PERSPEKTIVEN FÜR UMWELT & GESELLSCHAFT umweltbundesamt

GHG Projections and Assessment of Policies and Measures in Austria

Reporting under Decision 280/2004/EC, 15 March 2013

GHG PROJECTIONS AND ASSESSMENT OF POLICIES AND MEASURES IN AUSTRIA

Reporting under Decision 280/2004/EC, 15 March 2013

REPORT
REP-0412

Vienna 2013

Project management

Andreas Zechmeister

Authors

Michael Anderl
Michael Gössl
Elisabeth Kampel
Traute Köther
Thomas Krutzler
Christoph Lampert
Katja Pazdernik
Stephan Poupa
Wolfgang Schieder
Carmen Schmid
Gudrun Stranner
Alexander Storch
Herbert Wiesenberger
Peter Weiss
Manuela Wieser
Andreas Zechmeister
Gerhard Zethner
Matthias Braun (Lebensministerium)

Editor

Brigitte Read
Ulrike Lamb

Layout and typesetting

Manuela Kaitna

Title photograph

© Ute Kutschera

For further information about the publications of the Umweltbundesamt please go to: http://www.umweltbundesamt.at/

Imprint

Owner and Editor: Umweltbundesamt GmbH
Spittelauer Lände 5, 1090 Vienna/Austria

Printed on CO_2-neutral 100 % recycled paper.

Korrigierte Auflage

ISBN 978-3-99004-216-8

VORWORT

Der vorliegende Endbericht präsentiert die österreichischen Treibhausgasprojektionen für die Jahre 2015, 2020, 2025 und 2030.

Die Projektionen der Treibhausgasemissionsentwicklung beinhalten die Szenarien “with existing measures“ (WEM) und “with additional measures“ (WAM). Die Grundlage der Klimaschutzmaßnahmen stellt die österreichischen Klimastrategie 2002 und deren Anpassung 2007 dar. Die beiden Szenarien unterscheiden sich folgendermaßen: Für das WEM-Szenario sind die bis zum Stichtag 8. März 2012 bereits implementierten Maßnahmen inkludiert. Das WAM-Szenario baut auf den Maßnahmen in der Energiestrategie Österreich und den Maßnahmenverhandlungen zum Klimaschutzgesetz (KSG) auf. Es beinhaltet im Vergleich zu WEM jene zusätzlichen Maßnahmen im Planungsstadium, die nach ExpertInnenmeinung und nach Abstimmung mit dem Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) voraussichtlich umgesetzt und bis 2030 wirksam werden.

Die Emissionsszenarien in diesem Bericht basieren auf Wirtschaftsprognosen bis zum Jahr 2030 und berücksichtigen die Finanz- und Wirtschaftskrise 2008.

Zur Berechnung der Szenarien wurden mehrere Modelle verwendet. Die Energieszenarien basieren auf Analysen des Österreichischen Instituts für Wirtschaftsforschung (WIFO) zu Gesamtenergiebedarf und Produktion. Diese wurden durch Berechnungen von Nachfrage und Aufbringung von Elektrizität, Energie und Wärme der Technischen Universität Wien sowie der Österreichischen Energieagentur (AEA) ergänzt. Weitere Modelle wurden für den Verkehrsbereich, die Landwirtschaft und den Abfall eingesetzt.

Die Sektor-Einteilung der Emissionsszenarien orientiert sich am Format der Emissionsberichterstattung für das UN Rahmenübereinkommen über Klimaänderungen (UNFCCC). Der Bericht selbst folgt den Anforderungen zur Berichterstattung gemäß der *Entscheidung 280/2004/EG über ein System zur Überwachung der Treibhausgasemissionen in der Gemeinschaft und zur Umsetzung des Kyoto-Protokolls* und den UNFCCC-Leitlinien für nationale Klimaberichte.

PREAMBLE

This report presents Austria's greenhouse gas emission projections for 2015, 2020, 2025 and 2030.

The projections for greenhouse gas developments contained in this report include a scenario "with existing measures" (WEM) and a scenario "with additional measures" (WAM). The former takes into account climate change mitigation measures that were implemented under the Austrian Climate Strategy 2002 (as amended in 2007) before 8th February 2012. The latter is based on measures specified in the Austrian Energy Strategy and negotiations leading up to the Austrian climate law. It contains, in addition to the WEM scenario, further planned policies and measures which, according to the view of experts and in agreement with the Austrian Ministry of Agriculture, Forestry, Environment and Water Management, are expected to be implemented and become effective by 2030.

Emission projections in this report are based on economic forecasts for the period up to 2030. The economic and financial crisis from 2008 onwards has been taken into account in these emission projections.

To calculate the scenarios, several models have been used. The energy scenarios are based on analyses of total energy demand and production conducted by the Austrian Institute for Economic Research (WIFO). The calculations of the demand for and generation of electricity, energy and heat were carried out by the University of Technology in Vienna and the Austrian Energy Agency (AEA). For the transport, agricultural and waste sectors additional models were used.

The sectoral structure of the emission scenarios is based on the format for emission reporting under the UN Framework Convention on Climate Change (UNFCCC).

The report itself is in compliance with the requirements for reporting according to EU Council Decision 280/2004/EC of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, and with the UNFCCC Guidelines FCCC/CP/1999/7 (guidelines for the preparation of National Communications by Parties included in Annex I to the Convention) for national reports on climate change.

CONTENT

ZUSAMMENFASSUNG

Dieses Kapitel fasst die Emissionsprojektionen für die Szenarien „mit bestehenden Maßnahmen" (WEM) und „mit zusätzlichen Maßnahmen" (WAM) zusammen. Die wichtigsten Ergebnisse der fünf CRF-Sektoren (ohne LULUCF) und der einzelnen Treibhausgase (THG) werden als CO_2-Äquivalent angegeben. Trendgrafiken der THG sowie Darstellungen der THG-Emissionen nach Sektoren und pro THG sind enthalten.

THG-Emissionen

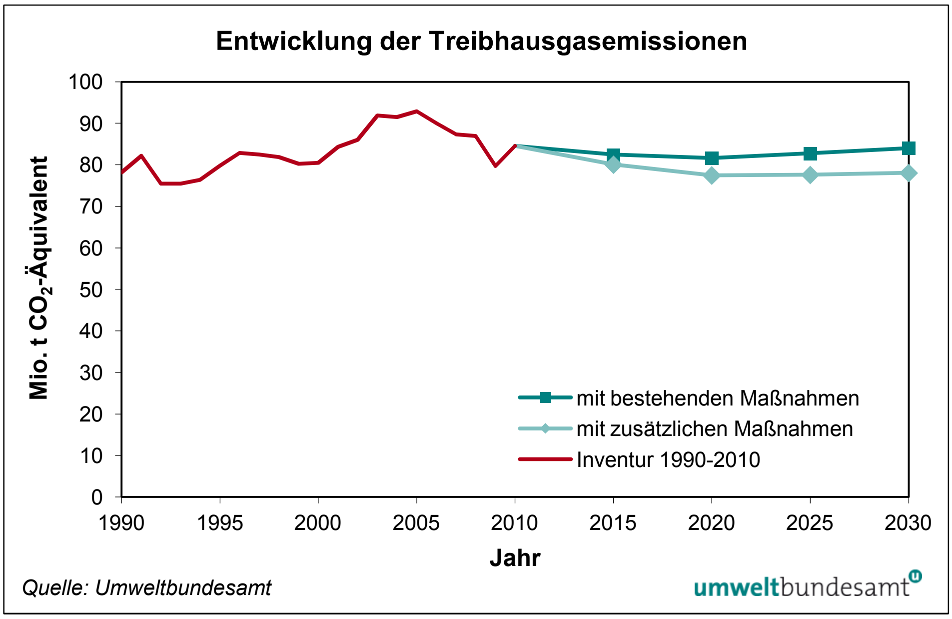
Tabelle 1: Gesamtemissionen, im Szenario „mit bestehenden Maßnahmen".

	Trend der Inventur [Gg CO_2e]			Emissionen „mit bestehenden Maßnahmen" [Gg CO_2e]			
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	78.162	92.880	84.594	82.441	81.636	82.759	84.034
1. Energie	55.397	72.113	64.328	62.775	61.760	62.556	63.424
2. Prozessemissionen	10.108	10.623	10.680	10.277	10.675	11.193	11.741
3. Lösemittel	512	387	327	342	340	338	336
4. Landwirtschaft	8.558	7.412	7.453	7.654	7.733	7.711	7.687
6. Abfall	3.587	2.345	1.806	1.392	1.128	961	847

Tabelle 2: Gesamtemissionen, im Szenario „mit zusätzlichen Maßnahmen".

	Trend der Inventur [Gg CO_2e]			Emissionen „mit zusätzlichen Maßnahmen" [Gg CO_2e]			
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	78.162	92.880	84.594	80.103	77.502	77.617	78.064
1. Energie	55.397	72.113	64.328	60.649	58.081	57.899	57.982
2. Prozessemissionen	10.108	10.623	10.680	10.194	10.491	10.972	11.469
3. Lösemittel	512	387	327	342	340	338	336
4. Landwirtschaft	8.558	7.412	7.453	7.526	7.461	7.447	7.430
6. Abfall	3.587	2.345	1.806	1.392	1.128	961	847

Abbildung 1: Entwicklung der THG-Emissionen (ohne LULUCF).



Das WEM-Szenario ohne LULUCF zeigt einen Anstieg um 4,4 % zwischen 1990 und 2020 und 7,5 % im Zeitraum von 1990 bis 2030, d. h. von 78,2 Mio. t CO_2-Äquivalent (1990) auf 81,6 Mio. t CO_2-Äquivalent 2020 und 84,0 Mio. t CO_2-Äquivalent 2030. Das WAM-Szenario zeigt einen Abnahme von 0,8 % zwischen 1990 und 2020 und eine Abnahme von 0,1 % bis 2030, d. h. von 78,2 Mio. t CO_2-Äquivalent (1990) auf 77,5 Mio. t CO_2-Äquivalent 2020 und 78,1 Mio. t CO_2-Äquivalent 2030. Bei den Gesamt THG-Emissionen wird in dieser Darstellung des Sektors „Landnutzung, Landnutzungsänderungen und Forstwirtschaft" aus methodischen Gründen ausgeklammert.

Tabelle 3: Entwicklung der THG-Emissionen nach THG (ohne LULUCF), mit bestehenden Maßnahmen.

	Emissionstrend [Gg CO_2e]			Emissionen mit bestehenden Maßnahmen [Gg CO_2e]			
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
CO_2	62.060	79.724	72.290	70.545	69.982	71.310	72.722
CH_4	8.305	6.095	5.575	5.214	5.016	4.879	4.797
N_2O	6.198	5.434	5.153	5.181	5.143	5.057	4.981
F-Gase	1.600	1.628	1.575	1.501	1.494	1.514	1.533
Gesamt	**78.162**	**92.880**	**84.594**	**82.441**	**81.636**	**82.759**	**84.034**

Im WEM-Szenario werden für die Gesamt THG-Emissionen zwischen 2005 und 2020 eine Abnahme von 12 % oder 11,2 Mio. t CO_2-Äquivalent vorausgesagt. Diese Veränderung ist hauptsächlich auf die Projektion zurückzuführen, dass die Emissionen im Energiesektor um 14 % oder 10,4 Mio. t CO_2-Äquivalent sinken werden. Ein leichter Anstieg der Emissionen im Sektor Industrieprozesse wird mit 0,5 % oder 0,1 Mio. t CO_2-Äquivalent vorausgesagt. Für die Emissionen des Sektors Lösemittel wird eine Abnahme um 12 % oder 46 Gg CO_2-Äquivalent erwartet. Für die Emissionen des Sektors Landwirtschaft wird eine Erhöhung von 4,3 % oder 0,3 Mio. t CO_2-Äquivalent erwartet. Für die Emissionen des Sektors Abfall wird im WEM-Szenario eine Abnahme um 51,9 % oder 1,2 Mio. t CO_2-Äquivalent angenommen. Im Sektors 1.A.1 Energieversorgung wird eine Abnahme der Emissionen um 30,2 % oder 4,9 Mio. t CO_2-Äquivalent angenommen und im Sektor 1.A.2 Industrie wird eine Abnahme um 1,6 % oder 0,3 Mio. t CO_2-Äquivalent angenommen. Für die Emissionen vom Sektor 1.A.3 Transport wird eine Abnahme um 5 % oder 1,2 Mio. t zwischen 2005 und 2020 und für die Emissionen der Sektoren 1.A.4 Kleinverbrauch und 1.A.5 Sonstige (Militär) wird eine Abnahme um 29,4 % oder 4,0 Mio. t CO_2-Äquivalent erwartet.

Gemäß der WEM-Projektion wird CO_2 weiterhin das wichtigste THG in Österreich sein, sein Anteil an den Gesamtemissionen wird von 85,8 % im Jahr 2005 auf 85,7 % im Jahr 2020 leicht abnehmen und sich auf 86,5 % im Jahr 2030 erhöhen. Zwischen 2005 und 2023 wird der Anteil am CO_2-Äquivalent für CH_4 und N_2O von 12,4 % und 11,6 % sinken, während für die Fluorierten Gase (HFKW, FKW und SF_6) der Anteil von 1,8 % gleich erwartet wird.

Tabelle 4: Entwicklung der THG-Emissionen nach THG (ohne LULUCF), mit zusätzlichen Maßnahmen.

	Emissionstrend [Gg CO_2e]			**Emissionen mit zusätzlichen Maßnahmen [Gg CO_2e]**			
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
CO_2	62.060	79.724	72.290	68.391	66.222	66.534	67.120
CH_4	8.305	6.095	5.575	5.191	4.967	4.829	4.746
N_2O	6.198	5.434	5.153	5.065	4.909	4.830	4.754
F-Gase	1.600	1.628	1.575	1.456	1.404	1.424	1.443
Gesamt	**78.162**	**92.880**	**84.594**	**80.103**	**77.502**	**77.617**	**78.064**

Im WAM-Szenario wird für die THG-Emissionen eine Abnahme zwischen 2005 und 2020 von 16,6 % oder 15,4 Mio. t CO_2-Äquivalent erwartet. Diese Abnahme ergibt sich hauptsächlich durch die erwartete Abnahme der Emissionen des Energie-Sektors um 19,5 % oder 14,0 Mio. t CO_2-Äquivalent. Für die Emissionen des Abfall-Sektors wird eine Abnahme um 51,9 % oder 1,2 Mio. t CO_2-Äquivalent angenommen. Im Gegensatz dazu wird bei den Emissionen des Sektors Industrieprozesse eine Reduktion um 1,2 % oder 0,1 Mio. t CO_2-Äquivalent erwartet und für die Emissionen der Lösemittel wird eine Abnahme um 12 % oder 46 Gg CO_2-Äquivalent erwartet. Im 1.A.4 Kleinverbrauch und 1.A.5 Sonstige (Militär) eine Abnahme um 31,1 % oder 4,3 Mio. t CO_2-Äquivalent angenommen. Für die Emissionen des Sektors 1.A.1 Energieversorgung wird eine Abnahme um 32 % oder 5,2 Mio. t CO_2-Äquivalent und im Sektor 1.A.3 Transport um 15,7 % oder 3,9 Mio. t CO_2-Äquivalent angenommen. Für die Emissionen im Sektor 1.B Diffuse Emissionen wird eine Zunahme um 29,2 % oder 1,29 Gg CO_2-Äquivalent erwartet. Im Gegensatz dazu wird für die Emissionen des Sektors 1.A.2 Fertigungsindustrie und Konstruktion eine Abnahme um 4,5 % oder 0,7 Mio. t CO_2-Äquivalent angenommen.

Gemäß der WAM-Projektion wird CO_2 weiterhin das wichtigste THG in Österreich sein, sein Anteil an den Gesamtemissionen sinkt von 85,8 % im Jahr 2005 auf 85,4 % im Jahr 2020 und steigt wieder auf 86,0 % im Jahr 2030. Zwischen 2005 und 2030 wird der Anteil am CO_2-Äquivalent für CH_4 und N_2O von 12,4 % auf 12,2 % sinken. Für die Fluorierten Gase (HFKW, FKW und SF_6) wird ein gleichbleibender Anteil von 1,8 % erwartet.

Eine Auswertung der Projektion für einzelne Sektoren wird in Kapitel 2 dargestellt. Die detaillierten Emissionstabellen der einzelnen Sektoren werden in Annex 1 dargestellt. Die spezifischen sektoralen Annahmen und Aktivitäten sind in den methodischen Kapiteln 3.1 bis 3.6 beschrieben.

Die nachfolgenden Abbildungen zeigen die sektorale Entwicklungen und die Emissionen für die einzelnen THG.

