Kraftstoffpreisniveau zwischen Österreich und seinen Nachbarländern.

Methodisch lassen sich die über die Grenzen verschobenen Kraftstoffmengen aus der Differenz zwischen Kraftstoffabsatz in Österreich und dem berechneten Inlandsverbrauch ermitteln. Davon können die Fahrleistungen (Kfz-km) von Pkw und schweren Nutzfahrzeugen abgeleitet werden und in weiterer Folge die zugehörigen Emissionen für den „Kraftstoffexport in Kraftfahrzeugen".

Nachstehende Tabelle zeigt die Emissionsmengen, die auf den Kraftstoffexport in Fahrzeugtanks zurückzuführen sind. Im Jahr 2020 sind 10,7 kt, rund 8,6 % der NO_x-Gesamtemissionen Österreichs, auf diesen Effekt zurückzuführen.

Ab Ende der 1990er-Jahre kam es – bedingt durch den zunehmenden Kraftstoffexport – zu einem verstärkten Anstieg der NO_x-Emissionen, vor allem im Schwerverkehr. Im Jahr 2005 wurde ein Höchstwert erreicht; seither nimmt der Kraftstoffexport kontinuierlich ab.

Tabelle 5: Emissionen aus Kraftstoffexport in Fahrzeugtanks. (Quelle: Umweltbundesamt).

	Emissionen in tausend Tonnen [Kilotonnen]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2,5}$***
1990	0,78	16,88	4,50	0,05	0,55
1995	0,94	17,38	1,45	0,04	0,69
2000	0,53	31,82	0,29	-0,13	0,77
2001	0,64	39,47	1,48	0,01	0,97
2002	0,69	47,78	3,46	0,35	1,28
2003	0,74	54,38	4,46	0,54	1,51
2004	0,06	54,13	4,46	0,59	1,52
2005	0,05	56,95	4,46	0,62	1,58
2006	0,04	46,14	3,34	0,58	1,31
2007	0,04	42,95	3,07	0,59	1,22
2008	0,03	36,54	2,43	0,50	0,98
2009	0,04	35,32	2,26	0,51	0,91
2010	0,04	35,42	2,00	0,49	0,87
2011	0,03	28,22	1,54	0,41	0,67
2012	0,03	26,84	1,34	0,36	0,59
2013	0,04	29,49	1,23	0,33	0,59

	Emissionen in tausend Tonnen [Kilotonnen]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2,5}$***
2014	0,04	25,33	1,02	0,29	0,48
2015	0,04	24,02	0,99	0,30	0,44
2016	0,04	20,73	0,89	0,29	0,38
2017	0,04	18,75	0,80	0,28	0,33
2018	0,04	15,33	0,68	0,26	0,25
2019	0,04	13,53	0,58	0,25	0,21
2020	0,03	10,67	0,48	0,21	0,16

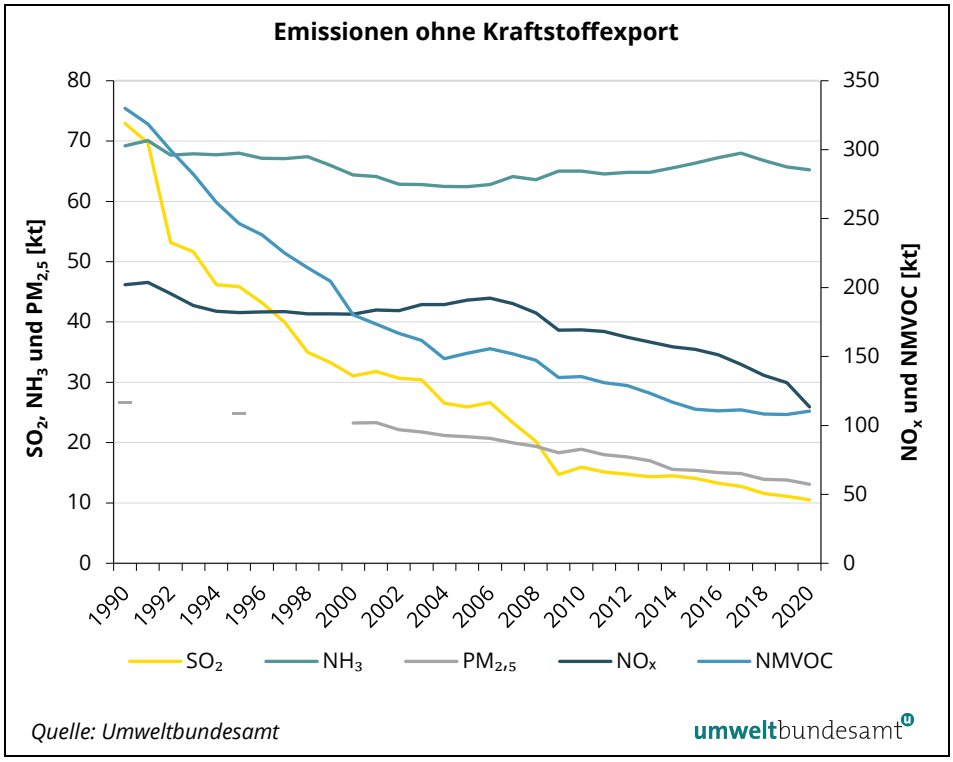
* *exkl. Brems-, Reifen-Abrieb und Aufwirbelung*

Die Emissionsmengen ohne Kraftstoffexport wurden für den Zielevergleich der Jahre 2010 bis 2019 herangezogen (EU-Emissionshöchstmengenrichtlinie, NEC-Richtlinie (EU) 2016/2284; Anhang IV).

Im Gegensatz dazu werden zur Überprüfung der NEC-Emissionsreduktions-verpflichtungen ab 2020 die Emissionsmengen auf Basis der verkauften Treib-stoffe (also inkl. Kraftstoffexport) herangezogen.

Die folgende Abbildung zeigt die österreichischen Emissionen der Schadstoffe SO_2, NO_x, NH_3, NMVOC und $PM_{2,5}$ abzüglich der Emissionen aus dem Kraft-stoffexport. Sie werden auf Basis des verbrauchten Kraftstoffs ("fuel used") er-mittelt. Die Emissionswerte in tabellarischer Form sind im Anhang 2 angeführt.

Abbildung 2: SO_2, NO_x, NMVOC, NH_3 und $PM_{2,5}$-Emissionen ohne Kraftstoffexport.



4 INTRODUCTION

This report provides a summary of Austria's SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$ emissions for the years 1990 until 2020. Trend tables for changes between 1990 and 2020 (SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$) for the main NFR sectors are presented in the following Annexes:

- Annex 1: national emission data on the basis of fuel sold;
- Annex 2: national emission data on the basis of fuel used.

The complete tables in the NFR format have been uploaded to the Central Data Repository (CDR)[4] of EIONET[5] as digital files (Excel).

[4] http://cdr.eionet.europa.eu/at/eu/nec

[5] European Environment Information and Observation Network (EIONET)

5 EMISSION TRENDS

The following table shows the current results of the Austrian Air Emission Inventory (OLI) for the emissions of SO_2, NO_x, NH_3, NMVOC und $PM_{2.5}$ for the years 1990 to 2020.

Compared to 2019, 2020 emissions decreased mainly due to the measures taken against the Corona pandemic. Only the 2020 emissions of NMVOC show an increase compared to 2019 due to the increased use of disinfectants.

Table 1: Emissions in Austria, 1990-2020 (Source: Umweltbundesamt)

	Emissions in Austria [kilotonnes]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	73.70	219.00	334.50	69.27	27.11
1995	46.81	199.32	247.93	68.01	25.59
2000	31.58	212.55	180.49	64.27	24.01
2001	32.46	223.20	174.99	64.12	24.29
2002	31.39	230.99	170.23	63.18	23.43
2003	31.18	241.98	166.21	63.36	23.29
2004	26.60	241.76	152.88	63.05	22.71
2005	25.94	247.80	156.84	63.06	22.55
2006	26.71	238.34	158.95	63.37	22.04
2007	23.34	231.37	154.89	64.73	21.20
2008	20.27	218.22	149.64	64.10	20.35
2009	14.75	204.40	136.91	65.53	19.22
2010	15.99	204.77	137.48	65.52	19.80
2011	15.18	196.37	132.52	64.94	18.65
2012	14.80	190.85	130.30	65.19	18.20
2013	14.37	190.01	124.48	65.15	17.60
2014	14.53	182.27	117.79	65.85	16.06
2015	14.13	179.15	112.81	66.64	15.82
2016	13.29	171.84	111.48	67.56	15.42
2017	12.81	162.90	112.13	68.29	15.21
2018	11.59	151.78	108.83	67.05	14.18
2019	11.16	144.55	108.50	65.96	14.01
2020	10.54	124.10	110.83	65.42	13.25

5.1 Description of trends since 1990

5.1.1 SO_2 emissions

In 2020, SO_2 emissions amounted to 10.5 kt. Since 1990 (73.7 kt), emissions have decreased by 85.7 % and since 2005 by 59.4 %.

This decline is mainly due to a reduction in the sulphur content in mineral oil products and fuels (as prescribed by the Austrian Fuel Ordinance), the installation of desulphurisation units in plants (according to the Clean Air Act for boilers) and an increased use of low-sulphur fuels such as natural gas.

From 2019 to 2020, SO_2 emissions continued to decrease (by 0.6 kt i.e. – 5.5 %), mainly because in the iron and steel industry (1.A.2.a), which accounts for the largest share of SO2 emissions (41.4 %), the emissions decreased by 5,3 % or 0.2 kt compared to 2019, due to the pandemic. Compared to the previous year, SO_2 emissions also decreased in the public electricity and heat generation sector (1.A.1.a) and in the oil refinery sector (1.A.1.b). Among others, the phase-out of coal is having an effect here. At the beginning of 2020, Austria's last coal-fired power plant in Mellach near Graz ceased operation.

5.1.2 NO_X emissions

In 1990, NO_x emissions amounted to 219.0 kt, and in 2020 to 124.1 kt, meaning a decrease of 43.3 % over the period.