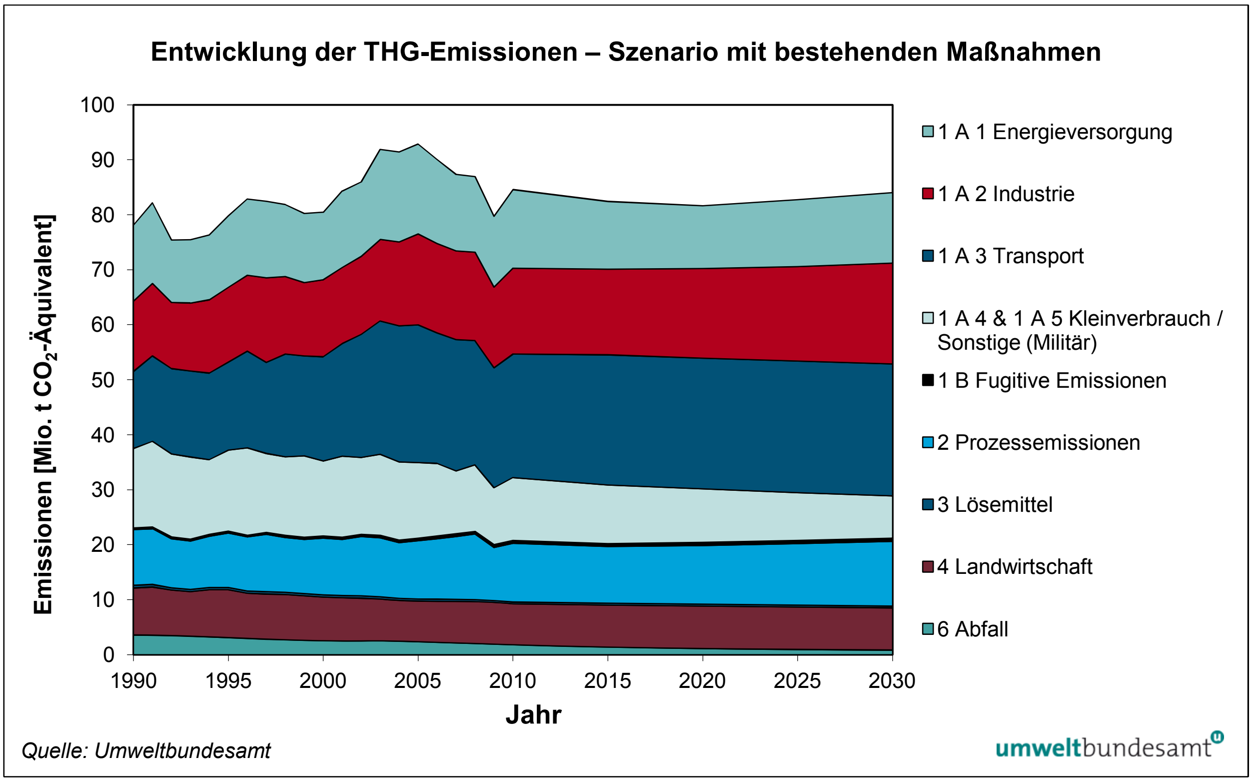


Abbildung 2: Entwicklung der THG-Emissionen nach Sektoren, Szenario mit bestehenden Maßnahmen.

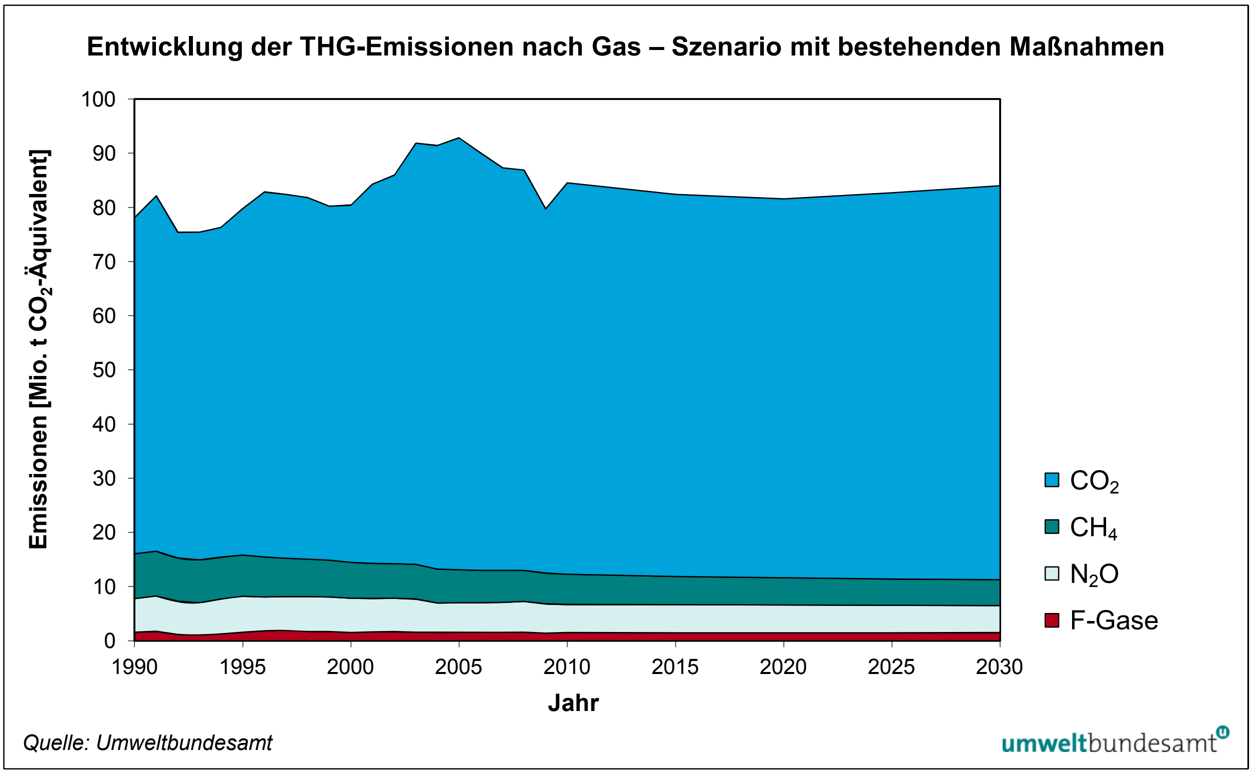


Abbildung 3: Entwicklung der THG-Emissionen nach THG, Szenario mit bestehenden Maßnahmen.

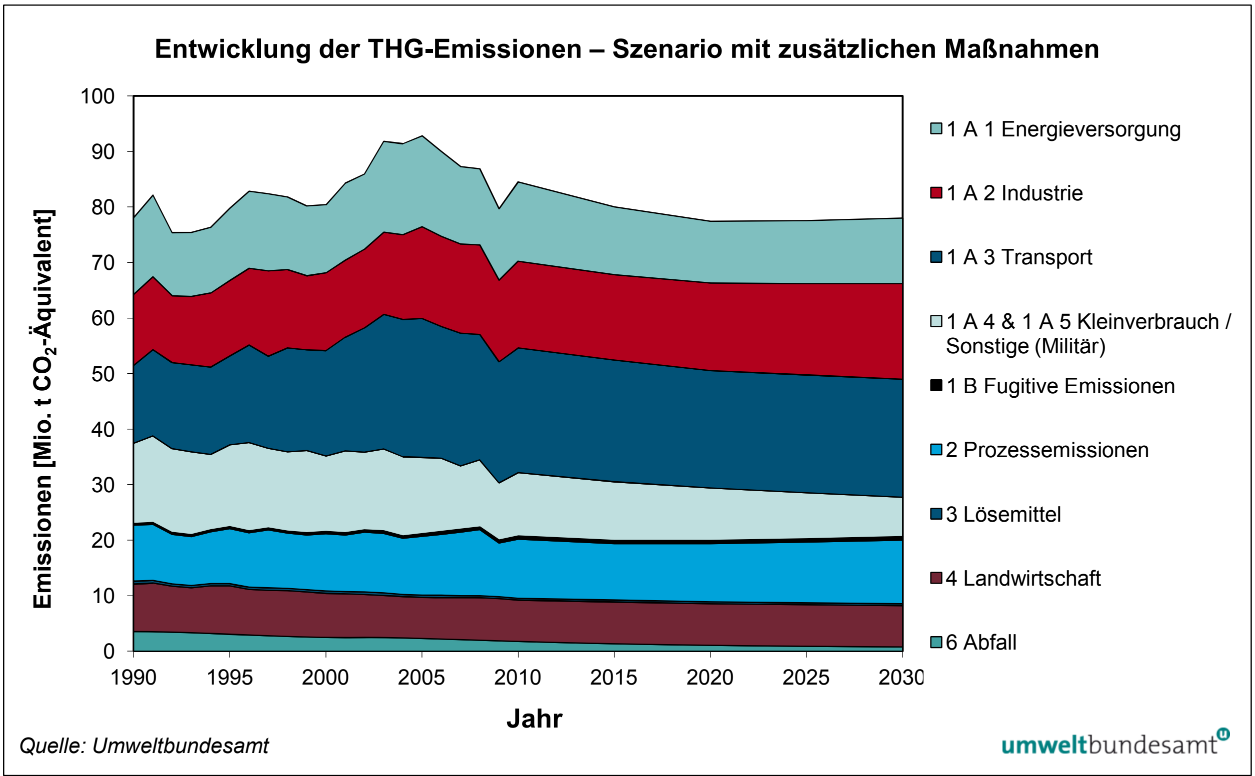


Abbildung 4: Entwicklung der THG-Emissionen nach Sektoren, Szenario mit zusätzlichen Maßnahmen.

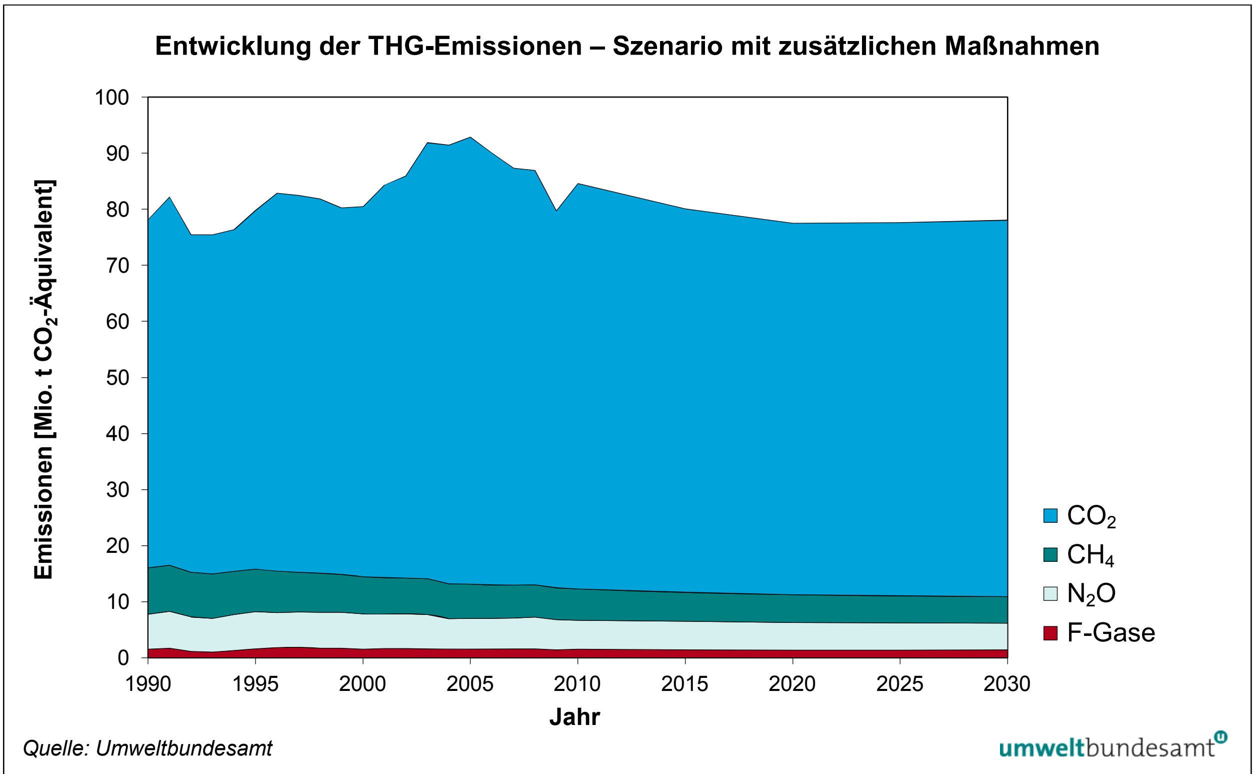


Abbildung 5: Entwicklung der THG-Emissionen nach THG, Szenario mit zusätzlichen Maßnahmen.

EU ETS/Non-ETS Emissionen

Die Treibhausgas-Emissionen innerhalb des EU Emissionshandels (emission trading scheme, ETS) zeigen im Szenario mit bestehenden Maßnahmen einen ansteigenden Trend bis 2030. Hauptverantwortlich dafür ist der Sektor Energie mit einem Anstieg von rd. 6 % und der Sektor Prozessemissionen mit einem Wachstum von rd. 22 % im Zeitraum von 2010 bis 2030. Die gesamten Emissionen, welche nicht dem Emissionshandel unterliegen (non-ETS) wird ein leicht sinkender Trend vorhergesagt.

Tabelle 5: EU ETS und non-ETS THG-Emissionen, Szenario mit bestehenden Maßnahmen

	mit bestehenden Maßnahmen [Gg CO_2 Äquivalent]				
EU ETS THG-Emissionen	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	30.918	30.263	30.336	32.215	34.160
1. Energie*	22.543	21.501	21.170	22.550	23.967
2. Prozessemissionen	8.375	8.762	9.166	9.665	10.193
non-ETS THG-Emissionen	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	53.676	52.178	51.299	50.544	49.874
1. Energie	41.785	41.274	40.589	40.006	39.458
2. Prozessemissionen	2.305	1.515	1.509	1.528	1.548
3. Lösemittel	327	342	340	338	336
4. Landwirtschaft	7.453	7.654	7.733	7.711	7.687
6. Abfall	1.806	1.392	1.128	961	847

** inkl. Flugverkehr*

Der Anstieg aus Emissionen von ETS-Anlage wird im WAM-Szenario aufgrund zusätzlicher Maßnahmen (mit rd. 5 %) niedriger als im WEM-Szenario (rd. 10 %) im Zeitraum vom 2010 bis 2030 erwartet. Genauer betrachtet wird eine Abnahme der EU ETS Emissionen im Sektor Energie um rd. 1 % und eine Zunahme im Sektor Prozessemissionen um rd. 20 % projiziert. Die gesamten Emissionen, welche nicht dem Emissionshandel unterliege (non-ETS) wird eine Reduktion von rd. 16 % vorausgesagt.

Tabelle 6: EU ETS und non-ETS THG-Emissionen, Szenario mit zusätzlichen Maßnahmen

	mit zusätzlichen Maßnahmen [Gg CO_2 Äquivalent]				
EU ETS THG-Emissionen	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	30.918	30.041	29.711	30.922	32.418
1. Energie *	22.543	21.317	20.638	21.388	22.407
2. Prozessemissionen	8.375	8.724	9.072	9.534	10.012
non-ETS THG-Emissionen	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	53.676	50.062	47.791	46.695	45.645
1. Energie	41.785	39.332	37.442	36.511	35.575
2. Prozessemissionen	2.305	1.470	1.419	1.438	1.458
3. Lösemittel	327	342	340	338	336
4. Landwirtschaft	7.453	7.526	7.461	7.447	7.430
6. Abfall	1.806	1.392	1.128	961	847

** inkl. Flugverkehr*

SUMMARY

This chapter presents a summary of the projections for the scenario "with existing measures" (WEM) and the scenario "with additional measures" (WAM). The main results of the five CRF sectors (without LULUCF) and of all greenhouse gases are presented in CO_2 equivalents. Trend graphs include GHG totals by category and by gas.

Total GHG emissions

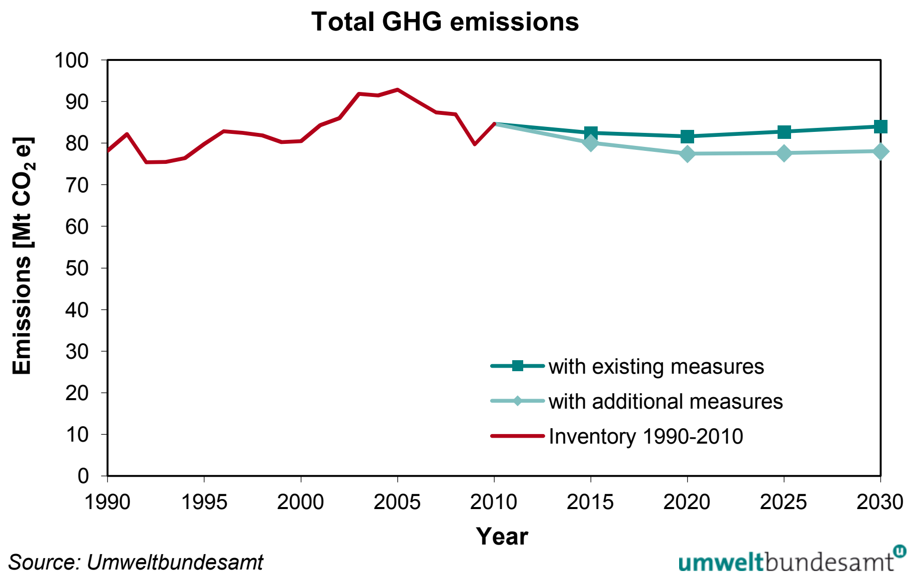
Table 1: Historical trends and projections (2015–2030): greenhose gas emissions – scenario "with existing measures".

	Inventory Trend [Gg CO_2e]			Emissions "with existing measures" [Gg CO_2e]			
	1990	**2005**	**2008**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	78 162	92 880	84 594	82 441	81 636	82 759	84 034
1. Energy	55 397	72 113	64 328	62 775	61 760	62 556	63 424
2. Industrial Processes	10 108	10 623	10 680	10 277	10 675	11 193	11 741
3. Solvents	512	387	327	342	340	338	336
4. Agriculture	8 558	7 412	7 453	7 654	7 733	7 711	7 687
6. Waste	3 587	2 345	1 806	1 392	1 128	961	847

Table 2: Historical trend and projections (2015–2030): greenhouse emissions – scenario "with additional measures".

	Inventory Trend [Gg CO_2e]			Emissions "with additional measures" [Gg CO_2e]			
	1990	**2005**	**2008**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	78 162	92 880	84 594	80 103	77 502	77 617	78 064
1. Energy	55 397	72 113	64 328	60 649	58 081	57 899	57 982
2. Industrial Processes	10 108	10 623	10 680	10 194	10 491	10 972	11 469
3. Solvents	512	387	327	342	340	338	336
4. Agriculture	8 558	7 412	7 453	7 526	7 461	7 447	7 430
6. Waste	3 587	2 345	1 806	1 392	1 128	961	847

Figure 1: Trend and forecast (2010–2030): total GHG emissions (without LULUCF).



Source: Umweltbundesamt

The “with existing measures” (WEM) scenario without LULUCF shows an increase of 4 % from 1990 to 2020 and 7.5 % from 1990 to 2030, i.e. from 78.2 in 1990 to 81.6 Mt CO_2 equivalents in 2020 and 84.0 Mt CO_2 equivalents in 2030. The WAM scenario shows a decrease by 0.8 % from 1990 to 2020 and a decrease by 0.1 % until 2030, i.e. from 78.2 Mt CO_2 equivalents in 1990 to 77.5 Mt CO_2 equivalents in 2020 and 78.1 Mt CO_2 equivalents in 2030.

Table 3: Trend and forecast (2015–2030): GHG emissions by gas (without LULUCF) – scenario “with existing measures”.

	Emission Trend [Gg CO_2e]			Emissions “with existing measures” [Gg CO_2e]			
	1990	**2005**	**2008**	**2015**	**2020**	**2025**	**2030**
CO_2	62 060	79 724	72 290	70 545	69 982	71 310	72 722
CH_4	8 305	6 095	5 575	5 214	5 016	4 879	4 797
N_2O	6 198	5 434	5 153	5 181	5 143	5 057	4 981
F-Gases	1 600	1 628	1 575	1 501	1 494	1 514	1 533
Total	**78 162**	**92 880**	**84 594**	**82 441**	**81 636**	**82 759**	**84 034**

The WEM scenario predicts a decrease in total GHG emissions by 12 % or 11.2 Tg CO_2 equivalents between 2005 and 2020. This change is mainly driven by the decrease in the Energy sector of 14 % or 10.4 Tg CO_2 equivalents. A slight increase in emissions from the Industrial Processes sector is expected (about 0.5 % or 0.1 Tg CO_2 equivalents). Emissions from the Solvents sector are forecast to decrease by 12 % or 46 Gg CO_2 equivalents. Emissions from the sector Agriculture are forecast to increase by 4.3 % or 0.3 Tg CO_2 equivalents. Emissions in the Waste sector in the scenario “with existing measures” are forecast to decrease by 51.9 % or 1.2 Tg CO_2 equivalents. In the Energy sector emissions from the sub-sector 1.A.1 Energy industries are forecast to decrease by 30.2 % or 4.9 Tg CO_2 equivalents and in 1.A.2 Manufacturing industries and construction emissions are forecast to decrease by 1.6 % or 0.3 Tg CO_2 equivalents. Emissions from the sub-sector 1.A.3 Transport are forecast to decrease by 5 % or 1.2 Tg between 2005 and 2020, and emissions from the sub-sector 1.A.4 and 1.A.5 ‘Other sectors’ are forecast to decrease by 29.4 % or 4.0 Tg CO_2 equivalents.

According to the WEM scenario the most important GHG in Austria will still be CO_2, but with a decreasing share in the national total emissions (from 85.8 % in 2005 to 85.7 % in 2020 and to 86.5 % in 2030). Between 2005 and 2020 total CO_2 equivalent CH_4 emissions and N_2O emissions are forecast to decrease from 12.4 % to 11.6 %, whereas the percentage of emissions of fluorinated gases (HFC, PFC and SF_6) is expected to remain constant at about 1.8 % until 2030.

Table 4: Trend and projections (2015–2030): GHG emissions by gas (without LULUCF) – scenario "with additional measures".

	Emission Trend [Gg CO_2e]			Emissions "with additional measures" [Gg CO_2e]			
	1990	**2005**	**2008**	**2015**	**2020**	**2025**	**2030**
CO_2	62.060	79.724	72.290	68.391	66.222	66.534	67.120
CH_4	8.305	6.095	5.575	5.191	4.967	4.829	4.746
N_2O	6.198	5.434	5.153	5.065	4.909	4.830	4.754
F-Gases	1.600	1.628	1.575	1.456	1.404	1.424	1.443
Total	**78.162**	**92.880**	**84.594**	**80.103**	**77.502**	**77.617**	**78.064**

In the scenario "with additional measures" total GHG emissions are forecast to decrease between 2005 and 2020 by 16.6 % or 15.4 Tg CO_2 equivalents. This decrease is mainly driven by the expected decrease of emissions from the Energy sector by 19.5 % or 14.0 Tg CO_2 equivalents. Emissions are forecast to decrease in the Waste sector by 51.9 % or 1.2 Tg CO_2 equivalents. By contrast, emissions from the Industrial Processes sector are forecast to decrease by 1.2 % or 0.1 Tg CO_2 equivalents and emissions from Solvents are expected to decrease by 12 % or 46 Gg CO_2 equivalents. In the Energy sector emissions from the sub-sector 1.A.4 and 1.A.5 'Other sectors' are forecast to decrease by 31.1 % or 4.3 Tg CO_2 equivalents. Emissions are also forecast to decrease in the sub-sector 1.A.1 Energy industries (by 32 % 5.2 Tg CO_2 equivalents) and in the subsector 1.A.3 Transport by 15.7 % or 3.9 Tg CO_2 equivalents. Emissions in the sub-sector 1.B 'Fugitive' emissions are forecast to increase by 29.2 % or 1.29 Gg CO_2 equivalents. By contrast, emissions from the sub-sector 1.A.2 Manufacturing industries and construction are forecast to decrease by 4.5 % or 0.7 Tg CO_2 equivalents.

According to the WAM scenario, the most important GHG in 2020 in Austria will still be CO_2, with a decreasing share in the national total emissions (from 85.8 % in 2005 to 85.4 % in 2020 and an increase to 86.0 % in 2030). Between 2005 and 2020 CH_4 emissions and N_2O emissions are forecast to decrease in total from 12.4 % and 12.2 %. Emissions of fluorinated gases (HFC, PFC and SF_6) are forecast to remain constant at 1.8 %.

An analysis of the trend forecast by sector is presented in chapter 2 'Sectoral Scenario Results'. Tables with detailed emissions by sub-sector and gas are included in Annex 1. The specific sectoral assumptions and activities are described in the methodical sub-chapters 3.1 to 3.6.

The following charts show sectoral developments and total emissions by gas.

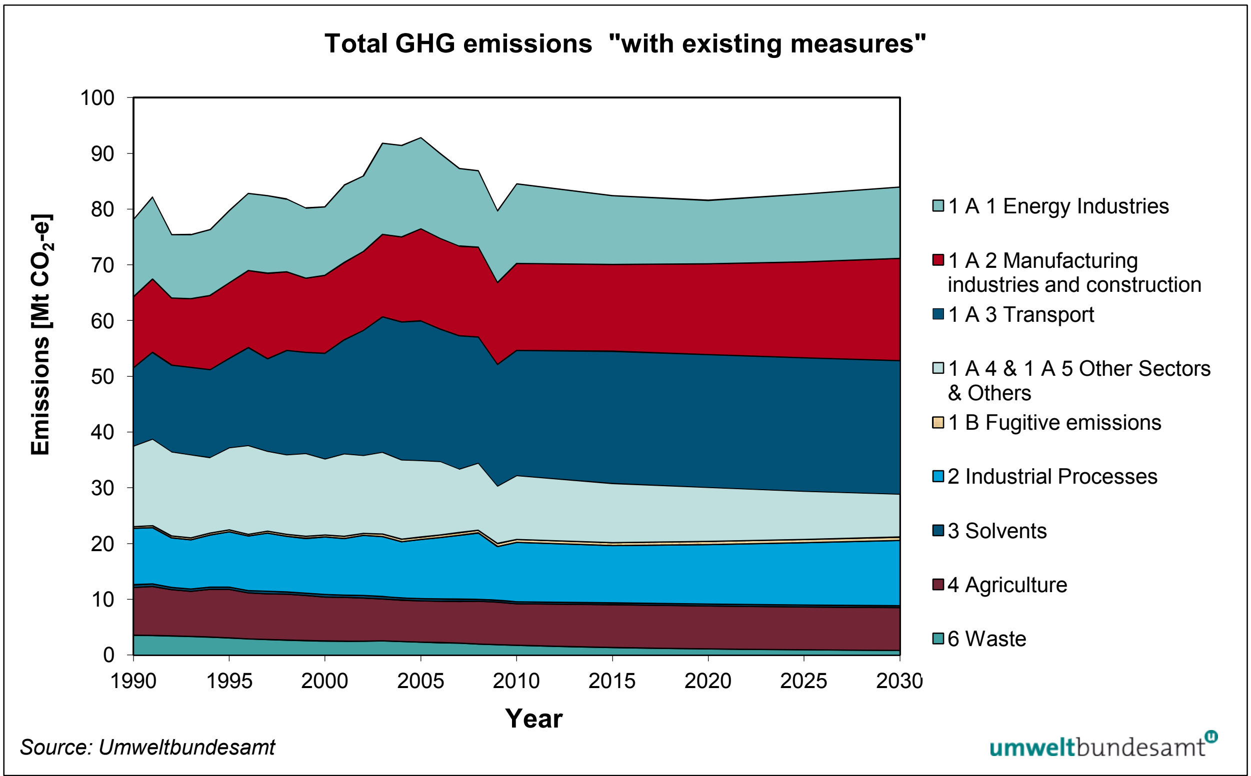


Figure 2: Trend and forecast (2010–2030): total GHG emissions by sector – scenario "with existing measures".

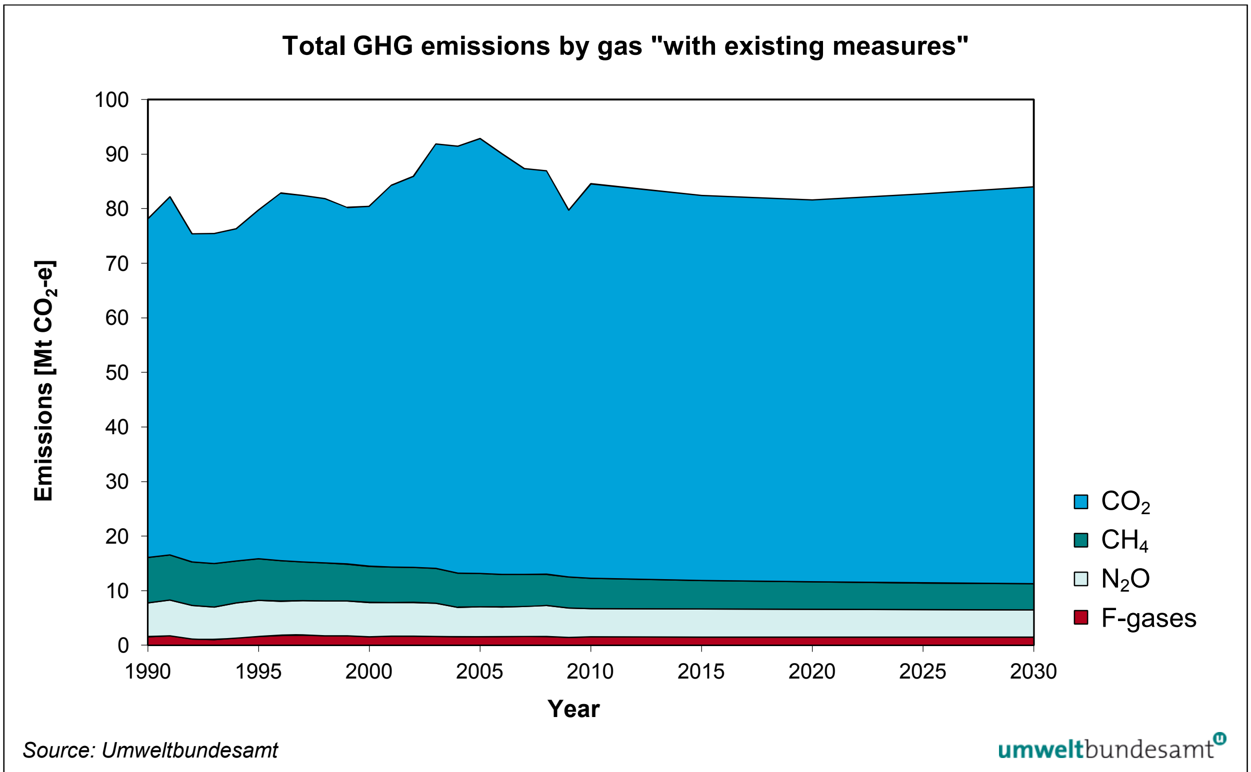


Figure 3: Trend and forecast (2010–2030): total GHG emissions by gas – scenario "with existing measures".

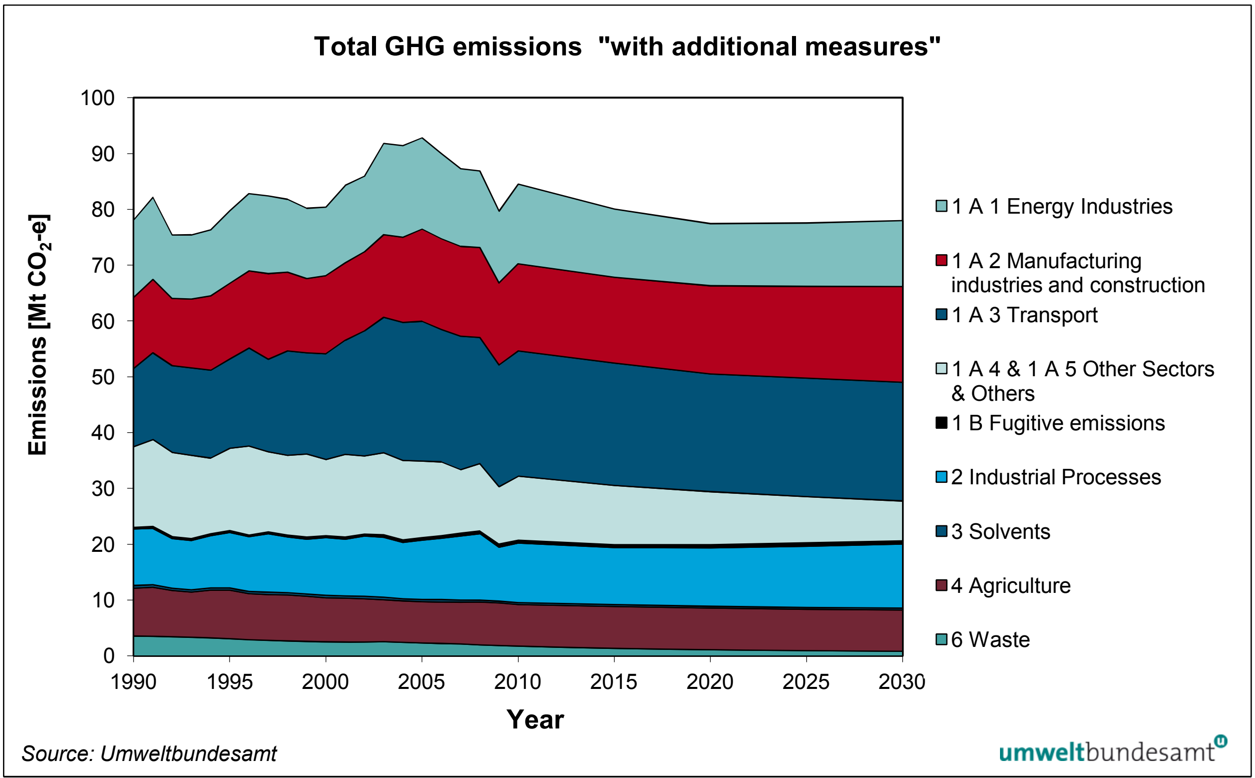


Figure 4: Trend and forecast (2010–2030): total GHG emissions by sector – scenario "with additional measures".