The reduction in NO_x emissions at the beginning of the 1990s was mainly due to reductions in sector 1.A.3.b (passenger cars), sector 1.A.1.a (large oil and coal power plants) and sector 2.B.10.a (chemicals industries). The economic crisis caused a decrease in emissions between 2008 and 2009.

The main share of Austria's national NO_x emissions is emitted by fuel combustion. At 46.5 %, road transport accounted for the biggest share of Austria's total NO_x emissions in the year 2020.

NO_x emissions climbed to extreme levels from 2003 to 2005 but have decreased continuously since then. Since 2005, an emission reduction of around 49.9 % has been achieved. This has mainly been due to reduced emissions from heavy duty vehicles (trucks and busses) following improvements in after-treatment technology.

Compared with 2019, emissions in the year 2020 were 14.1 % (20,4 kt) lower due to the pandemic. The main reason was the reduction of passenger car mileage in sector 1.A.3.b.1 by leading to a 11.7 kt reduction in emissions.

5.1.3 NMVOC emissions

NMVOC emissions amounted to 334.5 kt in 1990, and to 110.8 kt in 2020. This corresponds to a reduction of 66.9 %. From 2019 to 2020, NMVOC emissions increased by 2.3 kt (2.1 %).

The largest reductions since 1990 have been achieved in the road transport sector due to an increased use of catalytic converters and diesel cars. Currently the road transport sector (1.A.3.b.) accounts only for a small share (3.7 %) of Austria's total NMVOC emissions.

Reductions in the solvent sector (2.D.3) have been achieved due to the Solvent Ordinance and the VOC Installation Ordinance. In 2020, the solvent sector accounted for around 33.2 % of Austria's total NMVOC emissions. Compared to the previous year, emissions increased by 13.1 %, which was due to the increased use of disinfectants due to the pandemic.

The agriculture sector (3) accounted for a significant share of NMVOC emissions at 32.5 %; however, emission calculations for this sector are considerably uncertain. Here, NMVOC emissions originate mainly from manure management (3.B) and to a lesser extent from agricultural soils (3.D). Due to the reduced number of cattle, emissions in this sector fell by 0.5 % (0.2 kt) compared to 2019.

Residential stationary heating (1.A.4.b.1.) accounted for 20.6 % of the total 2020 emissions. Emissions from this sector did not change so much between 2019 and 2020 (minor decrease in emissions of 0.04 %), mainly due to a fairly constant level of biomass used for heating despite the slightly colder weather. Outdated mixed-fuel wood boilers continue to be the main source of the relatively high emissions.

5.1.4 NH_3 emissions

NH_3 emissions amounted to 65.4 kt in 2020. Since 1990, NH_3 emissions have decreased by 5.6 %, although since 2005 they have increased by 3.7 %.

The main source of ammonia emissions is the agriculture sector with a share of 93.9 % in 2020. Within the agriculture sector about 50 % of NH_3 emissions result from Agricultural Soils (3.D) and 50 % from Manure Management (3.B). There was a decrease of 7.7 % in NH_3 emissions between 1990 and 2020. This reduction can be mainly explained by decreasing cattle numbers, more efficient feeding and an increased application of low emission spreading techniques (e.g. band spreading, trailing shoe, rapid incorporation of manure).

Compared to the previous year 2020, emissions fell slightly by 0.5 kt (- 0.8 %), the main reasons for this short-term decrease being, on the one hand, a smaller number of cattle (dairy cows: + 0,1 %; other cattle: − 1,8 %, cattle in total - 1,3 %) and on the other, a lower consumption of urea despite increasing mineral fertilizer consumption in total.

5.1.5 $PM_{2.5}$ emissions

Since 1990, $PM_{2.5}$ emissions have decreased by 51.1 %. The decrease since 2005 is - 41.2 %.

Large reductions were achieved through reduced coal consumption in households (1.A.4.b.1) and road transport (1.A.3.b).

From 2019 to 2020 $PM_{2.5}$ emissions decreased by 0.8 kt (– 5.4 %), due to pandemic-related reductions in the transport sector.

With a share of about 44.0 %, 1.A.4.b.1 residential: stationary was the main source of total $PM_{2.5}$ emissions in 2020. The -0.5 % change in emissions between 2019 and 2020 was due to the volume of biomass used for heating remaining at a fairly constant level despite the slightly colder weather in 2020. To some extent, the overall decreasing trend of 1.A.4.b.1 residential: stationary since 2005 can also be explained by efficiency improvements through thermal renovation and a switch to modern biomass boilers and stoves (improvements in fuel combustion technologies).

5.2 Emission reduction obligations as of 2020

From 2020 onwards, new emission reduction obligations will apply to anthropogenic emissions of NO_x, SO_2, NMVOC, NH_3 and, for the first time, particulate matter ($PM_{2.5}$). These are set out in the EU Directive on the Reduction of National Emissions of Certain Atmospheric Pollutants (NEC Directive for short)[6] and the national Air Emissions Act 2018[7], respectively, and apply from 2020 to 2029 and from 2030 onwards. The Member States are obliged to comply with these emission reduction obligations annually and to limit the emissions of these five pollutants accordingly.

In contrast to the absolute emission ceilings for the years 2010 to 2019, which applied until the reporting year 2021, the NEC targets from 2020 onwards are set as relative values compared to base year values. The base year for the calculations of the emission reduction commitments is 2005.

The following table shows Austria's emission reduction commitments from 2020.

[6] Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC

[7] Air Emissions Act (Emissionsgesetz-Luft) 2018 (EG-L 2018; BGBl. I Nr. 75/2018): Bundesgesetz über nationale Emissionsreduktionsverpflichtungen für bestimmte Luftschadstoffe (Emissionsgesetz-Luft 2018 – EG-L 2018)

Table 2: National Emission reduction commitments under the NEC Directive for Austria (Source: EG - L 2018, BGBl. I Nr. 75/2018).

	National Emission reduction commitments under the NEC Directive	
atmospheric pollutant	**reduction compared with 2005 for any year from 2020 to 2029**	**reduction compared with 2005 for any year from 2030**
NO_x	– 37 %	– 69 %
SO_2	– 26 %	– 41 %
NMVOC	– 21 %	– 36 %
NH_3	– 1 %	– 12 %
$PM_{2.5}$	– 20 %	– 46 %

While the target comparison for the years 2010 to 2019 was based on emissions without exports of fuels, Austria's total emissions calculated on the basis of the volume of fuel sold will now be taken into account for the new target period. This is justified in the inventory reporting guidelines[8]. It provides that the assessment of the achievement of the target is, in principle, based on the inventory data calculated on the basis of the quantity of fuel sold. However, those States whose obligations have been determined on the basis of the fuel consumed may also choose the inventory data calculated on the basis of the quantities of fuel used as the basis for assessing the achievement of the target. The emission ceilings applicable from 2010 onwards were established in the late 1990s; at that time, the problem of fuel export in the vehicle tank had not even been recognised. However, the setting of emission reduction commitments for 2020 and 2030 is already based on model calculations on behalf of the European Commission, where fuel exports have been included in the Austrian data.

The emissions of NO_x and NMVOC from activities falling under categories 3B (manure management) and 3D (agricultural soils) are not to be taken into account in the context of the reduction obligations and should therefore be deducted from the respective total emissions.

In accordance with Article 5 of the NEC Directive, Member States will be given some flexibility and adaptation possibilities. These are not applied by Austria in the present report.

Based on the 2022 NEC emissions reporting, the compliance with the targets is as follows:

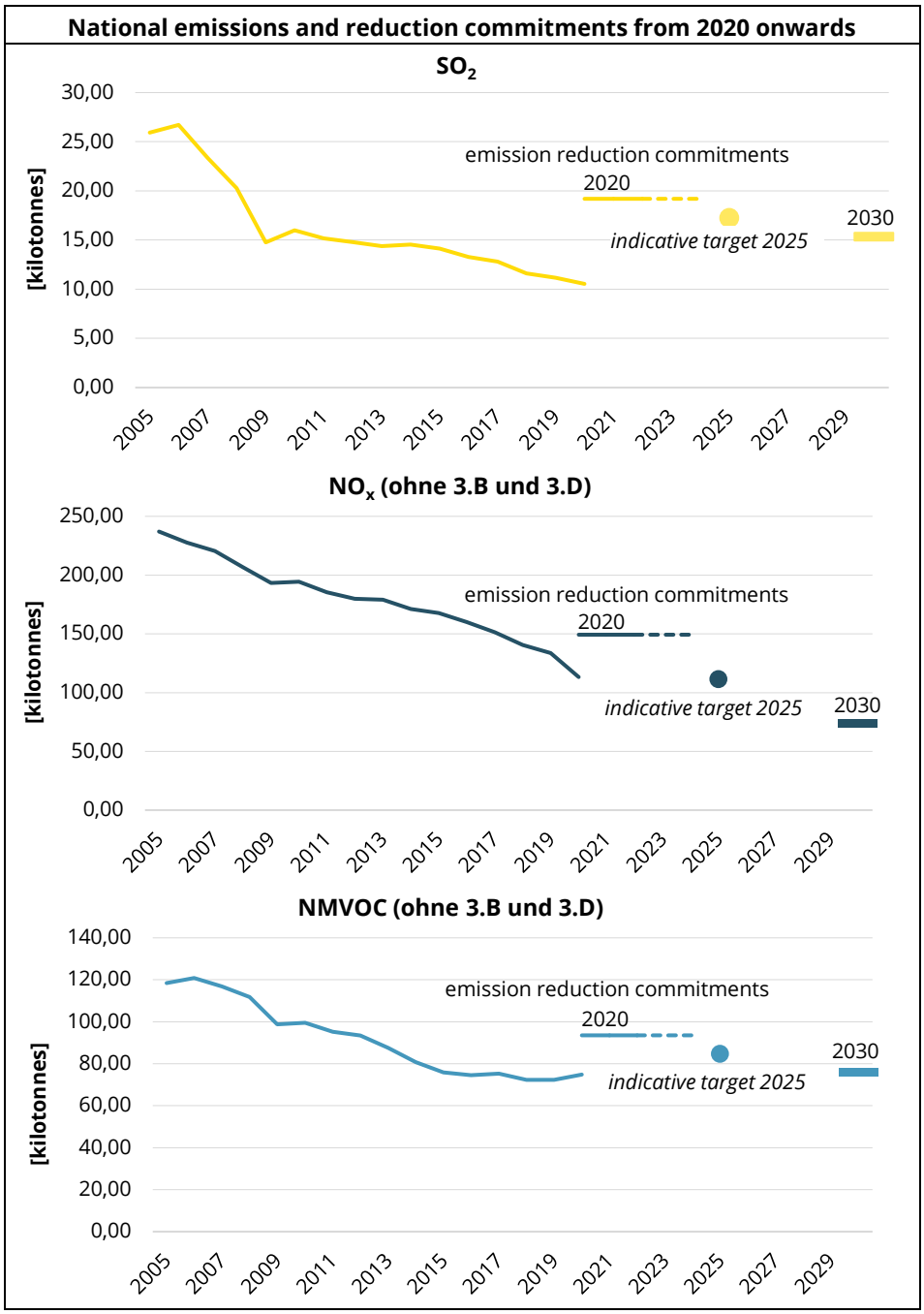
- For the air pollutants NO_x, SO_2, NMVOC and $PM_{2.5}$ the national emission reduction commitments for the year 2020 are met.
- For ammonia (NH_3), the national emission reduction commitment for 2020 is not met (+ 3.7 % instead of - 1 % compared to the base year 2005).

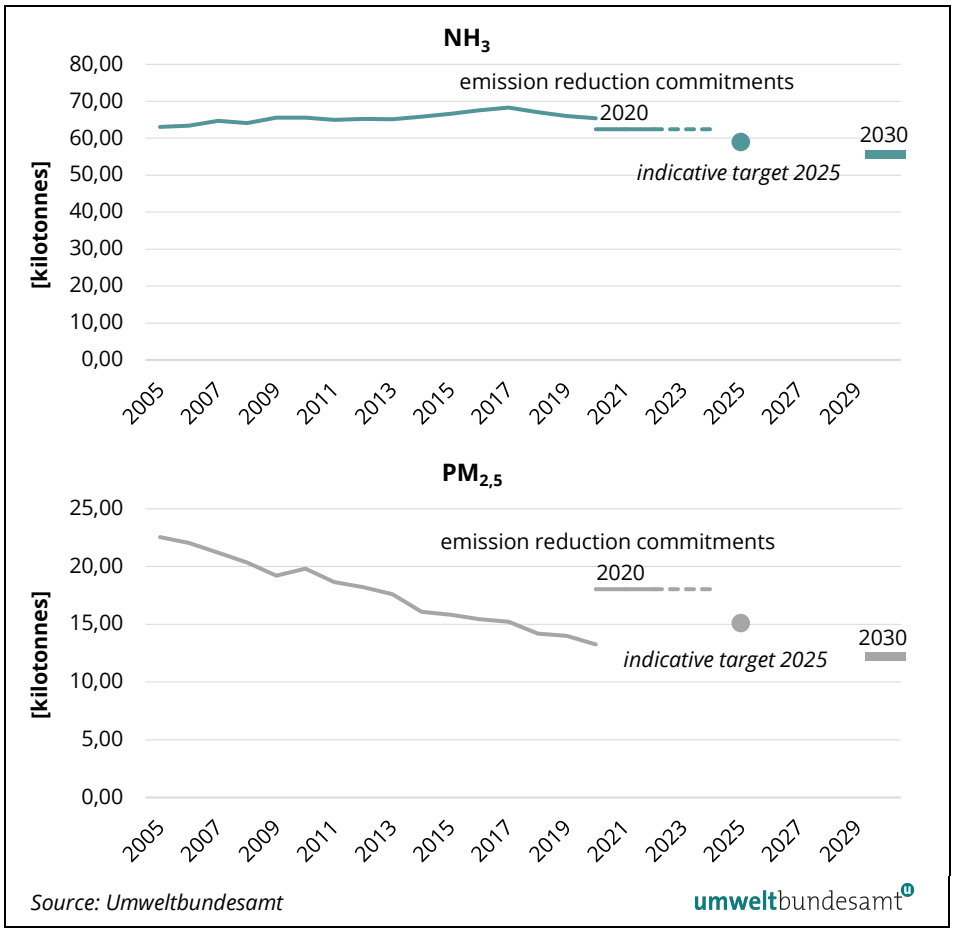
[8] Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution; ECE/EB.AIR/125. These guidelines are also applicable under the NEC Directive.

Table 3: Emissions and the percentage change from 2005 to 2020 (Source: Umweltbundesamt).

	2005	2020	2005-2020
NO_x (ohne 3.B und 3.D)	237,04	113,24	- 52,2 %
NMVOC (ohne 3.B und 3.D)	118,41	74,86	- 36,8 %
SO_2	25,94	10,54	- 59,4 %
NH_3	63,06	65,42	+ 3,7 %
$PM_{2,5}$	22,55	13,25	- 41,2 %

Figure 1: Comparison of emissions with emission reduction commitments from 2020 onwards.





5.3 Fuel export

The emission calculations for the sector road transport in this submission are based on the quantity of fuel sold in Austria. However, the fuel quantity sold is not completely used in Austria with part of it exported in the vehicle tanks and combusted beyond the national borders. This effect is called "fuel export".

The reasons for this effect are structural conditions (Austria is a landlocked country with a high share of exports in the economy) and differences in fuel price levels between Austria and its neighboring countries.

The quantities of fuel exported (and used) abroad can be determined from the difference between fuel sales in Austria and the calculated domestic consumption. From this, the mileage (car-km) can be derived from cars and heavy-duty vehicles and, subsequently, the associated emissions for "fuel exports in motor vehicles".

The table below shows the emissions due to fuel exports. In 2020, 10.7 kt, around 8.6 % of Austria's total NO_x emissions, are due to this effect.

From the end of the 1990s, there was an increase in NO_x emissions, mainly from heavy-duty vehicles, due to increased fuel exports. A peak was reached in 2005; since then, fuel exports have declined continually.

Table 4: Emissions from fuel exports. (Source: Umweltbundesamt).

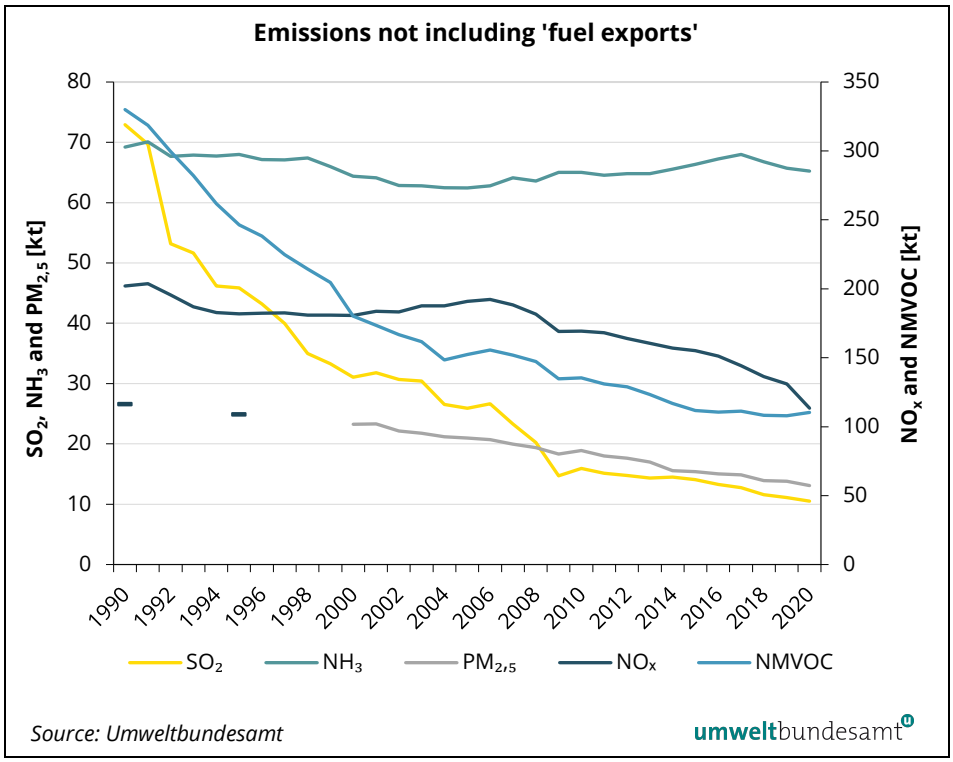
	Emissions in [kilotonnes]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$***
1990	0.78	16.88	4.50	0.05	0.55
1995	0.94	17.38	1.45	0.04	0.69
2000	0.53	31.82	0.29	-0.13	0.77
2001	0.64	39.47	1.48	0.01	0.97
2002	0.69	47.78	3.46	0.35	1.28
2003	0.74	54.38	4.46	0.54	1.51
2004	0.06	54.13	4.46	0.59	1.52
2005	0.05	56.95	4.46	0.62	1.58
2006	0.04	46.14	3.34	0.58	1.31
2007	0.04	42.95	3.07	0.59	1.22
2008	0.03	36.54	2.43	0.50	0.98
2009	0.04	35.32	2.26	0.51	0.91
2010	0.04	35.42	2.00	0.49	0.87
2011	0.03	28.22	1.54	0.41	0.67
2012	0.03	26.84	1.34	0.36	0.59
2013	0.04	29.49	1.23	0.33	0.59
2014	0.04	25.33	1.02	0.29	0.48
2015	0.04	24.02	0.99	0.30	0.44
2016	0.04	20.73	0.89	0.29	0.38
2017	0.04	18.75	0.80	0.28	0.33
2018	0.04	15.33	0.68	0.26	0.25
2019	0.04	13.53	0.58	0.25	0.21
2020	0.03	10.67	0.48	0.21	0.16

The national emissions without fuel exports were used to assess compliance with the emission ceilings under the NEC Directive for the years 2010 to 2019 (EU Emission Ceilings Directive, NEC Directive (EU) 2016/2284; Annex IV).