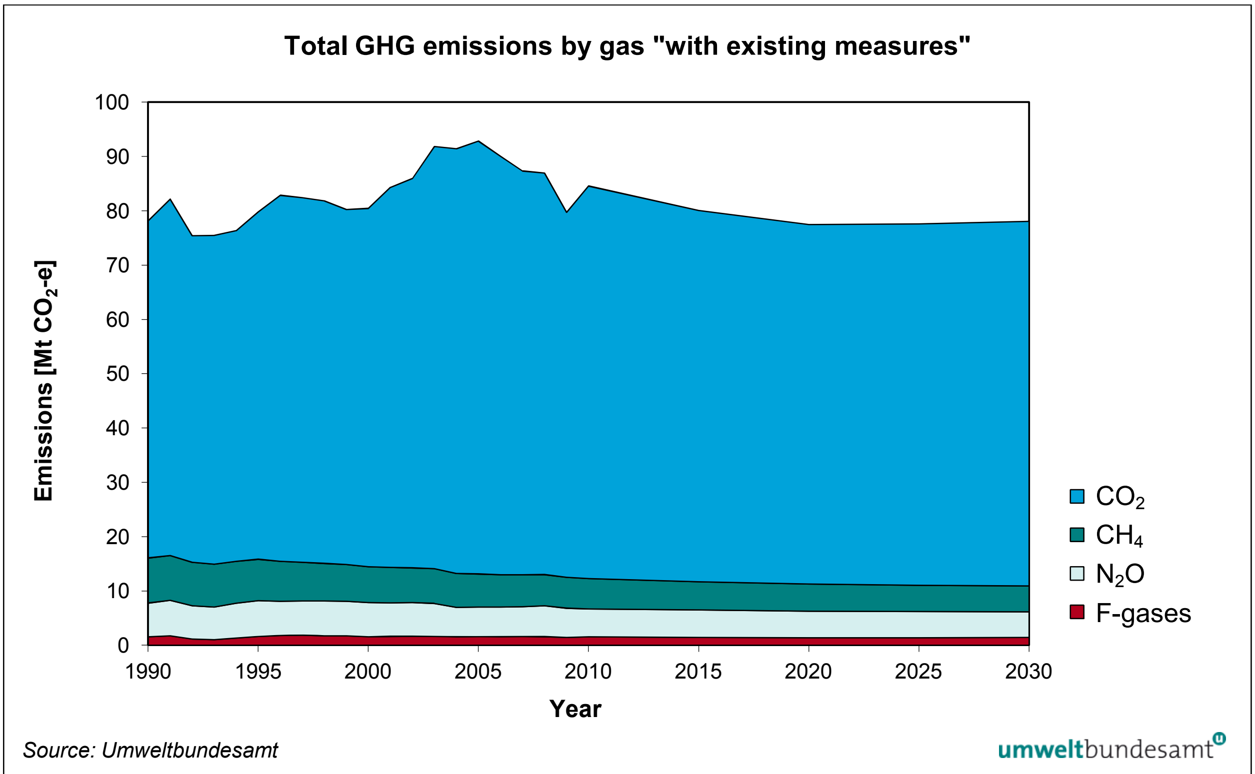


Figure 5: Trend and forecast (2010–2030): total GHG emissions by gas – scenario "with additional measures".

EU ETS/Non-ETS emissions

The GHG emissions covered by the EU emissions trading scheme (ETS) show (in the scenario "with existing measures") an upward trend until 2030. The driving forces are the Energy sector with a projected increase by about 6 % and the Industrial Processes sector with an increase by about 22 % from 2010 to 3030. Total non-ETS GHG emissions are expected to decrease slightly over the same period.

Table 5: EU ETS and non-ETS GHG emissions, with existing measures

	with existing measures [Gg CO_2e]				
EU ETS GHG emissions	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	30 918	30 263	30 336	32 215	34 160
1. Energy	22 543	21 501	21 170	22 550	23 967
2. Industrial Processes	8 375	8 762	9 166	9 665	10 193
Non ETS GHG emissions	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	53 676	52 178	51 299	50 544	49 874
1. Energy	41 785	41 274	40 589	40 006	39 458
2. Industrial Processes	2 305	1 515	1 509	1 528	1 548
3. Solvents	327	342	340	338	336
4. Agriculture	7 453	7 654	7 733	7 711	7 687
6. Waste	1 806	1 392	1 128	961	847

Due to additional measures, the increase in EU ETS emissions from 2010 to 2030 is expected to be slightly lower in the WAM scenario (about 5 %) than in the WEM scenario (10 %). More specifically, the projected decrease in EU ETS GHG emission in the Energy sector will be about 1 % and the increase in the Industrial Processes sector 20 %. Total non-ETS GHG emissions in the WAM scenario are expected to decrease by 16 % over the same period.

Table 6: EU ETS and non-ETS GHG emissions, with additional measures

	with additional measures [Gg CO_2e]				
EU ETS GHG emissions	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	30 918	30 041	29 711	30 922	32 418
1. Energy	22 543	21 317	20 638	21 388	22 407
2. Industrial Processes	8 375	8 724	9 072	9 534	10 012
Non ETS GHG emissions	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	53 676	50 062	47 791	46 695	45 645
1. Energy	41 785	39 332	37 442	36 511	35 575
2. Industrial Processes	2 305	1 470	1 419	1 438	1 458
3. Solvents	327	342	340	338	336
4. Agriculture	7 453	7 526	7 461	7 447	7 430
6. Waste	1 806	1 392	1 128	961	847

1 GENERAL APPROACH

1.1 Guidelines and Provisions

The following regulations and guidelines were taken into account:

- The Guidelines for the preparation of National Communications by parties included in Annex I to the Convention (FCCC/CP/1999/7).
- EU Monitoring Mechanism for anthropogenic CO_2 and other greenhouse gases according to Council Decisions 93/389/EEC revised by the Council Decision 99/296/EC and later revised by the Decision No. 280/2004/EC of the European Parliament and of the Council of 11 February 2004.
- Implementing Provisions of the EU Monitoring Mechanism: Commission Decision 2005/166/EC of 10 February 2005. In particular, Chapter II Section 2, Article 9 and Article 10 referring to Article 3(2)(a) and (b) of Decision No. 280/2004/EC.
- The structure of reporting information on projected GHG data and policies and measures follows the recommendation as included in the MM Article 2 Reporting Template v5.1 provided by the European Commission in 2011.

1.2 Description of General Methodology

1.2.1 Database and Historical Emission Data

Projections are consistent with the historical emission data of the Austrian Emission Inventory (submission March 2012) up to the data year 2010. Because of methodical changes and recalculations which became necessary when compiling the last inventory, the latest submission of March 2013 has been used as a basis for for F-gas projections up to 2030.

1.2.2 Emission projections

Emission projections are generally calculated by applying the same methodologies as those used for the national GHG inventory. These are described in Austria's National Inventory Report 2012 (UMWELTBUNDESAMT 2012a).

The activity forecast is modelled on the structure of the national inventory of greenhouse gases. The data structure for activities, input data, emission factors and emission calculations is based on SNAP categories (*Selected Nomenclature for sources of Air Pollution*). The output data are reported and aggregated in the Common Reporting Format (CRF) of the UNFCCC.

Emission factors and underlying parameters are described in the methodological sub-chapters 3.1–3.6 of this report.

1.2.3 Underlying Models and Measures

The emission projections are based on the following sectoral forecasts:

- Energy Forecast, based on the National Energy Balance of Statistik Austria and a macro-economic model DEIO of the Austrian Institute of Economic Research (WIFO 2013), supported by calculations with bottom-up models:
  - TIMES (Austrian Energy Agency, AEA 2013): electricity demand, public electrical power and district heating supply
  - INVERT/EE-Lab (Energy Economics Group of the Technical University of Vienna, TU WIEN 2013): domestic heating and hot water supply
  - GLOBEMI & GEORG (Technical University of Graz, TU GRAZ 2013): energy demand and emissions of transport (incl. off-road)
- Forecasts of emissions from industrial processes and solvent emissions are based on expert judgements of the Umweltbundesamt.
- The estimations of emissions for fluorinated gases are based on a study published in 2010 (GSCHREY 2010), in which the whole chapter on fluorinated gases was updated.
- The agricultural forecast is based on the PASMA model of the Austrian Institute of Economic Research (SINABELL et al. 2011a).
- Waste Forecast, based on the Umweltbundesamt forecast of types and quantities of waste deposited as well as of quantities of wastes which have undergone mechanical biological treatment. The forecast of composted waste (as well as the sub-sector wastewater) is based on the population forecast of ÖROK 2010 (for methodological reasons).

Two scenarios were modelled: “with existing measures” includes all measures implemented by 8 March 2012; “with additional measures” includes planned policies and measures with a realistic chance of being adopted and implemented in time to influence the emissions. All additional measures have been defined at expert level in consultation with the Federal Ministry of Agriculture, Forestry, Environment and Water Management. Information on national policies and measures included in the scenarios can be found in chapter 5.

1.2.4 General Key Underlying Assumptions

Scenarios "with existing measures" and "with additional measures"

The same general key factors are used for both scenarios.

Table 7: Key input parameters of emission projections (UMWELTBUNDESAMT 2013)

Year	2010	2015	2020	2025	2030
GDP [billion € 2010]	286	312	340	372	410
Population [1 000]	8 382	8 555	8 733	8 889	9 034
Stock of dwellings [1 000]	3 683	3 820	3 957	4 069	4 166
Heating degree days	3 241	3 166	3 100	3 053	3 006
Exchange rate [US$/€]	1.33	1.30	1.30	1.30	1.30
International coal price [US$10/t]	99.2	105	109	113	116
International oil price [US$10/bbl]	78.1	106	118	127	135
International natural gas price [US$10/GJ]	7.1	9.3	10.4	11.3	11.9
CO_2 certificate price [€/t CO_2]	13	15	20	25	30

Other underlying assumptions are included in the sectoral methodology chapters 3.1–3.6 and in Annexes 1 and 2.

1.3 Sensitivity of Underlying Assumptions

This report presents sensitivity assessments for specific sectors, analysing the increase and decrease of key factors or of a combination of key factors. The assessment in the Energy sector was based on the influence of economic growth on GHG emissions from Transport, Energy Industries and Manufacturing Industries and Construction, as well as the influence of changes in fuel prices and subsidies on GHG emissions in the Residential and Commercial sector.

All these assessments are based on model results, obtained by calculating the effects on the Energy sector. It is necessary to mention that the emission results in general are not linearly dependent on changes of an input factor. This is the reason why the presented sensitivity data cannot be seen as a functional dependency with varied parameters. The emission effect can only be seen for the specific values of the given parameters.

For the Energy sector two complete scenarios with different assumptions on economic growth and energy prices were calculated:

- WEMsens1 and
- WEMsens2.

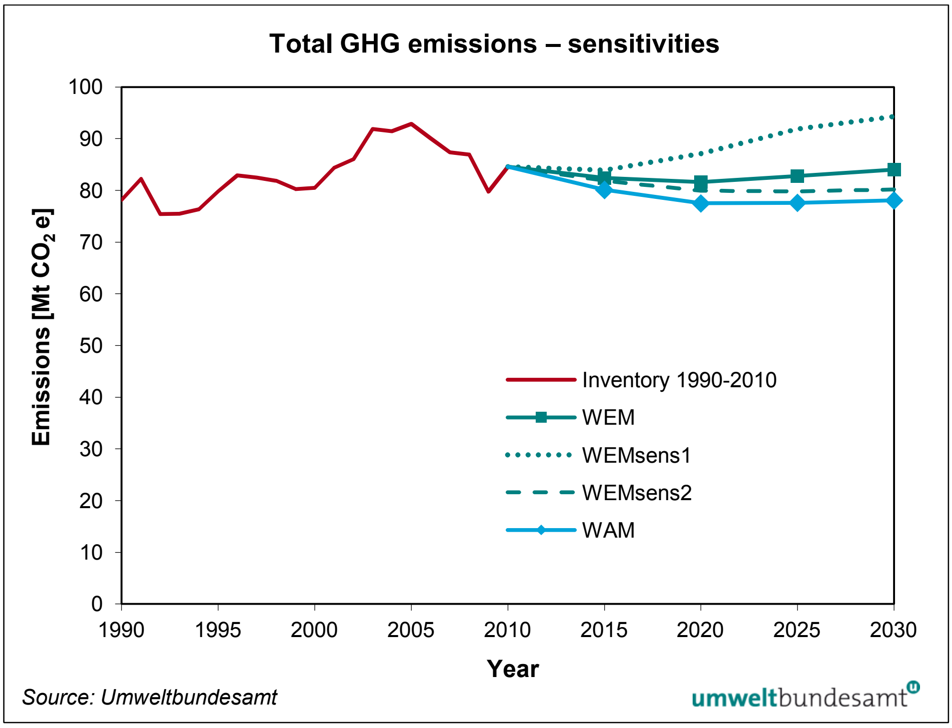
The input main variables are summarised in Table 8. Average economic growth was assumed to be 2.5 % per year in WEMsens 1 and 0.8 % per year in WEMsens2.

Table 8: Basic parameters for sensitivity analysis modelling (UMWELTBUNDESAMT 2013)

Parameter WEMsens1	**2010**	**2015**	**2020**	**2025**	**2030**
GDP [bn. € 2010]	286	329	379	438	510
International coal prices [US$10/t]	99.2	105	112	121	131
International oil price [US$/bbl]	78.1	124	163	215	284
International oil price [US$10/bbl]	78.1	111	130	153	180
International natural gas price [US$10/GJ]	7.1	9.6	11.5	13.6	16.1
CO_2 certificate price [€/t CO_2]	13	17	30	35	40
Parameter WEMsens2	**2010**	**2015**	**2020**	**2025**	**2030**
GDP [bn € 2010]	286	302	318	336	356
International coal prices [US$10/t]	99.2	104	107	109	110
International oil price [US$/bbl]	78.1	112	136	159	184
International oil price [US$10/bbl]	78.1	100	108	113	117
International natural gas price [US$10/GJ]	7.1	9.0	9.9	10.1	10.2
CO_2 certificate price [€/t CO_2]	13	13	15	17	20

The following chart shows the trend analysis of national total GHG emissions and the two sensitivity analyses. Detailed results and the effect of sensitivity analysis can be found in chapter 3.1.

Figure 6: Trend and projections (2010–2030): total GHG emissions for the different scenarios and sensitivities



1.4 Quality Assurance & Control

A questionnaire has been used for checking input data for compliance with the most important data quality requirements. The project strategy includes several data consistency checks, e.g. through documentation of data inputs and changes in the calculation files. A standard data input form has been used for each sector.

In general, data quality checks similar to the management system of the Austrian Air Emission Inventory have been performed for each sector. Often the person who is responsible for the sectoral emissions is identical with the person who is also responsible for the relevant secors in the Inventory and some sectors use emission methods based on the verified inventory methods.

An output data check has been carried out by comparing the results of the sectors in detail and checking the plausibility of emission trends.

Specific responsibilities for this report have been as follows:

- Coordination & General chapters ... Andreas Zechmeister
- Energy Industries & Manufacturing Industries ... Michael Gössl, Thomas Krutzler, Herbert Wiesenberger
- Transport ... Gudrun Stranner
- Other Energy Sectors ... Andreas Zechmeister, Wolfgang Schieder
- Fugitive Emissions ... Stephan Poupa
- Industrial Processes ... Herbert Wiesenberger, Manuela Wieser
- Solvents ... Traute Köther
- Agriculture ... Michael Anderl, Gerhard Zethner
- Waste ... Katja Pazdernik, Christoph Lampert, Stephan Poupa
- LULUCF ... Peter Weiss, Matthias Braun.