But from 2020 onwards the emissions based on fuels sold (i.e. including fuel exports) are used for assessing the compliance with the relevant national emission reduction commitments.

The following figure shows the Austrian emissions of the pollutants SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$ without emissions from fuel exports. They are determined on the basis of the fuel used. The emission values in tabular form are listed in Annex 2.

Figure 2: SO_2, NO_x, NMVOC, NH_3 and $PM_{2.5}$-emissions without fuel exports.



6 METHOD OF REPORTING

6.1 Methodology

The Austrian air emission inventory for the period 1990 to 2020 has been compiled according to the revised Guidelines for Reporting Emissions and Projections Data as approved by the Executive Body for the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP Convention) at its 32nd session.

In Austria, emissions of air pollutants as well as emissions of greenhouse gases are all gathered in a database based on the CORINAIR nomenclature (CORe INventory AIR)/SNAP (Selected Nomenclature for sources of Air Pollution). This nomenclature was designed by the EEA to estimate emissions of all kinds of air pollutants. To comply with the reporting obligations under the UNECE/LRTAP Convention, emissions are then transformed into the NFR (Nomenclature for Reporting) format.

The complete set of tables in the NFR format, including – in particular – sectoral reports and sectoral background tables, is submitted separately in digital form only (Excel files). In this report, NFR summary tables are presented in Annexes 1 and 2.

The following table summarises the status of this report:

Table 5: Status of report.

Format	Inventory	Version
NFR Format (UNECE)	OLI 2021	February 14th 2022

Data presented in this report are based on the Austrian Air Emission Inventory 2021 (Österreichische Luftschadstoff-Inventur, OLI 2021) prepared by the Umweltbundesamt in the year 2021 with annual emissions estimates for the years between 1990 and 2020. The Austrian air emission inventory is subject to continuous improvement, resulting in recalculations as outlined in Chapter 7.

6.2 Sources of Data

Table 6 presents the main data sources used for activity data as well as information on the institutions that carried out the actual calculations.

Table 6: Main data sources for activity data and emission values.

Sector	Data Sources for Activity Data
Energy	Energy Balance from Statistik Austria; EU-ETS; LCP emission declarations; direct information from industry or associations of industry; energy demand model for space heating (fuel technology shares)
Transport	Energy Balance from Statistik Austria; yearly new vehicle registrations from Statistik Austria; yearly growth rates of transport performance on Austrian roads from Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK); ZBD: Zentrale Beguchtachtungsdatenbank (periodically updated specific mileage); yearly flight movements from AustroControl; yearly FC of airport ground activities at Vienna International Airport
IPPU	National production statistics, import/export statistics; economic indicators EU-ETS; direct information from industry or associations of industry; Surveys conducted at companies and associations; Reports submitted under the Industrial Emissions Directive
Agriculture	National studies, national agricultural statistics obtained from Statistik Austria, National fertiliser statistics obtained from Agrarmarkt Austria (AMA) and distributing companies
Waste	Federal Waste Management Plans (Data sources: Database on landfills (1998–2007), EDM – Electronic Data Management (from 2008 onwards)); EMREG-OW (Electronic Emission Register of Surface Water Bodies)

Emission calculations and related inventory work (reporting, QA/QC, documentation and archiving, etc.) are carried out by sector experts of the Inspection Body for Emission Inventories (IBE).

In cases which exceed the IBE's resources, the IBE concludes service contracts with qualified institutions (particularly universities or research institutes).

The IBE is responsible for

- choice of the contractor i.e. judging his/her expertise with regard to the technical and QMS requirements
- specifying the technical and QMS requirements in the service contract
- performing and documenting a detailed QC check of the results i.e. checking if the specified requirements were fulfilled
- implementation of the results into the emission inventory in line with the technical and QMS requirements particularly the requirement of full reproducibility of the emission inventory

Service contracts have e.g. entered into with:

- Technical University Graz (road and off-road transport)
- University of Natural Resources and Applied Life Sciences (agriculture)

All relevant service contracts are referenced in the sector specific chapters of the IIR.

A detailed description of the activity data, emission factors, and the methodologies applied will be provided in Austria's Informative Inventory Report (IIR) 2022[9], which is to be submitted under the UNECE Convention on Long-range Transboundary Air Pollution and the NEC-Directive (EU 2016/2284) on 15 March 2022.

[9] https://www.umweltbundesamt.at/emiberichte

7 RECALCULATIONS

Following the continuous improvements made to Austria's annual Air Emission Inventory, some sources have been recalculated on the basis of updated activity data or revised methodologies. Thus, the emission data for the period from 2005 to 2019 submitted this year may differ from the data previously reported.

The figures presented in this report replace former data reported by the Umweltbundesamt under the reporting framework of the UNECE/LRTAP Convention and the NEC Directive of the European Union.

Table 7: Recalculation difference with respect to the previous submission (Source: Umweltbundesamt).

	Recalculation Difference [%]		
	1990	**2005**	**2019**
SO_2	0.00 %	0.02 %	2.07 %
NO_x	0.76 %	0.19 %	0.24 %
NMVOC	– 0.31 %	– 0.56 %	– 0.08 %
NH_3	12.01 %	4.95 %	3.35 %
$PM_{2.5}$	0.11 %	– 0.04 %	– 0.39 %

The most significant recalculations were made in the agriculture sector (3). In this sector the results of a country-specific study on feeding and nutrition ("MiNutE" study) were implemented, leading to updated and representative values for nitrogen and energy intake, excretion of nitrogen (Nex) and volatile solids (VSex). As a result emissions of NH_3, NMVOC and NO_x have been revised.

The following section describes the methodological changes made to each sector of the inventory since the previous submission.

7.1 ENERGY (1)

7.1.1 Stationary combustion 1.A.1.a-c, 1.A.2.a-g, 1.A.3.e.i and 1.A.4.a-1.A.4.c

7.1.1.1 Update of activity data

Revision of the energy balance

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

- Natural gas 2019: about 2 PJ have been shifted from power plant transformation input to final energy consumption (1.5 PJ to *Manufacturing Industries (1.A.2)* and 0.5 PJ to C*ommercial/Institutional (1.A.4.a).*

- Natural gas 2017: about 0.5 PJ final energy consumption have been shifted from *Pulp/Paper Industries (1.A.2.d)* to C*ommercial/Institutional (1.A.4.a).*
- Gasoil 2019: gross inland consumption has been revised by -0.7 PJ. Final energy consumption of *Manufacturing Industries (1.A.2)* has been reduced by 1.2 PJ and final energy consumption of C*ommercial/Institutional (1.A.4.a)* has been increased by 0.5 PJ.
- Gasoil 2018: about 0.6 PJ final energy consumption have been shifted from C*ommercial/Institutional (1.A.4.a)* to *Manufacturing Industries (1.A.2)*.
- Fuel oil 2019: about 1.8 PJ have been shifted from the energy sector's own use (*1.A.1.b Petroleum* Refinery) to final energy consumption of *Manufacturing Industries (1.A.2)*
- Motor Diesel 2019: gross inland consumption has been revised by -2.8 PJ
- Motor Diesel 1990–2019: For reasons of consistency within the GHG inventory, between 0.1 and 0.7 PJ have been shifted from *Road Transport* (*1.A.3.b*) to *Inland Navigation (1.A.3.d)*.
- Industrial Waste 2019: Final energy consumption has been reduced by about 1.9 PJ (-0.7 PJ from *non-metal mineral industries* (*1.A.2.f*) and -1.2 PJ from *chemical industries (1.A.2.c*) and replaced with solid biomass.
- Solid fuels 2019: gross inland consumption has been revised by about +3.3 PJ which does not have large implications on emission calculations, because the affected energy balance categories are mainly iron and steel industries (blast furnace use, final energy consumption, non-energy consumption of energy sector).
- Solid biomass 2019: Final energy consumption of *Manufacturing Industries (1.A.2)* has been revised by +2.4 PJ, of which about +1.2 PJ for *non-metal mineral industries (1.A.2.f)* and +1 PJ for *wood processing industries (1.A.2.gviii)*.

7.1.1.2 Methodological Changes

Energy Industries (1.A.1) and Manufacturing Industries (1.A.2)

For the categories 1.A.1 and 1.A.2, the revisions follow those of the energy balance. The methods applied (emissions factors and data sources) remain unchanged. Changes to NO_x and $PM_{2.5}$ emissions 2019 are mainly due to a revision of biomass consumption data. Changes to SO_2 emissions are mainly due to a revision of residual fuel oil as well as biomass consumption data.

For 1990 to 2019, minor changes in air pollutants emissions of categories Commercial/Institutional *(1.A.4.a)* and Residential *(1.A.4.b)* occur because of updated heating stock data and newly allocated shares of combustion technologies per energy carrier (updated energy demand model for space heating).

7.1.2 Fugitive emissions from Exploration, Production, Transport (1.B.2.a.1)

Activity data in NFR *1.B.2.a.1 Transport of oil* (crude oil throughput) had to be converted from unit tonnes to unit cubic metres, resulting in revised NMVOC emissions over the whole time series (e.g. 2019: + 0.10 kt).

7.2 Transport (1.A.3)

7.2.1 Update of activity data

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

Based on a recommendation made by the UNFCCC in the course of the 2020 Review, fuel consumption data of mobile sources used for aircraft handling at Austrian airports was collected from Vienna's International Airport. Based on this information emissions for aircraft handling on all Austrian airports were estimated and reported separately under 1.A.3.e.II Other in the submission 2022 for the first time. Emissions from this source were previously part of 1.A.3.b Road Transportation.

However, the quantities refuelled at airports represent only a very small proportion of total national fuel sales (0.01 % petrol; 0.03 % diesel; 0.3 % natural gas). Freight and car traffic to and from the airport is not part of the so-called "airport ground activities". With the help of a constant average fuel consumption factor ($FC_{\text{airport ground activity / flight movement}}$) emissions for the whole time series have been calculated (+ 0.05 kt NO_x, + 0.0001 kt, SO_2, - 0.0002 kt NH_3, + 0.005 kt NMVOC, 0.001 kt $PM_{2.5}$ in 2019).