1.5 Uncertainty of emission projections

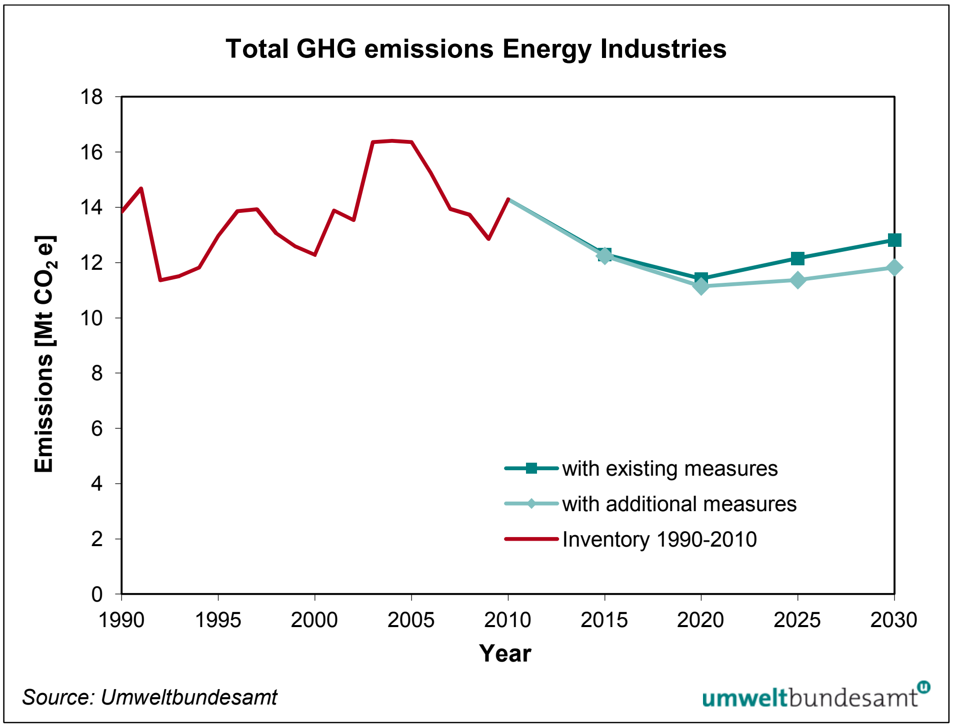
The variation of the chosen input parameters in the Sensitivity Analysis can be seen as an indicator of the overall uncertainty caused by changing the input data. The methodological subchapters 3.1–3.6 additionally include qualitative discussions of uncertainties in specific sectors.

2 SECTORAL SCENARIO RESULTS

2.1 Energy (CRF Category 1)

2.1.1 Energy industries (1.A.1)

Figure 7: Trend and forecast (2011–2030): GHG emissions from 1.A.1 – Energy Industries.



In the Energy Industries sector GHG emissions will continue to decrease due to fuel shifts from oil and coal to gas and renewables. The installed capacities of biomass plants, hydro power plants and wind plants are expected to increase significantly. After 2017 the first biomass plants will be decommissioned, which will lead to higher emissions, unless more subsidies are made available than foreseen in the WAM scenario. After 2020 all existing and additional measures will slowly expire. Additionally, overall electricity demand is expected to increase and the available fossil fuel power plants will resume production. Therefore, emissions are expected to increase again.

The major driving force behind the emissions in this sector is electricity demand. In the WEM scenario, demand in the year 2015 is expected to be 4 % above the 2010 value. In 2020, it is expected to be 11 % higher and in 2030 34 % higher. In the WAM scenario, demand is expected to be 10 % higher in 2020 than in 2010, and 30 % higher in 2030.

Emissions from petroleum refining are projected to remain constant as, from the current point of view, total production capacity is not expected to change significantly. Higher emissions caused by the operation of new production units (or expansion of existing ones) are likely to be offset by a general increase in energy efficiency. Here there is no difference between the scenarios WEM and WAM.

Emissions from oil and gas exploration and storage will continue to rise.

2.1.2 Manufacturing industries and construction (1.A.2)

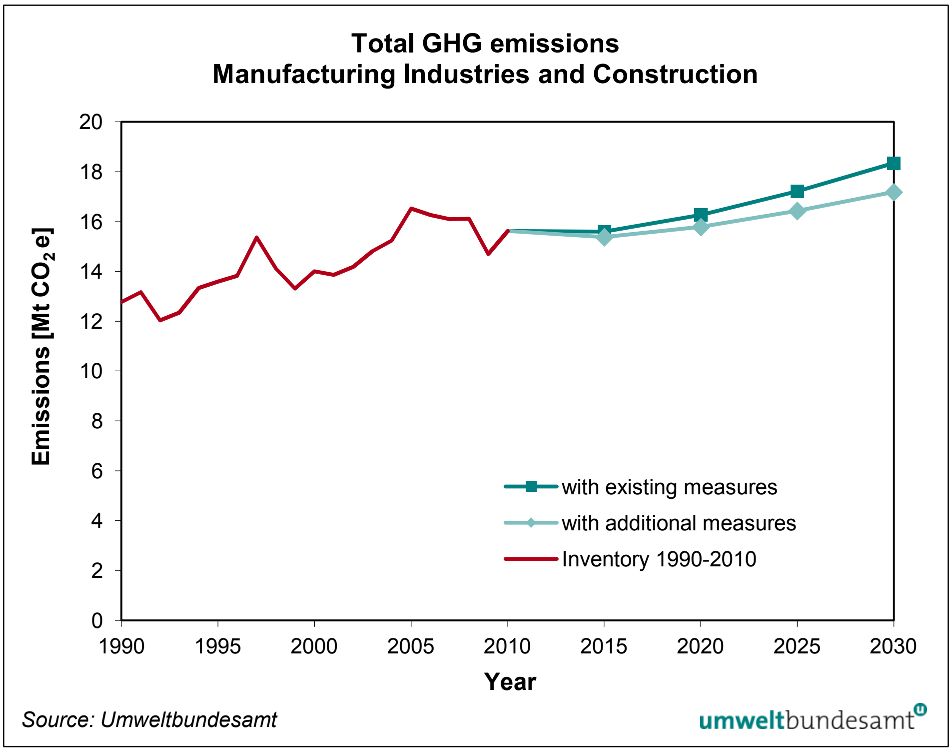


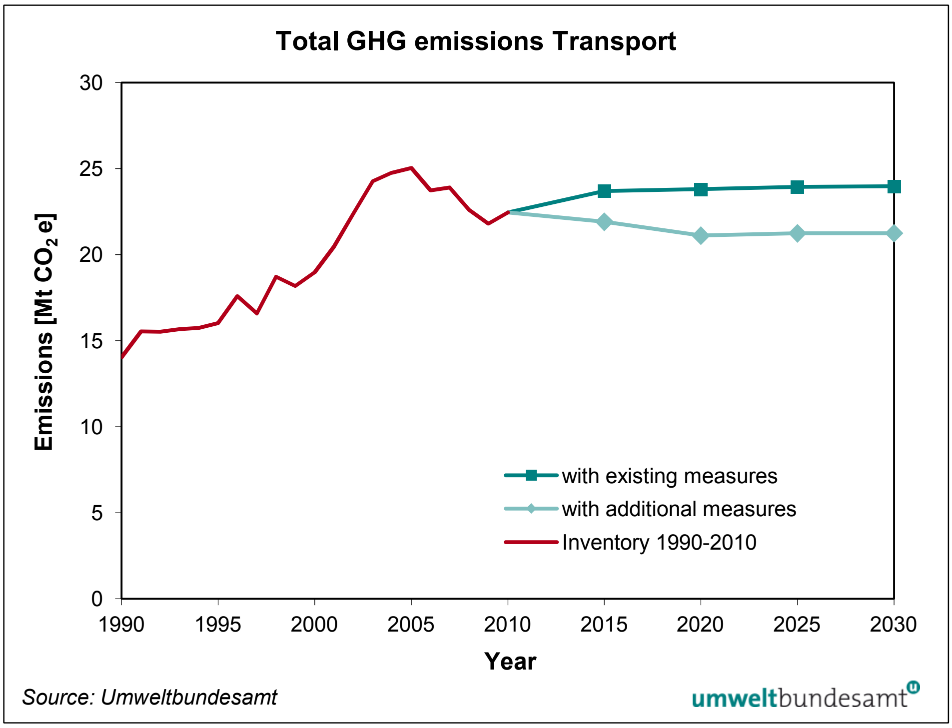
Figure 8: Historical and forecast (2011–2030) GHG emissions from 1.A.2 – Manufacturing Industries and Construction.

The Industry sector is one of the main sources of greenhouse gases in Austria, mainly due to the CO_2 emissions in this sector. Major sub-groups contributing to these emissions are: the production of iron and steel, the production of non-metallic minerals, the paper industry and the chemicals industry.

During the period between 1990 and 2005 the Industry sector was characterised by an emission increase by more than 20 %. Since 2005 emissions have slightly decreased. For the period 2011 to 2015 emissions are expected to remain stable, whereas from 2015 to 2030 a stable increase of CO_2 emissions (as a result of higher sectoral GDP projections) is expected.

2.1.3 Transport (1.A.3)

Figure 9: Historical and forecast (2011–2030) GHG emissions from 1.A.3 – Transport.



The Transport sector is one of the main sources of greenhouse gases in Austria. While emissions from gasoline vehicles are declining steadily, emissions from diesel are increasing constantly. Up to 30 % of the GHG emissions are caused by fuel exports due to persistently low fuel prices in Austria compared to the neighbouring countries.

GHG emissions saw a steep increase in recent years and reached their peak in 2005. Then the implementation of the EU Biofuels Directive and declining fuel exports changed this trend. In addition, the economic downturn resulted in further emission reductions, especially in 2008 and 2009, but emissions are now expected to rise again because of an increase in economic and transport activities from 2010 onwards. Up to 2015, the implemented measures (WEM scenario) are not expected to change this trend. From 2015 onwards, an increased use of biofuels in the Transport sector, plus higher fuel efficiency standards of the fleet – in addition to electro-mobility initiatives – are expected to help stabilise the increasing trend and keep emissions at a constant level.

In the WAM scenario the two-stage increase of the Austrian fuel tax (MöSt) in 2015 and 2019 is the main measure through which the estimated reduction of GHG emissions up to 2020 is expected to be achieved.

2.1.4 Other Sectors & Other (1.A.4 & 1.A.5)

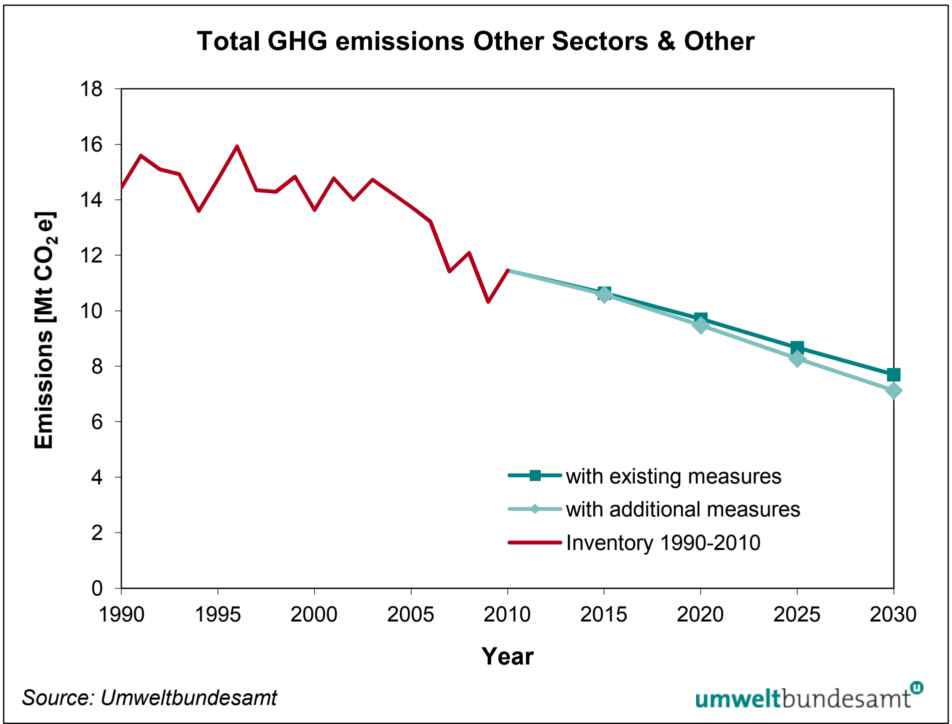


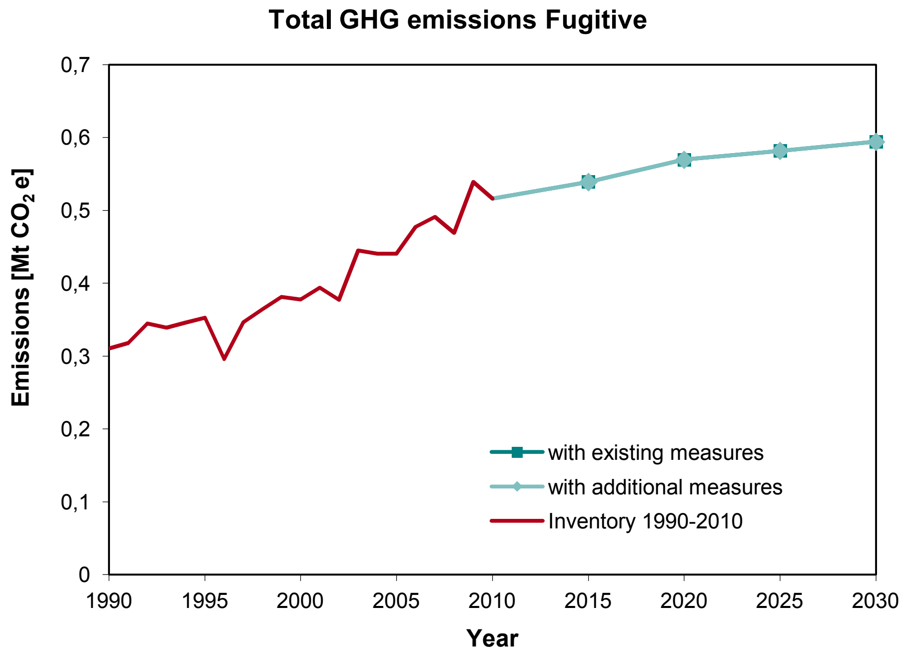
Figure 10: Historical and forecast (2010–2030) GHG emissions from 1.A.4 – Other sectors (includes Residential, Commercial/Institutional and Agriculture/Forestry/ Fishing) and 1.A.5 – Other (military transport).

The "1.A.4 other sectors" account for a considerable amount of the total greenhouse gas emissions in Austria. Despite growing numbers of households and occupied living space, the total GHG emissions in this sector are expected to see considerable reductions by 2030 in the scenario "with existing measures" and even more reductions in the scenario "with additional measures".

The driving force behind these reductions is the shift from fossil fuels to renewables like biomass, solar heat and heating pumps as well as a slight transfer of emissions to other sectors (district heat). Furthermore, a slight reduction of total energy consumption (incl. electricity) together with increased insulation in new buildings (or better insulation through renovation measures), as well as an improved efficiency of primary heating systems in buildings are all expected to lead to a considerable reduction of GHG emissions between now and 2030.