Road Transport (1.A.3.b)

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

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

In the year 2021, plug-in hybrid electric vehicles (PHEVs) in light duty trucks were reported in the official inventory statistics for the first time with 9 pieces. Based on earlier forecast assumptions very small amounts of PHEVs in light duty trucks were already planned for this vehicle category. These were set to zero before 2021 in accordance with Statistik Austria.

Due to the relatively strong reductions in activity data in 2020 according to traffic counting points, it was necessary to calibrate the mileage of heavy duty trucks in 2019 (towards somewhat lower total urban and rural mileage shares). This made it possible to better map the relatively constant level of activity on motorways.

All these recalculations result in marginal changes of the time series of *1.A.3.b. Road Transport* (- 0.2 kt NO_x, - 0.0001 kt SO_2, - 0.0001 kt NH_3, - 0.01 kt NMVOC, - 0.01 kt $PM_{2.5}$ in 2019).

7.2.2 Methodological changes

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

In response to a recommendation made by the UNFCCC 2020 on Austria's methodology for estimating emissions from military aviation 2000–2018, data on kerosene consumption was re-evaluated. Based on a flight study (provided once by the Ministry of Defense, covering data for 1990-1998), the historical number of aircrafts (fighter jets, airplanes, helicopters, latest available data for 2008) was compared with current data on the number of operating military aircraft, assuming constant flight hours. The subsequent revision of activity data refers to the years 2009-2019 only; for the years 1999-2008 the previously applied method (linear extrapolation) has been retained, while for the years 1990–1998 the results of the flight study have been used directly as in previous submissions. The change in methodology results in recalculations for 2009–2019 (- 0.03 kt NO_x, - 0.01 kt SO_2, - 0.00004 kt NH_3, - 0.01 kt NMVOC, - 0.01 kt $PM_{2.5}$ in 2019).

7.3 INDUSTRIAL PROCESSES (2)

7.3.1 Update of activity data

7.3.1.1 Iron and Steel Production (2.C.1)

Activity data for foundries for 2019 was updated, due to revised AD in the 2021 industry report, which led to a minor decrease in emissions of NO_x (- 0.00056 kt), SO_2 (0.00048 kt), NMVOC (- 0.004 kt) and CO (- 0.04 kt).

7.3.1.2 Road paving with asphalt (2.D.3.b)

As a result of QA measures the source of activity data was changed. A recent internal evaluation indicated that the previously used statistical data did not include all asphalt used for road paving in Austria. The deviation might result from methodological set up of the statistics: it includes production from all com-

panies with more than 20 employees, and a sample of the remaining companies so that in total a certain percentage of the total production value of the respective economic sector is reflected. For products with a low value per ton this might result in an underestimation. Now data from the European Asphalt Pavement Association (EAPA) that provides a consistent time series is used. This led to an increase of NMVOC emissions of 0.086 kt compared to 2019.

7.3.1.3 Asphalt Roofing (2.D.3.c)

Activity data from 2003 onwards have been updated, previously the value of 2002 was used for subsequent years: + 0.046 kt CO for 2019.

7.3.2 Methodological changes

The following emissions were previously reported as "NE":

7.3.2.1 Road paving with asphalt (2.D.3.b) – PM

PM emissions were estimated using the default EF for abated technologies from the EMEP EEA 2019 Guidebook (as no unabated technologies are used in Austria) (0.3 kt PM_{10}, 0.45 kt TSP, and 0.02 kt $PM_{2.5}$).

7.3.2.2 Asphalt Roofing (2.D.3.c) – PM and NMVOC

As a result of investigations on asphalt roofing production sites in Austria plant specific emission factors for NMVOC and PM for this category were obtained (0.003 kt NMVOC, 0.00015 t PM_{10}, 0.0006 kt TSP, and 0.00003 kt $PM_{2.5}$).

7.4 AGRICULTURE (3)

7.4.1 Update of activity data

7.4.1.1 Manure Management (3.B), Agricultural Soils (3.D)

Livestock data – poultry and deer

New livestock data for poultry (layers, broilers, turkeys and other poultry) as well as for deer became available for the year 2020, based on the preliminary results of the farm structure survey 2020 (STATISTIK AUSTRIA 2021[10]). For 2016, activity data of the farm structure survey 2016 was used (STATISTIK AUSTRIA

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

2018[11]). Values for the years 2017, 2018 and 2019 have been derived by interpolation.

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

The feeding of cattle and swine has changed substantially in the last two decades. Therefore, a new research project on country-specific animal feeding and nutrition (MiNutE[12] study, Hörtenhuber et. al. 2021) has been carried out. As a result, updated and representative values for nitrogen and energy intake, excretion of nitrogen (N_{ex}) and volatile solids (VS_{ex}) have been included in the inventory.

Livestock data – cattle

In previous calculations, the animal categories "cattle <1 year", "cattle 1-2 years, breeding animals", "cattle 1-2 years, fattening animals", "dairy cows", "suckling cows" and "other cattle > 2 years" were used in the Austrian inventory. For the present update, most of the mentioned cattle categories were further divided into several sub-categories to allow for an application of refined IPCC 2019-coefficients and to better differentiate the duration of feeding milk. This has impacted emissions estimates and a detailed description will be included in Austria´s IIR 2022.

Livestock data –swine

For emission calculations the swine number has been grouped into three categories: "breeding sows (including suckling piglets up to 8 kg live weight) and boars", "piglets 8 to 32 kg live weight" and "fattening pigs". This has impacted emissions estimates and a detailed description will be included in Austria´s IIR 2022.

Raw material balance

For the year 2019 new information on input materials for Austria's biogas plants became available (E-CONTROL 2021[13]). Furthermore, nitrogen amounts of specific plant-based substrates have been updated. In the context of the "MiNutE"-study results, fermented manure quantities (VS-excretion and N-excretions) were recalculated. Inventory improvements resulted in revised NH_3 and NO_x emissions

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

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

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

for the entire time series with an impact on source categories *3.B Manure Management*, *3.D.a.2.a Animal manure applied to soils* and *3.D.a.2.c Other organic fertilizers applied to soils*.

7.4.2 Methodological changes

7.4.2.1 Manure Management (3.B) – NH_3, NO_x, and NMVOC

Reasons for revised estimates in category 3.B Manure Management for cattle and swine are the improved calculations of energy intake, VS-excretion and N-excretion (see above) as well as improved methane calculations for the source category 3.A Enteric Fermentation in Austria's greenhouse gas inventory (with an impact on NMVOC calculations).

The annual nitrogen excretion of cattle shows consistently higher absolute values over the complete time series. Also for swine the new study results indicate increased N-excretion amounts. Overall, NH_3 and NO_x emissions from manure management have been increased compared to the previous inventory (+ 1.8 kt NH_3 and + 0.03 kt NO_x for 2019).

Improvements of the enteric CH_4 emission calculations in Austria's greenhouse gas inventory led to lower NMVOC emissions for the entire time series (- 0.5 kt for 2019).

7.4.2.2 Manure Management (3.B) – PM

Due to the reallocation of the swine numbers as a result of the "MiNutE-study" and the improvements for the GHG calculations (see above) as well as the new poultry and deer numbers there have been slight recalculations of PM emissions (+ 0.003 kt $PM_{2.5}$ for 2019).

7.4.2.3 Agricultural Soils (3.D) – NH_3 and NO_x

Animal Manure Applied to Soils (3.D.a.2.a)

Revisions have been carried out for the entire time series as a result of the updated livestock data, revised feeding and excretion values for specific animal categories as well as the improved biogas calculation (+ 1.0 kt NH_3 and +0.3 kt NO_x for 2019).

Other organic fertilisers (including compost) (3.D.a.2.c)

The new raw material balance, the revised nitrogen amounts of specific plant-based substrates as well as the improvements of the calculations as a result of the "MiNutE"-study lead to recalculations of the entire time series (- 0.5 kt NH_3 and - 0.2 kt NO_x for 2019).

Urine and dung deposited by grazing animals (3.D.a.3)

Livestock related updates as already described above, resulted in higher ammonia emissions for the whole time series (+ 0.03 kt NH_3 for 2019).

7.4.2.4 Agricultural Soils (3.D) – NMVOC

Animal Manure Applied to Soils (3.D.a.2.a)

As a result of the revised methane calculations for *3.A Enteric Fermentation* by applying the 2019 Refinement to the 2006 IPCC GL and the updated activity data (livestock numbers, intake and excretion values) the entire time series was recalculated upwards (+ 0.1 kt NMVOC for 2019).

Urine and dung deposited by grazing animals (3.D.a.3)

The complete time series was slightly revised upwards (+ 0.003 kt NMVOC for 2019) due to the improved methane calculations and updated activity data, as described above.

Cultivated crops (3.D.e)

As a result of the adjustments of cropland areas in the LULUCF sector, NMVOC emissions for the years 2008-2012 have been slightly recalculated.

7.4.2.5 Agricultural Soils (3.D) – PM

On-farm storage, handling and transport of agricultural products (3.D.c)

As a result of the adjustments of cropland areas in the LULUCF sector, PM emissions for the years 2008-2012 have changed slightly.

7.4.2.6 Field burning of agricultural residues (3.F) – NO_x, SO_2, NMVOC, NH_3, PM

Due to revisions of activity data (vineyard area) there have been marginal revisions for several years.

7.4.2.7 New emission source

Urine and dung deposited by grazing animals (3.D.a.3) – NO_x

In previous years NO_x emissions from grazing animals have been reported as IE. During the NEC Review 2021, the TERT recommended to include these emissions. Therefore, NO_x emissions have been calculated following the Tier 1 methodology of the EMEP/EEA GB 2019 (+ 0.5 kt NO_x for 2019).

7.5 WASTE (5)

7.5.1 Update of activity data

7.5.1.1 Biological treatment of waste (5.B)

Composting (5.B.1)

2019 emissions of NH_3 had to be revised (- 0.0027 kt corresponding to 0.2 %) due to a correction of a transcription error.

Anaerobic digestion at biogas facilities (5.B.2)

Recalculations of NH_3 reported for 5.B.2 anaerobic digestion at biogas facilities (- 0.2 kt in 2019) are due to new information available on input materials for Austria's biogas plants (E-CONTROL 2021[14]), the update of nitrogen amounts of specific plant-based substrates as well as revised fermented manure quantities (VS-excretion and N-excretions) in the context of the new country-specific study on feeding and nutrition ("MiNutE" study). See also Chapter 7.4.1 on recalculations in the agriculture sector.

7.5.2 Methodological Changes

No methodological changes were carried out in sector Waste.

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

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ANNEX 1: AUSTRIA´S EMISSIONS BASED ON FUEL SOLD (WITH 'FUEL EXPORTS')

Notation keys:

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

IE (included elsewhere) ... for emissions by sources and removals by sinks of pollutants 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 pollutants 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 pollutant.

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: SO_2 emissions [in kilotonnes] 1990–2020 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	71.69	69.69	2.00	1.93	0.01	0.07	NO	**73.70**	0.25
1991	69.06	67.76	1.30	1.61	0.00	0.06	NO	**70.73**	0.28
1992	52.79	50.79	2.00	1.36	0.00	0.04	NO	**54.20**	0.30
1993	51.66	49.56	2.10	1.11	0.00	0.04	NO	**52.82**	0.32
1994	46.02	44.74	1.28	1.12	0.00	0.05	NO	**47.19**	0.34
1995	45.68	44.15	1.53	1.07	0.01	0.05	NO	**46.81**	0.38
1996	42.90	41.70	1.20	0.99	0.00	0.05	NO	**43.94**	0.42
1997	39.38	39.32	0.07	0.96	0.00	0.05	NO	**40.41**	0.43
1998	34.71	34.66	0.04	0.87	0.00	0.06	NO	**35.64**	0.45
1999	32.87	32.83	0.04	0.81	0.01	0.06	NO	**33.75**	0.44
2000	30.74	30.69	0.04	0.78	0.00	0.06	NO	**31.58**	0.48
2001	31.69	31.64	0.05	0.71	0.01	0.06	NO	**32.46**	0.47
2002	30.62	30.58	0.04	0.71	0.01	0.06	NO	**31.39**	0.43
2003	30.41	30.36	0.05	0.71	0.00	0.06	NO	**31.18**	0.40
2004	25.82	25.77	0.04	0.72	0.01	0.06	NO	**26.60**	0.47
2005	25.15	25.11	0.04	0.72	0.00	0.06	NO	**25.94**	0.55
2006	25.93	25.88	0.05	0.73	0.00	0.05	NO	**26.71**	0.58
2007	22.55	22.49	0.05	0.75	0.00	0.04	NO	**23.34**	0.61
2008	19.46	19.41	0.04	0.78	0.00	0.03	NO	**20.27**	0.61
2009	14.03	13.97	0.06	0.70	0.00	0.02	NO	**14.75**	0.53
2010	15.27	15.22	0.05	0.70	0.00	0.01	NO	**15.99**	0.57
2011	14.49	14.45	0.05	0.68	0.00	0.01	NO	**15.18**	0.60
2012	14.14	14.10	0.05	0.65	0.00	0.01	NO	**14.80**	0.57
2013	13.77	13.73	0.04	0.59	0.00	0.01	NO	**14.37**	0.54
2014	13.96	13.93	0.04	0.55	0.00	0.01	NO	**14.53**	0.54
2015	13.55	13.51	0.04	0.57	0.00	0.01	NO	**14.13**	0.58
2016	12.71	12.69	0.02	0.57	0.00	0.01	NO	**13.29**	0.54
2017	12.23	12.19	0.04	0.57	0.00	0.01	NO	**12.81**	0.52
2018	11.01	10.99	0.02	0.57	0.00	0.01	NO	**11.59**	0.59
2019	10.57	10.55	0.02	0.57	0.00	0.01	NO	**11.16**	0.68
2020	9.97	9.94	0.02	0.56	0.00	0.01	NO	**10.54**	0.24

Table A.I-2: NO_x emissions [in kilotonnes] 1990–2020 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	200.93	200.93	IE	4.27	13.69	0.10	NO	219.00	2.48
1991	210.85	210.85	IE	3.93	13.61	0.09	NO	228.47	2.80
1992	199.66	199.66	IE	4.02	13.18	0.06	NO	216.92	3.06
1993	193.85	193.85	IE	1.46	12.93	0.05	NO	208.29	3.27
1994	185.95	185.95	IE	1.38	12.73	0.05	NO	200.10	3.43
1995	185.58	185.58	IE	0.90	12.80	0.05	NO	199.32	3.85
1996	203.55	203.55	IE	0.87	12.62	0.05	NO	217.08	4.24
1997	189.77	189.77	IE	0.86	12.62	0.05	NO	203.29	4.43
1998	201.56	201.56	IE	0.83	12.63	0.05	NO	215.07	4.59
1999	193.74	193.74	IE	0.82	12.20	0.05	NO	206.81	4.52
2000	199.71	199.71	IE	0.83	11.96	0.05	NO	212.55	6.44
2001	210.52	210.52	IE	0.78	11.86	0.05	NO	223.20	6.32
2002	218.35	218.35	IE	0.79	11.81	0.05	NO	230.99	5.67
2003	229.80	229.80	IE	0.81	11.32	0.05	NO	241.98	5.21
2004	230.26	230.26	IE	0.69	10.76	0.05	NO	241.76	6.09
2005	236.25	236.25	IE	0.70	10.80	0.05	NO	247.80	6.99
2006	226.88	226.88	IE	0.58	10.83	0.04	NO	238.34	7.54
2007	219.87	219.87	IE	0.48	10.98	0.04	NO	231.37	7.99
2008	206.13	206.13	IE	0.56	11.50	0.03	NO	218.22	7.90
2009	192.72	192.72	IE	0.41	11.25	0.02	NO	204.40	6.86
2010	193.84	193.84	IE	0.55	10.36	0.02	NO	204.77	7.60
2011	184.93	184.93	IE	0.52	10.90	0.02	NO	196.37	7.98
2012	179.29	179.29	IE	0.55	11.00	0.02	NO	190.85	7.68
2013	178.67	178.67	IE	0.45	10.88	0.02	NO	190.01	7.46
2014	170.62	170.62	IE	0.46	11.17	0.02	NO	182.27	7.49
2015	167.06	167.06	IE	0.52	11.56	0.02	NO	179.15	8.18
2016	159.49	159.49	IE	0.52	11.81	0.02	NO	171.84	10.28
2017	150.83	150.83	IE	0.47	11.59	0.02	NO	162.90	10.06
2018	140.03	140.03	IE	0.41	11.31	0.02	NO	151.78	11.54
2019	133.17	133.17	IE	0.50	10.86	0.02	NO	144.55	13.47
2020	112.72	112.72	IE	0.48	10.88	0.02	NO	124.10	4.54

Table A.I-3: NMVOC emissions [in kilotonnes] 1990–2020 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	164.77	149.21	15.56	118.62	50.94	0.16	NO	334.50	0.18
1991	166.57	151.37	15.20	112.10	50.08	0.16	NO	328.90	0.20
1992	152.41	137.14	15.27	105.33	47.58	0.15	NO	305.47	0.21
1993	140.36	125.62	14.74	98.63	47.04	0.15	NO	286.18	0.23
1994	124.95	113.75	11.20	92.07	46.59	0.14	NO	263.75	0.24
1995	116.54	106.97	9.57	85.36	45.89	0.14	NO	247.93	0.26
1996	109.80	101.25	8.55	83.80	44.70	0.13	NO	238.44	0.31
1997	97.69	89.64	8.05	82.46	43.83	0.13	NO	224.10	0.35
1998	90.87	84.34	6.52	81.14	43.70	0.13	NO	215.84	0.39
1999	83.16	77.40	5.76	78.39	42.94	0.12	NO	204.62	0.38
2000	76.62	70.85	5.78	62.23	41.51	0.12	NO	180.49	0.42
2001	73.49	69.57	3.92	60.53	40.86	0.11	NO	174.99	0.41
2002	70.03	65.92	4.12	60.11	39.97	0.11	NO	170.23	0.37
2003	67.88	63.84	4.04	58.70	39.51	0.11	NO	166.21	0.34
2004	64.08	60.42	3.65	49.49	39.19	0.11	NO	152.88	0.40
2005	61.61	58.18	3.43	56.65	38.47	0.11	NO	156.84	0.47
2006	58.23	54.79	3.44	62.47	38.14	0.10	NO	158.95	0.50
2007	55.24	52.17	3.07	61.46	38.09	0.10	NO	154.89	0.53
2008	52.82	49.98	2.84	58.87	37.85	0.10	NO	149.64	0.52
2009	49.91	47.23	2.67	48.71	38.20	0.09	NO	136.91	0.45
2010	51.26	48.73	2.53	48.16	37.97	0.08	NO	137.48	0.49
2011	47.06	44.57	2.49	48.10	37.28	0.08	NO	132.52	0.51
2012	46.63	44.14	2.49	46.69	36.90	0.08	NO	130.30	0.49
2013	45.82	43.42	2.39	41.65	36.94	0.07	NO	124.48	0.46
2014	40.83	38.33	2.50	39.90	37.00	0.07	NO	117.79	0.46
2015	40.93	38.52	2.41	34.92	36.89	0.06	NO	112.81	0.50
2016	40.15	37.79	2.36	34.39	36.88	0.06	NO	111.48	0.23
2017	39.59	37.21	2.38	35.59	36.90	0.06	NO	112.13	0.20
2018	36.61	34.35	2.27	35.63	36.52	0.06	NO	108.83	0.22
2019	36.31	33.98	2.33	35.99	36.16	0.05	NO	108.50	0.24
2020	34.71	32.84	1.87	40.10	35.97	0.05	NO	110.83	0.10