2.1.5 Fugitive emissions (1.B)

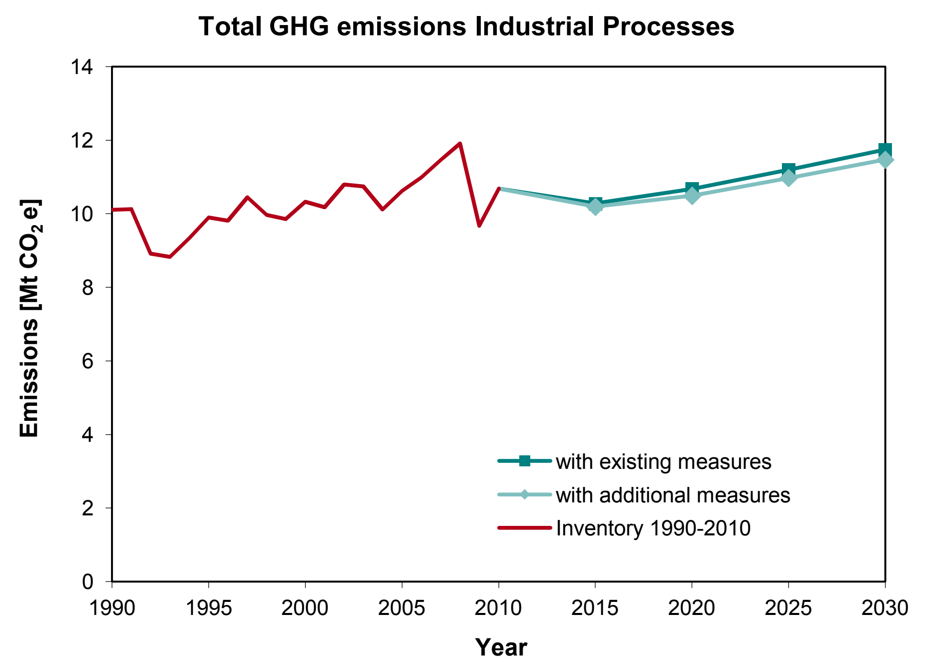
Figure 11: Historical and forecast (2010–2030) GHG emissions from 1.B – Fugitive emissions.



Source: Umweltbundesamt

Between 1990 and 2010 fugitive emissions from fossil fuel exploration, refining, transport, production and distribution increased by 66 %. The main driving force behind this increase was the extension of the natural gas distribution network and the increasing natural gas and oil extraction. It is expected that total emissions will slightly increase due to an increase in natural gas exploration, an expansion of the gas distribution and pipeline network and an extension of gas storage capacities.

2.2 Industrial Processes (CRF Category 2)



Source: Umweltbundesamt

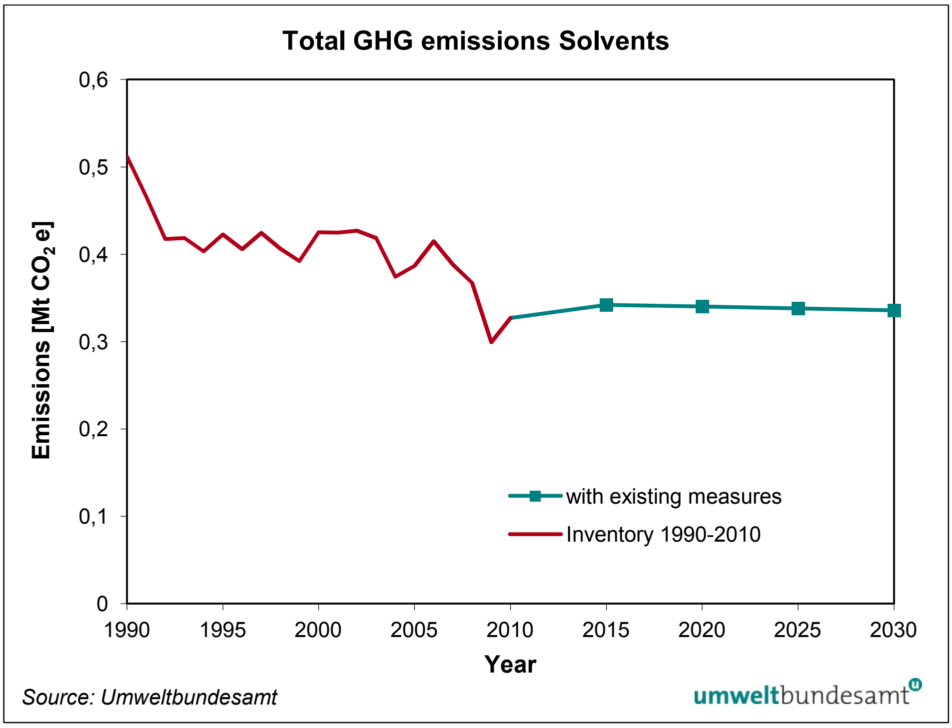
Figure 12: Historical and forecast (2011–2030) GHG emissions from 2 – Industrial Processes.

Emissions from industrial processes are expected to see a slight decrease in the years 2011-2015, whereas they are expected to rise from 2015 up to 2030 due to a projected increase in production. The main contributors are the categories "metal production" and "mineral products".

Another source in this sector are the fluorinated gas (HFC, PFC and SF_6) emissions. These contributed 14.8 % of the emissions in the industrial processes sector in 2010 with a projected decrease to 13.1 % by 2030, a decrease mainly to be brought about by several legislative measures (see chapter on methodology for more information).

2.3 Solvents (CRF Category 3)

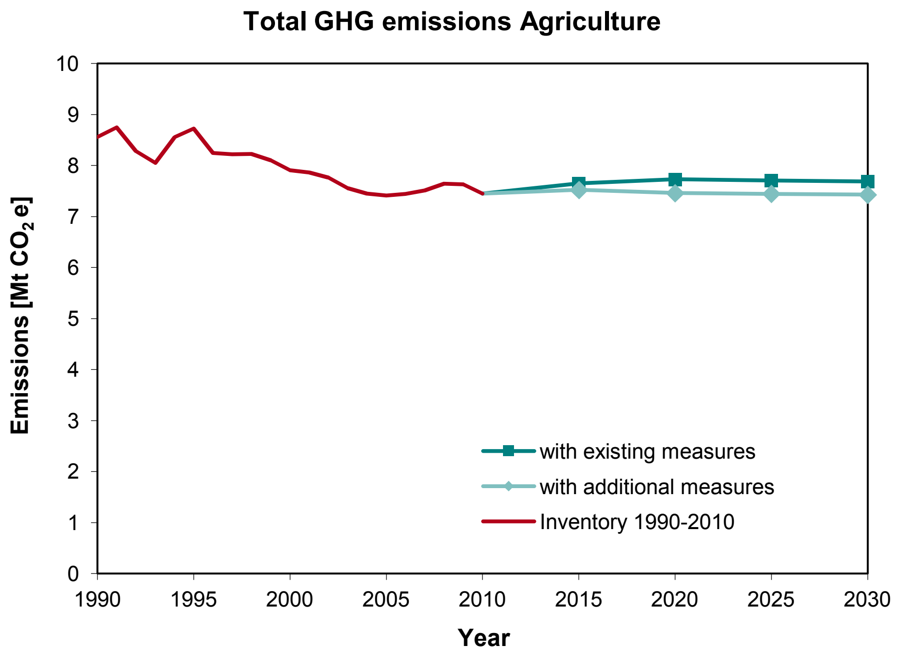
Figure 13: Historical and forecast (2011–2030) GHG emissions from 3 – Solvents.



The CRF source category 3 "Solvents and Other Product Use" is one of the minor sources, contributing less than 1 % of total greenhouse gases in Austria.

Greenhouse gas emissions in this sector decreased by –36 % between 1990 and 2010 due to decreasing solvent and N_2O use and as a result of the positive impact of the laws and regulations enforced in Austria. From 2010 onwards a slight increase of GHG emissions has been observed due to increasing solvent use as a result of a growing population. From 2020 onwards we expect a minor decrease in emissions. In the scenario "with existing measures" (WEM), which is equal to the scenario "with additional measures" (WAM), emissions are forecast to increase by 3 % up to 2030 (compared to 2010).

2.4 Agriculture (CRF Category 4)



Source: Umweltbundesamt

Figure 14: Historical and forecast (2011–2030) GHG emissions from 4 – Agriculture.

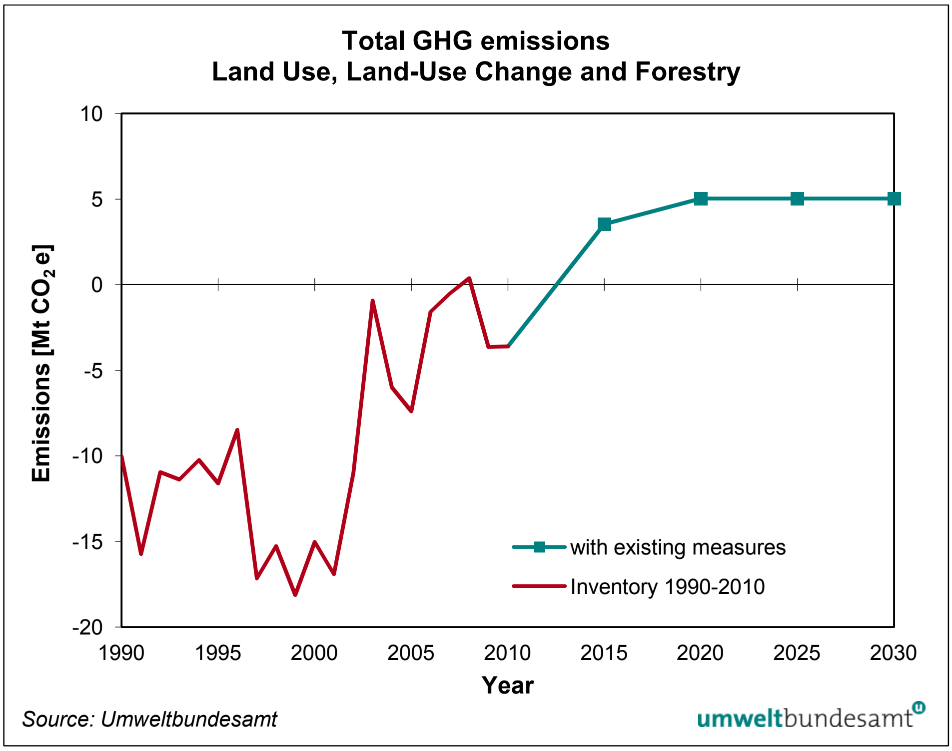
The CRF source category 4 "Agriculture" contributed 8.8 % of the total of Austria's greenhouse gas emissions in 2010 (without LULUCF). The Agriculture sector is the largest source of both N_2O and CH_4 emissions in Austria.

From 1990 to 2005, emissions showed a stable decrease, mainly due to decreasing livestock numbers. An increased fertiliser application was responsible for a peak in 2008. Between 2010 and 2020 a slight increase of emissions is expected. Underlying livestock projections indicate that the declining trends will come to an end and that dairy cattle numbers will stabilise on a higher level. Thus, from 2020 up to 2030 emissions are expected to remain constant. One major trend is common to all scenarios: the output of milk and beef is expected to increase (SINABELL et al. 2011).

In the WAM scenario, policy measures (as outlined in chapter 4) are expected to cause a slight decrease in emissions.

2.5 LULUCF (CRF Category 5)

Figure 15: Historical and forecast (2011–2030) GHG emissions from 5 – Land Use, Land-Use Change and Forestry[1].



Modelled data for CRF 5.A.1 – forest land remaining forest land, quantitatively by far the most important sub-category of CRF Source Category 5, show an increase in net emissions to 5 674 Gg CO_2 equivalents in the period up to 2020. Projections for the period beyond 2020 are not available. The 2020 value has thus been assumed to remain constant for 2020 and 2030. The reported values for sector 5.A.1 were significantly revised for the 2012 submission on the basis of the results provided in the new NFI 2007/09, the introduction of estimates for forest soil carbon pools and several improvements in the estimates. The 5.A.1 projections up to 2020 were adjusted according to these improvements and by taking into account the introduction of soil carbon pools. The NFI 2007/09 shows clearly higher harvest rates than the NFI 2000/02, which shows a significant decrease in the net sink in category 5.A.1 for the years after 2002, clearly lower than reported in the 2011 submission and in the last emission projection report. Following the methodological improvements and first-time estimates for the forest soil carbon pool, the projected values up to 2020 have also been changed significantly to be methodologically consistent with the historical values. It should be noted that the historical values in category 5.A.1 for the years 2009 and 2010 are based on averages of the NFI observation period 2002 and 2008 and will be revised in line with the results of the next NFI.

For the other LULUCF sub-sectors no projections are available. The emissions/removals reported for 2010 are also reported also for later years.

---

[1] The historical values of category 5.A.1 (having the main impact on LULUCF totals) for the years 2009 and 2010 are based on averages of the NFI observation period 2002 and 2008 and will be revised in line with the results of the next NFI

2.6 Waste (CRF Category 6)

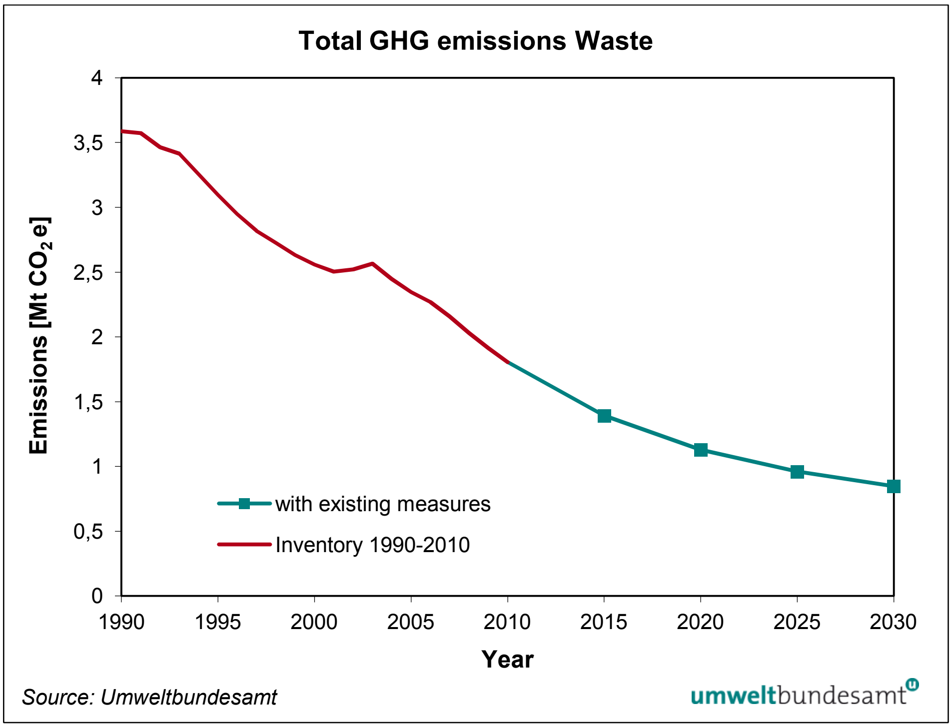


Figure 16: Historical and forecast (2011–2030) GHG emissions from 6 – Waste.

The scenario shows a further downward trend in waste treatment and disposal up to 2020/2030. This is in line with a decreasing carbon content of historically landfilled waste as well as a decrease in the amount of waste deposited in landfills (due to legislative regulations). Increases in waste incineration and dry stabilisation are further reasons for declining emissions from waste disposal and other waste treatment (mechanical-biological treatment). As the sub-sector 'solid waste disposal on land' is responsible for a major part of greenhouse gas emissions from the Waste sector (73 % in the year 2010), the projected increase in N_2O emissions from the sub-sector 'wastewater handling' is not expected to change the declining trend. Emissions from the sub-sectors 'compost production' and 'waste incineration' are of minor importance. Emissions from 'waste incineration without energy recovery' have been of minor importance since 1993. Emissions from 'waste incineration with energy recovery' are reported under category 1.A (Fuel Combustion).

3 SECTORAL METHODOLOGY – PROJECTIONS

3.1 Energy (CRF Source Category 1)

Total energy demand and production was evaluated on the basis of energy scenarios developed by a consortium of the Environment Agency Austria (Umweltbundesamt), the Austrian Institute of Economic Research (Wirtschaftsforschungsinstitut WIFO), the Austrian Energy Agency, the Energy Economics Group of the Vienna University of Technology and the Institute for Internal Combustion Engines and Thermodynamics at the Graz University of Technology (UMWELTBUNDESAMT 2013b). The scenarios were developed with the help of several models:

- macroeconomic input-output data (DEIO),
- domestic heating and domestic hot water supply (INVERT/EE-Lab),
- electricity demand and public electrical power and district heating supply (TIMES Austria) and
- energy demand and emissions of transport (GLOBEMI & GEORG).

In addition, several parameters were calculated endogenously, e.g. pipeline compressors and industrial autoproducers.

The macroeconomic model DEIO combines a private consumption module with an energy and environment module. Important input parameters are energy prices, population and household income (WIFO 2013).

For evaluating the electricity demand, a model based on TIMES has been used. The model has been adapted especially for Austria. For the calculation of the electricity demand it combines a bottom-up (used devices and the characteristics thereof in several sub-sectors) approach for households with a top-down (development of energy intensity and gross- value added) approach for industry, the service sector and agriculture. For transport and heating the results of different models have been used (AEA 2013).

For projecting the production of electricity and district heating the same model (i.e. TIMES Austria) has been used. It is based on available capacities for all types of power plants in combination with energy prices and the demand for electricity and district heating (taken from the model INVERT/EE-Lab). Subsidies (e.g. granted under the Green Electricity Act) and fees (like emission allowances) are also important input parameters (AEA 2013).