Table A.I-4: NH_3 emissions [in kilotonnes] 1990–2020 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	1.96	1.96	IE	0.34	66.61	0.36	NO	69.27	0.002
1991	2.43	2.43	IE	0.58	66.87	0.37	NO	70.25	0.002
1992	2.61	2.61	IE	0.44	64.31	0.42	NO	67.79	0.002
1993	2.89	2.89	IE	0.29	64.33	0.50	NO	68.02	0.002
1994	3.03	3.03	IE	0.24	63.94	0.59	NO	67.79	0.002
1995	3.22	3.22	IE	0.17	64.02	0.60	NO	68.01	0.003
1996	3.39	3.39	IE	0.16	62.89	0.63	NO	67.07	0.003
1997	3.46	3.46	IE	0.16	62.70	0.61	NO	66.93	0.003
1998	3.76	3.76	IE	0.17	62.85	0.64	NO	67.42	0.003
1999	3.79	3.79	IE	0.19	61.19	0.69	NO	65.86	0.003
2000	3.74	3.74	IE	0.17	59.63	0.73	NO	64.27	0.003
2001	3.91	3.91	IE	0.15	59.24	0.82	NO	64.12	0.003
2002	4.04	4.04	IE	0.13	58.10	0.91	NO	63.18	0.003
2003	4.15	4.15	IE	0.14	58.08	0.99	NO	63.36	0.003
2004	4.04	4.04	IE	0.12	57.66	1.23	NO	63.05	0.003
2005	4.00	3.99	0.00	0.13	57.61	1.33	NO	63.06	0.004
2006	3.92	3.91	0.01	0.14	57.97	1.35	NO	63.37	0.004
2007	3.83	3.82	0.01	0.14	59.37	1.39	NO	64.73	0.004
2008	3.57	3.57	0.00	0.14	59.00	1.39	NO	64.10	0.004
2009	3.38	3.38	0.00	0.15	60.61	1.39	NO	65.53	0.004
2010	3.43	3.43	0.00	0.15	60.53	1.41	NO	65.52	0.004
2011	3.13	3.13	0.00	0.16	60.25	1.41	NO	64.94	0.004
2012	3.00	3.00	0.00	0.15	60.62	1.42	NO	65.19	0.004
2013	2.83	2.83	0.00	0.16	60.81	1.35	NO	65.15	0.004
2014	2.60	2.60	0.00	0.15	61.71	1.39	NO	65.85	0.004
2015	2.65	2.65	0.00	0.14	62.44	1.41	NO	66.64	0.004
2016	2.56	2.56	0.00	0.15	63.39	1.46	NO	67.56	0.004
2017	2.60	2.60	0.00	0.17	64.08	1.45	NO	68.29	0.004
2018	2.54	2.54	0.00	0.14	62.94	1.44	NO	67.05	0.005
2019	2.56	2.56	0.00	0.16	61.79	1.45	NO	65.96	0.006
2020	2.32	2.32	0.00	0.16	61.46	1.48	NO	65.42	0.002

Table A.I-5: $PM_{2.5}$ emissions [in kilotonnes] 1990–2020 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	22.68	22.57	0.11	3.84	0.37	0.23	NO	27.11	0.27
1995	21.82	21.73	0.09	3.18	0.36	0.24	NO	25.59	0.41
2000	20.48	20.39	0.09	2.97	0.34	0.23	NO	24.01	0.52
2001	20.83	20.74	0.09	2.88	0.35	0.23	NO	24.29	0.51
2002	20.35	20.26	0.10	2.51	0.34	0.23	NO	23.43	0.46
2003	20.26	20.16	0.10	2.45	0.34	0.24	NO	23.29	0.43
2004	19.66	19.57	0.09	2.42	0.38	0.24	NO	22.71	0.51
2005	19.67	19.58	0.09	2.34	0.33	0.21	NO	22.55	0.59
2006	19.40	19.32	0.09	2.11	0.32	0.21	NO	22.04	0.63
2007	18.70	18.62	0.08	1.91	0.33	0.26	NO	21.20	0.66
2008	17.76	17.69	0.08	2.01	0.32	0.25	NO	20.35	0.66
2009	16.78	16.72	0.06	1.87	0.32	0.25	NO	19.22	0.57
2010	17.31	17.24	0.07	1.89	0.32	0.29	NO	19.80	0.62
2011	16.14	16.06	0.07	1.93	0.30	0.29	NO	18.65	0.65
2012	15.75	15.69	0.07	1.87	0.28	0.30	NO	18.20	0.62
2013	15.20	15.14	0.07	1.86	0.28	0.26	NO	17.60	0.59
2014	13.59	13.53	0.06	1.87	0.28	0.31	NO	16.06	0.59
2015	13.42	13.35	0.07	1.79	0.28	0.33	NO	15.82	0.63
2016	13.03	12.97	0.06	1.80	0.28	0.31	NO	15.42	0.70
2017	12.81	12.75	0.07	1.80	0.28	0.32	NO	15.21	0.67
2018	11.89	11.83	0.06	1.74	0.27	0.28	NO	14.18	0.76
2019	11.60	11.54	0.06	1.81	0.27	0.32	NO	14.01	0.88
2020	10.96	10.91	0.05	1.71	0.26	0.31	NO	13.25	0.31

ANNEX 2: AUSTRIA´S EMISSIONS BASED ON FUEL USED (WITHOUT 'FUEL EXPORTS')

Notation keys:

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

IE (included elsewhere) ... for emissions by sources and removals by sinks of pollutants 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 pollutants 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 pollutant.

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.

The complete tables in the NFR format are submitted separately in digital form only (Excel files).

Table A.II-1: SO_2 emissions [in kilotonnes] 1990–2020 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	70.91	68.91	2.00	1.93	0.005	0.07	NO	72.92	0.25
1991	68.02	66.72	1.30	1.61	0.005	0.06	NO	69.69	0.28
1992	51.77	49.77	2.00	1.36	0.005	0.04	NO	53.17	0.30
1993	50.51	48.41	2.10	1.11	0.004	0.04	NO	51.67	0.32
1994	44.99	43.71	1.28	1.12	0.005	0.05	NO	46.16	0.34
1995	44.74	43.21	1.53	1.07	0.005	0.05	NO	45.86	0.38
1996	42.16	40.96	1.20	0.99	0.005	0.05	NO	43.20	0.42
1997	38.96	38.89	0.07	0.96	0.005	0.05	NO	39.98	0.43
1998	34.05	34.01	0.04	0.87	0.005	0.06	NO	34.98	0.45
1999	32.41	32.37	0.04	0.81	0.005	0.06	NO	33.28	0.44
2000	30.21	30.17	0.04	0.78	0.005	0.06	NO	31.05	0.48
2001	31.05	31.00	0.05	0.71	0.005	0.06	NO	31.82	0.47
2002	29.94	29.89	0.04	0.71	0.005	0.06	NO	30.71	0.43
2003	29.67	29.62	0.05	0.71	0.005	0.06	NO	30.44	0.40
2004	25.76	25.72	0.04	0.72	0.008	0.06	NO	26.55	0.47
2005	25.10	25.06	0.04	0.72	0.005	0.06	NO	25.89	0.55
2006	25.89	25.84	0.05	0.73	0.004	0.05	NO	26.67	0.58
2007	22.51	22.46	0.05	0.75	0.004	0.04	NO	23.30	0.61
2008	19.42	19.38	0.04	0.78	0.004	0.03	NO	20.24	0.61
2009	13.99	13.94	0.06	0.70	0.004	0.02	NO	14.71	0.53
2010	15.23	15.19	0.05	0.70	0.004	0.01	NO	15.95	0.57
2011	14.46	14.41	0.05	0.68	0.003	0.01	NO	15.15	0.60
2012	14.11	14.06	0.05	0.65	0.002	0.01	NO	14.77	0.57
2013	13.73	13.69	0.04	0.59	0.002	0.01	NO	14.33	0.54
2014	13.93	13.89	0.04	0.55	0.002	0.01	NO	14.49	0.54
2015	13.51	13.47	0.04	0.57	0.002	0.01	NO	14.09	0.58
2016	12.67	12.65	0.02	0.57	0.002	0.01	NO	13.26	0.54
2017	12.19	12.15	0.04	0.57	0.001	0.01	NO	12.77	0.52
2018	10.97	10.95	0.02	0.57	0.001	0.01	NO	11.56	0.59
2019	10.54	10.51	0.02	0.57	0.001	0.01	NO	11.12	0.68
2020	9.93	9.91	0.02	0.56	0.001	0.01	NO	10.51	0.24

Table A.II-2: NO_x emissions [in kilotonnes] 1990–2020 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	184.05	184.05	IE	4.27	13.69	0.10	NO	202.11	2.48
1991	186.09	186.09	IE	3.93	13.61	0.09	NO	203.72	2.80
1992	178.36	178.36	IE	4.02	13.18	0.06	NO	195.62	3.06
1993	172.57	172.57	IE	1.46	12.93	0.05	NO	187.01	3.27
1994	168.68	168.68	IE	1.38	12.73	0.05	NO	182.84	3.43
1995	168.20	168.20	IE	0.90	12.80	0.05	NO	181.94	3.85
1996	168.76	168.76	IE	0.87	12.62	0.05	NO	182.29	4.24
1997	169.06	169.06	IE	0.86	12.62	0.05	NO	182.59	4.43
1998	167.39	167.39	IE	0.83	12.63	0.05	NO	180.90	4.59
1999	167.92	167.92	IE	0.82	12.20	0.05	NO	180.99	4.52
2000	167.89	167.89	IE	0.83	11.96	0.05	NO	180.73	6.44
2001	171.05	171.05	IE	0.78	11.86	0.05	NO	183.74	6.32
2002	170.57	170.57	IE	0.79	11.81	0.05	NO	183.22	5.67
2003	175.42	175.42	IE	0.81	11.32	0.05	NO	187.61	5.21
2004	176.13	176.13	IE	0.69	10.76	0.05	NO	187.63	6.09
2005	179.30	179.30	IE	0.70	10.80	0.05	NO	190.85	6.99
2006	180.75	180.75	IE	0.58	10.83	0.04	NO	192.20	7.54
2007	176.92	176.92	IE	0.48	10.98	0.04	NO	188.41	7.99
2008	169.59	169.59	IE	0.56	11.50	0.03	NO	181.68	7.90
2009	157.39	157.39	IE	0.41	11.25	0.02	NO	169.08	6.86
2010	158.43	158.43	IE	0.55	10.36	0.02	NO	169.35	7.60
2011	156.71	156.71	IE	0.52	10.90	0.02	NO	168.15	7.98
2012	152.45	152.45	IE	0.55	11.00	0.02	NO	164.01	7.68
2013	149.18	149.18	IE	0.45	10.88	0.02	NO	160.52	7.46
2014	145.29	145.29	IE	0.46	11.17	0.02	NO	156.94	7.49
2015	143.03	143.03	IE	0.52	11.56	0.02	NO	155.13	8.18
2016	138.76	138.76	IE	0.52	11.81	0.02	NO	151.10	10.28
2017	132.08	132.08	IE	0.47	11.59	0.02	NO	144.16	10.06
2018	124.70	124.70	IE	0.41	11.31	0.02	NO	136.45	11.54
2019	119.64	119.64	IE	0.50	10.86	0.02	NO	131.02	13.47
2020	102.05	102.05	IE	0.48	10.88	0.02	NO	113.43	4.54