For modelling the energy consumption for domestic heating and domestic hot water supply, the software package INVERT/EE-Lab[2] (TU WIEN 2013) was applied. This model is based on a stochastic, non-recursive, myopic and economic algorithm with the objective function to minimise costs. The basic algorithm was developed by Schriefl (EEG 2007). It is based on the principle of the model INVERT. It allows the calculation of the energy demand for heating (space heating and hot water) in apartment buildings and buildings of the public or private service sector by including the effects of various funding instruments. The main inputs for the calculation are:

---

[2] http://eeg.tuwien.ac.at

- availability of resources,
- market penetration of different technologies,
- maximum replacement and refurbishment periods,
- minimum and maximum lifetime of technical installations.

The results obtained with the different models were exchanged and balanced within a few cycles. Umweltbundesamt experts combined the data obtained with the different models and included additional calculations for

- energy inputs for the iron and steel industry,
- production of electric power and district heating in industry,
- use of waste as fuel in power plants and industry,
- energy input of compressor stations,
- total energy demand,
- electricity demand in the transport sector.

3.1.1 Energy Industries (1.A.1)

3.1.1.1 Methodology of the sectoral emission forecast

The output of the model based on TIMES (see chapter 3.1) provides fuel-specific activity data for the Energy Industries (i.e. Electricity and Heat Production including Waste Incineration). These were multiplied by established and fuel-specific emission factors used by the Austrian Inventory. Emission factors for fuels not specified (e.g. for refinery fuel gas, refinery coke) or for wastes (e.g. municipal solid waste, hazardous waste) were derived from plant-specific data. The methodology for the emission factors is discussed in the Austrian Inventory Report (UMWELTBUNDESAMT 2013a).

As regards the only refinery operated in Austria, no major changes in the production capacities or in the technologies used are expected from the current point of view. Restructuring programmes and a start-up of new production units were undertaken in the past few years. The last one was completed in 2008. Thus, the emissions of 2011 have been used for the projection.

Emissions from oil and gas exploration and storage, have been calculated by multiplying the energy input by fuel-specific emission factors.

3.1.1.2 Assumptions

The assumptions on which both scenarios are based (for gross total inland energy consumption and total inputs/outputs for power plants, all split into the different fuel types) can be seen in Annex 1 and Annex 2. Moreover, the energy demand by sectors is shown, split into the fuel types delivered (final energy consumption).

The assumption on which the basic weather parameter is based (heating degree days) is explained in chapter 1.2.4.

EU ETS/non-ETS

In "Public Electricity and Heat Production" (1A1a) none of the non-ETS installations uses coal whereas waste is completely burned in non-ETS installations.

For natural gas and liquid fuels it is assumed that the current ETS/non-ETS share will remain stable throughout the reporting period. “Petroleum Refining” (1A1b) is completely covered by the ETS except for non-CO_2 greenhouse gas emissions. ETS emissions from “Manufacture of Solid Fuels and Other Energy Industries” (1A1c) are expected to remain constant at a 2007–2009 average as no additional installations will be included in the ETS in the forthcoming period.

Scenario “with existing measures”

Price of CO_2 tonne under the Emission Trading scheme

It has been assumed that the European ETS will continue beyond 2020 and that the price will not be influenced by decisions of Austrian plant operators. The following prices have been assumed:

- 15 €/t up to 2015, 20 €/t up to 2020; 25 €/t up to 2025; 30 €/t up to 2030.

The effects of recent changes in the ETS have been considered.

Losses in electricity production due to implementation of the Water Framework Directive

As regards the implementation of the Water Framework Directive, assumptions have been made as summarised in Table 9. Projected losses for 2015 amount to 360 GWh, for 2020 to 720 GWh and for 2030 to 1 489 GWh.

Table 9: Projected losses in electricity production due to implementation of the Water Framework Directive.

	losses until 2030 [GWh]	base year
small plants (< 10 MW)	832	2010
large plants (> 10 MW)	377	2010
storage plants (> 10 MW)	280	2020

Optimisation of existing hydro power plants

According to a study conducted by (PÖYRY 2008), the potential for optimisation amounts to a total of 1 400 GWh, with 50 % to be contributed by small plants (< 10 MW) and 50 % by large plants (> 10 MW).

Green Electricity Act

For the scenario “with existing measures” it is assumed that the goals of the Green Electricity Act 2012 (Federal Law Gazette I No. 75/2011) will be fulfilled. The Act aims at a construction of hydroelectric power plants with a capacity of 1000 MW, wind farms with 2000 MW, photovoltaic systems with 1200 MW and biomass plants with 200 MW_{th} up to the year 2020. The Green Electricity Act stipulates no specific goals beyond the year 2020.

Petroleum refining

See chapter 3.1.1.1 for assumptions regarding this sector.

Manufacture of solid fuels and other energy industries

See section 3.1.1.1 for assumptions regarding this sector.

Scenario "with additional measures"

For biomass plants it has been assumed that additional subsidies will be granted for the first installed capacities to prevent decommissioning.

A further measure is the setting of additional targets for 2030 in the Green Electricity Act: + 2000 MW wind plants and + 1200 MW photovoltaics (in relation to the 2020 targets.

Energy efficiency measures (see chapter 4) are expected to have been fully implemented, leading to a decrease in electricity demand.

3.1.1.3 Activities

Scenario "with existing measures"

The transformation input to Austrian heat and power plants for the WEM scenario is depicted in Figure 17. The input to coal, oil and gas plants is expected to see a reduction until 2018 which will, however, mostly be compensated by the increased input to hydroelectrical, wind and photovoltaic plants. From 2019 onwards, inputs to coal plants are expected to remain constant and inputs to gas plants are expected to rise to match the increase in electricity demand.

The input of biomass and waste, wind power and photovoltaics is assumed to increase significantly.

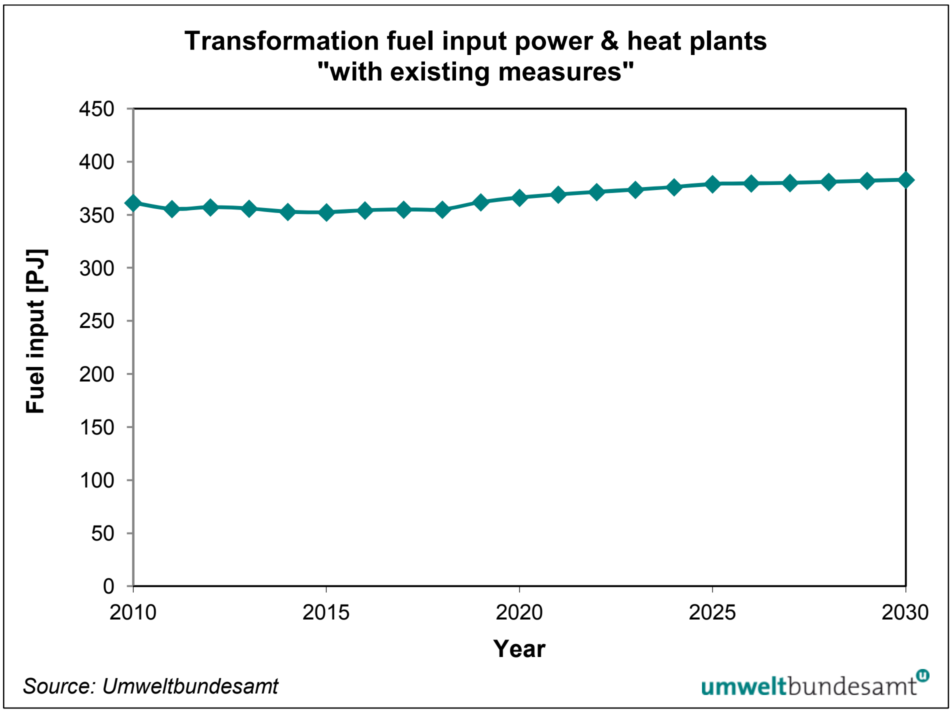
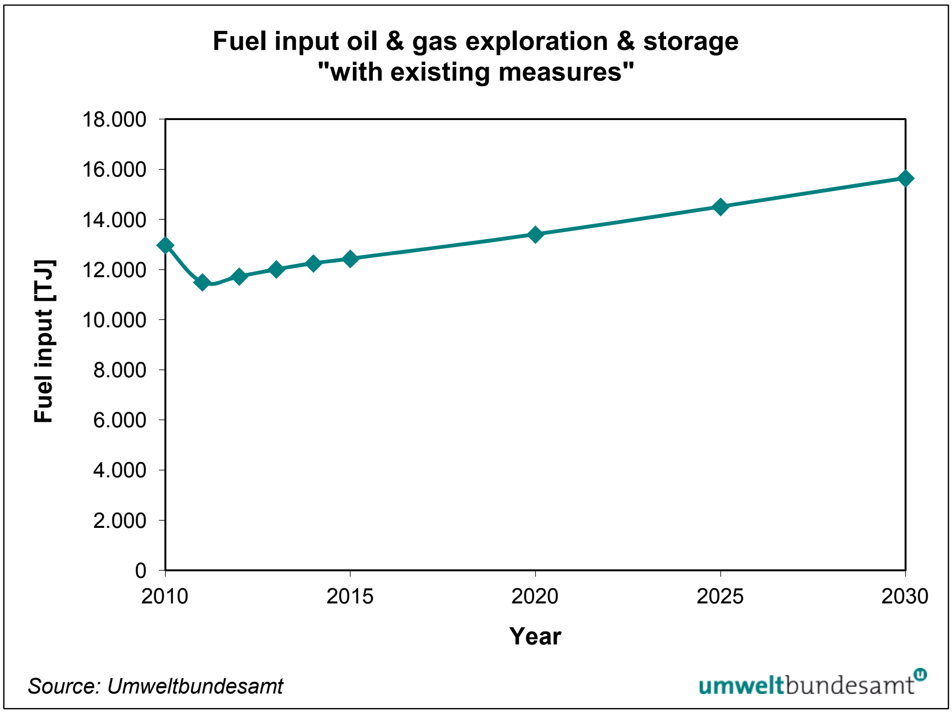


Figure 17: Transformation fuel input in Austrian heat and power plants (1.A.1.a), – scenario "with existing measures".

Emissions (and thus energy inputs) of the only refinery in Austria are expected to remain stable until 2030 as indicated in chapter 3.1.1.1, both in the scenarios WEM and WAM.

For oil and gas exploration and storage natural gas is the only fuel source. The input is expected to remain more or less constant up to 2020 and to increase by 21 % by 2030 (compared to 2010) (see Figure 18).

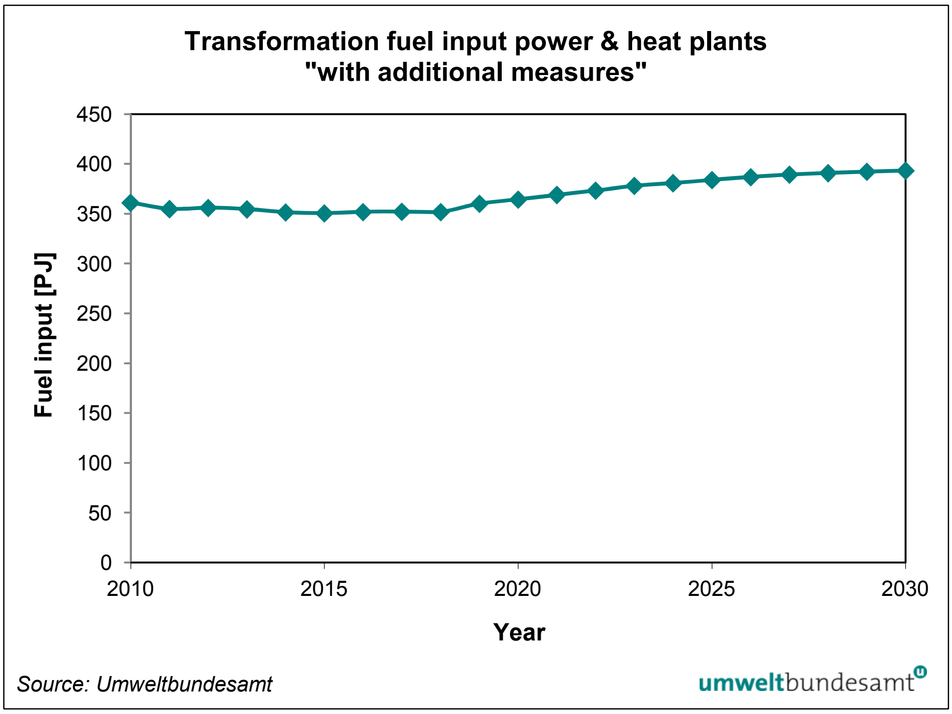
Figure 18: Fuel input in oil and gas exploration and storage (1.A.1.c) –scenario "with existing measures".



Scenario "with additional measures"

The transformation input to Austrian heat and power plants in the WAM scenario is depicted in Figure 19. Trends and effects are similar to the WEM scenario, with lower inputs until 2020 and higher inputs afterwards due to an increased production of wind energy, biomass and photovoltaic power.

Figure 19: Transformation fuel input in Austrian heat and power plants (1.A.1.a) – scenario "with additional measures".



3.1.1.4 Sensitivity Analysis

For general assumptions on sensitivity analysis see chapter 1.3.

For sensitivity analysis in heat and power generation, the impact of GDP growth has been evaluated. In the first sensitivity scenario, a GDP growth of 2.5 % p.a. has been assumed, in the second one a growth of 0.8 % p.a. The growth assumed in the WEM scenario is 1.5 % p.a.

Figure 20 depicts changes in tranformation inputs resulting from lower and higher GDP growth rates. In the first sensitivity scenario (WEM sens 1), the higher growth rate of 2.0 % p.a. is compensated by an increase in fuel prices up to 2015. In later years (due to an increased demand in electricity) it is expected to be economically viable to increase production in existing power plants and even to install new gas power plants. In 2026 all installations are expected to be operated at their maximum economic capacities.

In 2015 the difference between the scenarioes WEM and WEM sens 1 is expected to be 0.4 % or 1.4 PJ, in 2020 14 % or 52 PJ and in 2030 24 % or 93 PJ.

In the second sensitivity scenario (WEM sens 2), the tranformation input is expected to remain nearly constant from 2012 to 2030. The growth rate of 0.8 % p.a. is expected to be compensated by efficiency measures. Input is lower than in the WEM scenario. In 2015 the difference between the scenarios is expected to be -0.2 % or -0.6 PJ, in 2020 -1.6 % or -5.9 PJ and in 2030 it is -3.8 % or -15 PJ.