Table A.II-3: NMVOC emissions [in kilotonnes] 1990–2020 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	160.28	144.72	15.56	118.62	50.94	0.16	NO	330.00	0.18
1991	156.18	140.98	15.20	112.10	50.08	0.16	NO	318.51	0.20
1992	146.45	131.18	15.27	105.33	47.58	0.15	NO	299.51	0.21
1993	136.32	121.59	14.74	98.63	47.04	0.15	NO	282.14	0.23
1994	122.95	111.75	11.20	92.07	46.59	0.14	NO	261.75	0.24
1995	115.09	105.52	9.57	85.36	45.89	0.14	NO	246.48	0.26
1996	109.57	101.02	8.55	83.80	44.70	0.13	NO	238.20	0.31
1997	98.49	90.45	8.05	82.46	43.83	0.13	NO	224.91	0.35
1998	89.44	82.92	6.52	81.14	43.70	0.13	NO	214.41	0.39
1999	83.25	77.49	5.76	78.39	42.94	0.12	NO	204.70	0.38
2000	76.33	70.56	5.78	62.23	41.51	0.12	NO	180.20	0.42
2001	72.01	68.09	3.92	60.53	40.86	0.11	NO	173.51	0.41
2002	66.57	62.46	4.12	60.11	39.97	0.11	NO	166.77	0.37
2003	63.43	59.38	4.04	58.70	39.51	0.11	NO	161.75	0.34
2004	59.61	55.96	3.65	49.49	39.19	0.11	NO	148.41	0.40
2005	57.15	53.72	3.43	56.65	38.47	0.11	NO	152.38	0.47
2006	54.90	51.46	3.44	62.47	38.14	0.10	NO	155.61	0.50
2007	52.17	49.10	3.07	61.46	38.09	0.10	NO	151.82	0.53
2008	50.39	47.55	2.84	58.87	37.85	0.10	NO	147.21	0.52
2009	47.65	44.98	2.67	48.71	38.20	0.09	NO	134.65	0.45
2010	49.26	46.73	2.53	48.16	37.97	0.08	NO	135.48	0.49
2011	45.52	43.03	2.49	48.10	37.28	0.08	NO	130.98	0.51
2012	45.29	42.80	2.49	46.69	36.90	0.08	NO	128.96	0.49
2013	44.58	42.19	2.39	41.65	36.94	0.07	NO	123.25	0.46
2014	39.81	37.30	2.50	39.90	37.00	0.07	NO	116.77	0.46
2015	39.95	37.54	2.41	34.92	36.89	0.06	NO	111.82	0.50
2016	39.25	36.90	2.36	34.39	36.88	0.06	NO	110.59	0.23
2017	38.79	36.41	2.38	35.59	36.90	0.06	NO	111.33	0.20
2018	35.94	33.67	2.27	35.63	36.52	0.06	NO	108.15	0.22
2019	35.72	33.40	2.33	35.99	36.16	0.05	NO	107.92	0.24
2020	34.23	32.36	1.87	40.10	35.97	0.05	NO	110.35	0.10

Table A.II-4: NH_3 emissions [in kilotonnes] 1990–2020 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	1.91	1.91	IE	0.34	66.61	0.36	NO	69.22	0.002
1991	2.26	2.26	IE	0.58	66.87	0.37	NO	70.08	0.002
1992	2.48	2.48	IE	0.44	64.31	0.42	NO	67.66	0.002
1993	2.79	2.79	IE	0.29	64.33	0.50	NO	67.91	0.002
1994	2.98	2.98	IE	0.24	63.94	0.59	NO	67.74	0.002
1995	3.18	3.18	IE	0.17	64.02	0.60	NO	67.97	0.003
1996	3.48	3.48	IE	0.16	62.89	0.63	NO	67.15	0.003
1997	3.60	3.60	IE	0.16	62.70	0.61	NO	67.07	0.003
1998	3.75	3.75	IE	0.17	62.85	0.64	NO	67.41	0.003
1999	3.93	3.93	IE	0.19	61.19	0.69	NO	65.99	0.003
2000	3.88	3.88	IE	0.17	59.63	0.73	NO	64.41	0.003
2001	3.90	3.90	IE	0.15	59.24	0.82	NO	64.11	0.003
2002	3.70	3.70	IE	0.13	58.10	0.91	NO	62.84	0.003
2003	3.61	3.61	IE	0.14	58.08	0.99	NO	62.81	0.003
2004	3.45	3.45	IE	0.12	57.66	1.23	NO	62.46	0.003
2005	3.38	3.37	0.005	0.13	57.61	1.33	NO	62.44	0.004
2006	3.34	3.33	0.006	0.14	57.97	1.35	NO	62.79	0.004
2007	3.24	3.23	0.005	0.14	59.37	1.39	NO	64.14	0.004
2008	3.07	3.07	0.003	0.14	59.00	1.39	NO	63.60	0.004
2009	2.87	2.86	0.003	0.15	60.61	1.39	NO	65.01	0.004
2010	2.94	2.93	0.003	0.15	60.53	1.41	NO	65.03	0.004
2011	2.72	2.72	0.002	0.16	60.25	1.41	NO	64.54	0.004
2012	2.64	2.63	0.001	0.15	60.62	1.42	NO	64.83	0.004
2013	2.50	2.50	0.001	0.16	60.81	1.35	NO	64.82	0.004
2014	2.32	2.31	0.001	0.15	61.71	1.39	NO	65.57	0.004
2015	2.36	2.36	0.000	0.14	62.44	1.41	NO	66.34	0.004
2016	2.27	2.27	0.000	0.15	63.39	1.46	NO	67.26	0.004
2017	2.31	2.31	0.000	0.17	64.08	1.45	NO	68.00	0.004
2018	2.28	2.28	0.001	0.14	62.94	1.44	NO	66.79	0.005
2019	2.31	2.31	0.000	0.16	61.79	1.45	NO	65.71	0.006
2020	2.11	2.11	0.000	0.16	61.46	1.48	NO	65.21	0.002

Table A.II-5: $PM_{2.5}$ emissions [in kilotonnes] 1990–2020 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	22.13	22.02	0.11	3.84	0.37	0.23	NO	26.56	0.27
1995	21.12	21.04	0.09	3.18	0.36	0.24	NO	24.90	0.41
2000	19.71	19.62	0.09	2.97	0.34	0.23	NO	23.24	0.52
2001	19.86	19.77	0.09	2.88	0.35	0.23	NO	23.32	0.51
2002	19.07	18.97	0.10	2.51	0.34	0.23	NO	22.15	0.46
2003	18.75	18.65	0.10	2.45	0.34	0.24	NO	21.78	0.43
2004	18.14	18.05	0.09	2.42	0.38	0.24	NO	21.18	0.51
2005	18.09	18.00	0.09	2.34	0.33	0.21	NO	20.97	0.59
2006	18.09	18.00	0.09	2.11	0.32	0.21	NO	20.73	0.63
2007	17.48	17.40	0.08	1.91	0.33	0.26	NO	19.98	0.66
2008	16.79	16.71	0.08	2.01	0.32	0.25	NO	19.37	0.66
2009	15.87	15.82	0.06	1.87	0.32	0.25	NO	18.31	0.57
2010	16.43	16.36	0.07	1.89	0.32	0.29	NO	18.93	0.62
2011	15.47	15.39	0.07	1.93	0.30	0.29	NO	17.98	0.65
2012	15.16	15.09	0.07	1.87	0.28	0.30	NO	17.61	0.62
2013	14.62	14.55	0.07	1.86	0.28	0.26	NO	17.02	0.59
2014	13.11	13.05	0.06	1.87	0.28	0.31	NO	15.58	0.59
2015	12.98	12.91	0.07	1.79	0.28	0.33	NO	15.38	0.63
2016	12.66	12.59	0.06	1.80	0.28	0.31	NO	15.05	0.70
2017	12.48	12.42	0.07	1.80	0.28	0.32	NO	14.88	0.67
2018	11.64	11.58	0.06	1.74	0.27	0.28	NO	13.93	0.76
2019	11.39	11.34	0.06	1.81	0.27	0.32	NO	13.80	0.88
2020	10.80	10.75	0.05	1.71	0.26	0.31	NO	13.09	0.31

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The report on Austria's Annual Air Emission Inventory 1990–2020, compiled by the Umweltbundesamt , provides a summary of Austria's SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$ emissions for the years 1990 to 2020.

The report includes information on emission trends and recalculations for the pollutants regulated in the NEC Directive performed from 1990 to 2020. Detailed descriptions will be provided in Austria's Informative Inventory Report (IIR) 2022.

The results of the calculations presented in the report show that NMVOC emissions increased by 2.3 kt (2.1 %) between 2019 and 2020. This was due to the increased use of disinfectants due to the pandemic. The emissions of the other pollutants decreased: emissions of sulphur dioxide (SO_2) by 5.5 %, nitrogen oxide emissions (NO_x) by 14.1 %, ammonia emissions (NH_3) by 0.8 % and particulate matter ($PM_{2.5}$) by 5.4 %.

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