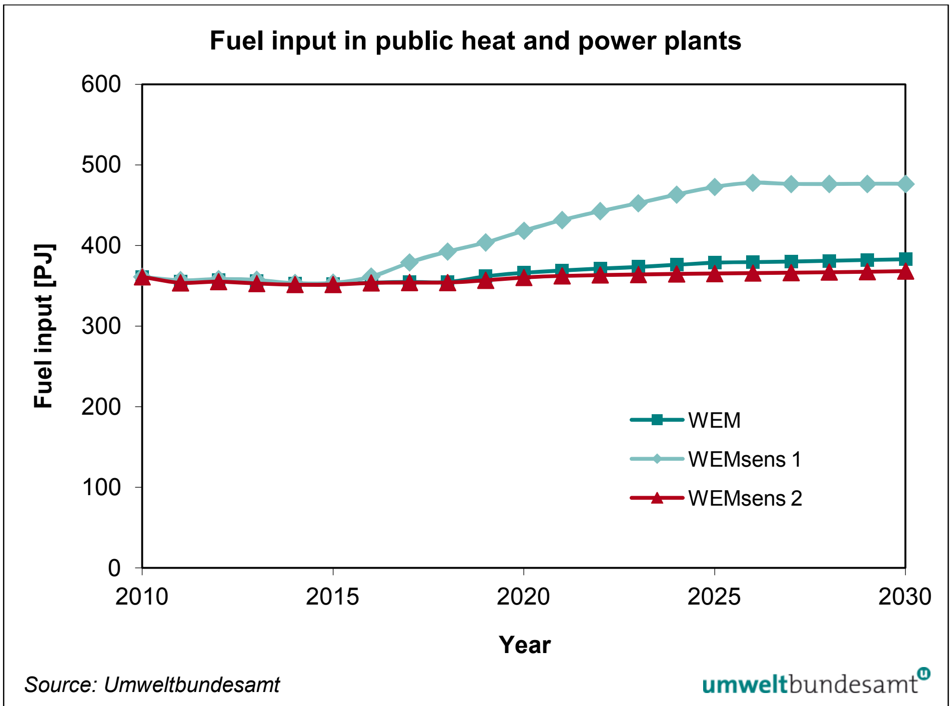
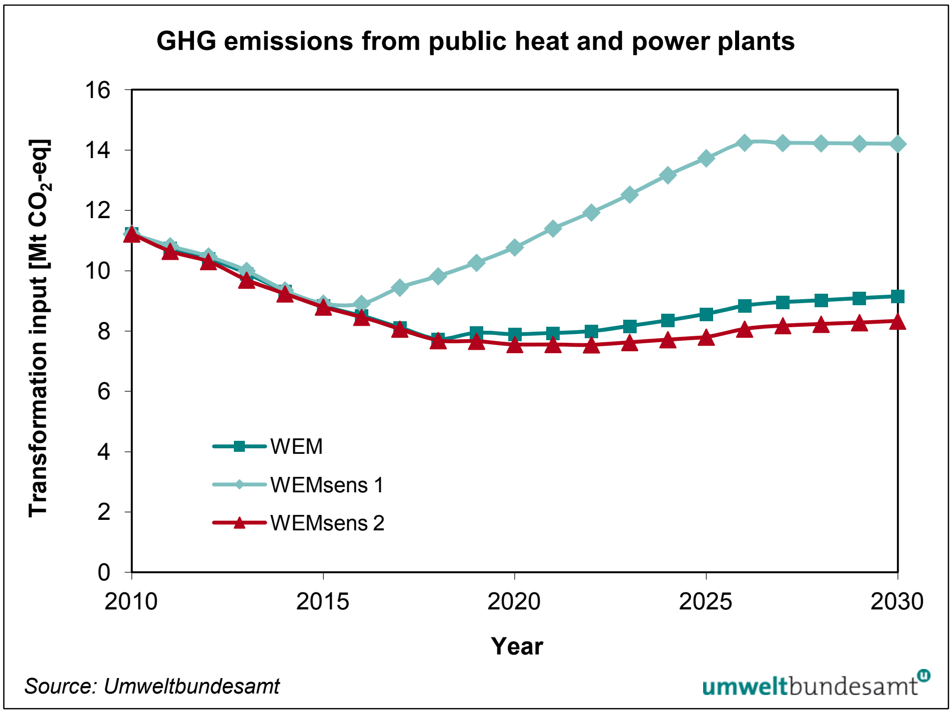


Figure 20: Changes in fuel inputs in public heat and power plants according to GDP growth.

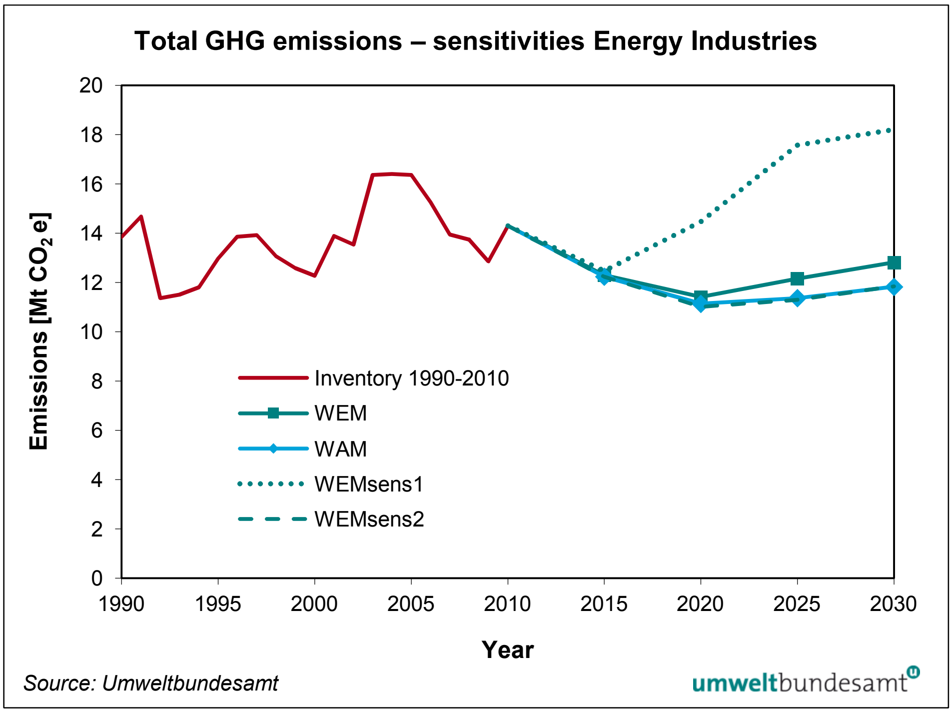
For public electricity and heat production a significant decrease in emissions is expected if GDP growth is lower (15 % in 2020). For 2030, with lower imports in the sensitivity scenario, the decrease is expected to be less pronounced (6 %). If the GDP growth rate is higher, emissions increase significantly (22 % in 2020 and 61 % in 2030) (see Figure 21).

Figure 21: Changes in GHG emissions from public heat and power plants according to GDP growth.



For the only Austrian refinery no GDP growth-related changes are expected. Therefore, trends in 1.A.1 total sensitivity are dependent on the sensitivity in calculated for subsector 1.A.1.a (see Figure 22 for comparison).

Figure 22: Trend and projections (2010–2030): total GHG emissions for the different scenarios and sensitivities, sector 'Energy Industries'



3.1.1.5 Uncertainty

For uncertainties regarding emission factors see the Austrian National Inventory Report 2012 (UMWELTBUNDESAMT 2012a).

Economic development (gross value added) directly influences energy demand and is the most important parameter. As can be seen in the sensitivity analysis, a decrease in GDP growth reduces the energy demand more than any additional measures.

Another very important parameter is the global oil price and, subsequently, the development of energy prices. It depends on the international price for electricity how much power the Austrian plants will produce for the international market.

The third important parameter is the number of existing and prospective heat and power plants in Austria. Any long-term decisions whether or not to build new coal-fired power plants in Austria strongly depend on the coal/oil price ratio, the availability of CCS and national and international policies.

Less uncertainty is associated with population growth in Austria.

3.1.2 Manufacturing Industries and Construction (1.A.2)

3.1.2.1 Methodology of the sectoral emission forecast

The models are described in the energy chapter 3.1.

3.1.2.2 Assumptions

Scenario “with existing measures”

Assumptions for the global oil price are given in US$, starting from 2010 (see Table 10). After a decline until 2010 a continuous increase in the oil price is expected. GDP growth is expected to average at 1.5 % per year until 2030. Until 2013, the US$/€ ratio is expected to decrease from 1.327 to 1.3 and to remain stable afterwards.

Table 10: Global oil price per barrel in the scenario “with existing measures” and the sensitivity analysis 1 and 2 scenarios (in US$ 2010).

Global oil price [US$ 2010]	2010	2015	2020	2025	2030
WEM	78.1	106	118	127	135
WEM sens1	78.1	111	130	153	180
WEM sens2	78.1	100	108	113	117

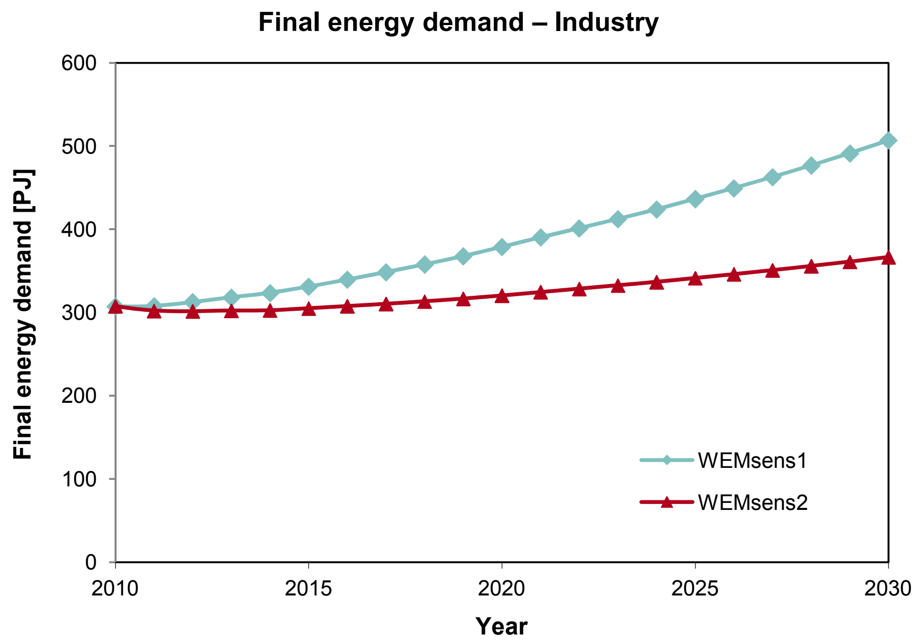
Scenario “with additional measures”

Due to increased efficiencies (through measures described in chapter 5.3), the energy demand is expected to decline. The difference between the relevant scenarios is shown in the Table 11. In the year 2020 the difference is expected to be 13 PJ and in 2030 37 PJ for the total energy demand in the industrial sector.

Table 11: Total final energy demand in the industrial sector (in PJ).

Energy demand [PJ]	scenario	2010	2015	2020	2025	2030
Industry	WEM	308	313	340	374	416
Industry	WAM	308	308	327	351	379

Figure 23: Final energy demand in the industrial sector.



Source: Umweltbundesamt

3.1.2.3 Activities

Scenario "with existing measures"

The energy input in the industrial sector is expected to increase continuously from 2010 to 2030. The difference between the scenarios WEM and WAM is mainly due to efficiency measures (see Figure 23 and Table 11). Detailed figures are given in the Annexes.

Scenario "with additional measures"

The difference between this scenario and the scenario "with existing measures" is described in chapter 3.1.2.2.

3.1.2.4 Sensitivity Analysis

For general assumption on sensitivity analysis see chapter 1.3.

The impact of GDP growth on energy demand has been assessed by calculating scenarios where a GDP growth of 2.5 % p.a. and 0.8 % respectively has been assumed (instead of 1.5 % p.a. as in WEM).

As can be seen in Figure 24, the fuel input in the sensitivity scenario 1 is expected to be 11 % higher in 2020 and 22 % higher in 2030. In the sensitivity scenario 2, the fuel input is expected to be 6 % lower in 2020 and 12 % lower in 2030.

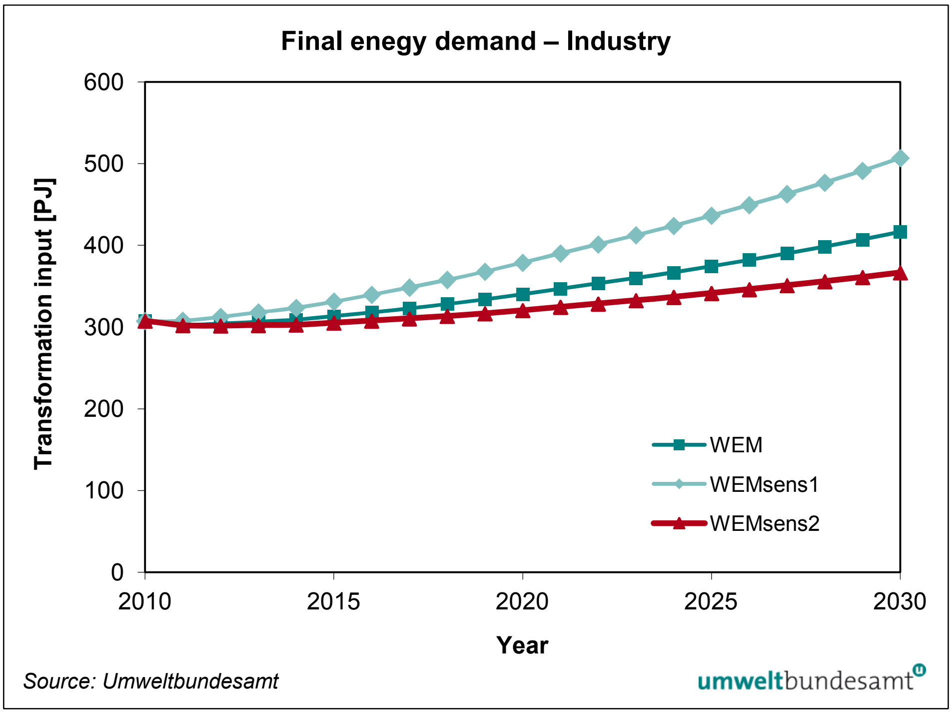


Figure 24: Final energy demand in the sector industry with sensitivities

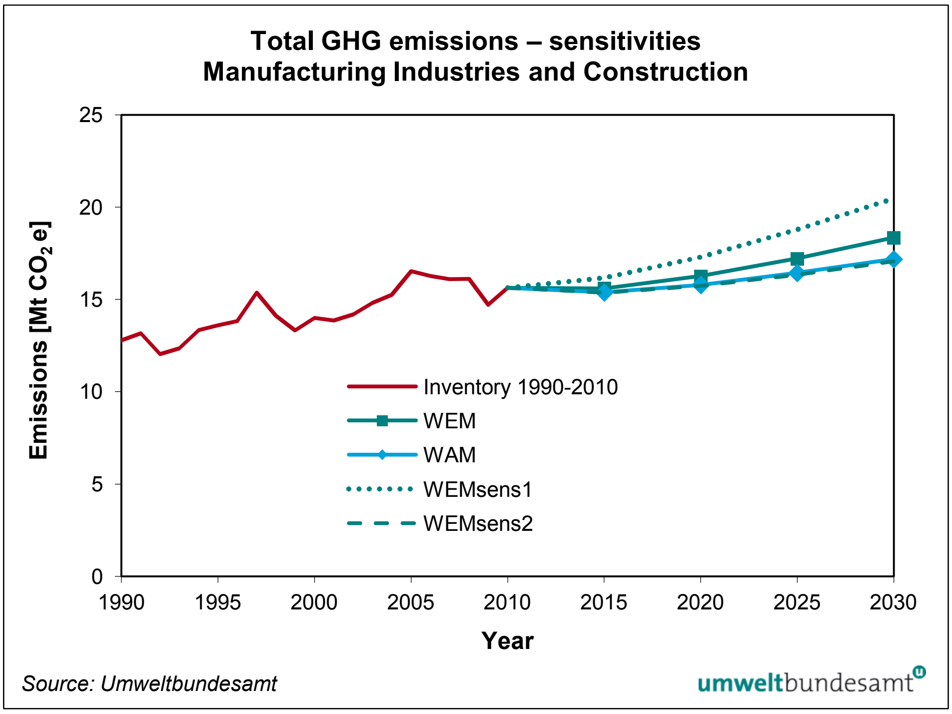


Figure 25: Trend and projection (2010–2030) of total GHG emissions for the scenarios and sensitivities, sector manufacturing industries and construction

3.1.2.5 Uncertainty

For uncertainties regarding emission factors see the Austrian National Inventory Report 2010 (UMWELTBUNDESAMT 2012a).

Economic development (gross value added) directly influence energy demand and is the most important parameter. As can be seen in the sensitivity analysis a decrease in GDP growth reduces the energy demand more than any additional measures.

Another very important parameter is the global oil price and, subsequently, the trend in energy prices. For the wood and the pulp and paper industries the availability of biomass and the costs involved are also a key parameter.

Less uncertainty is associated with population growth in Austria.

3.1.3 Transport (CRF Source Category 1.A.3)

3.1.3.1 Methodology of the sectoral emission forecast

The forecast comprises different models:

1 A 3 Transport (without aviation)

The calculation of transport emissions is based on different models:

- **GLOBEMI – Emission model road (CRF Source Category *1 A 3 b*)**

  For the calculation of road emissions the GLOBEMI model is used (HAUSBERGER 1998; HAUSBERGER & SCHWINGSHACKL 2012). GLOBEMI was developed for the calculation of emission inventories in larger areas. Input parameters include – amongst others – the vehicle stock of each category (cars, light duty vehicles, …) split into layers according to the propulsion system (SI, CI, …), engine volume or vehicle mass, the emission factors of the vehicles according to the year of their first registration as well as the number of passengers per vehicle and tonnes payload per vehicle. Furthermore, the model delivers an assumption for the fuel export effect.

- **GEORG – Emission model off-road (CRF Source Category 1 A 2 f, 1 A 3 c, 1 A 3 d, 1 A 4 b, 1 A 4 c, 1 A 5)**

  Energy consumption and off-road emissions in Austria are calculated with the model GEORG (**G**razer **E**missionsmodel für **O**ff **R**oad **G**eräte) (PISCHINGER 2000). The model GEORG has a fleet model part, which simulates the actual age and size distribution of the vehicle stock via age- and size-dependent drop-out rates (i.e. the probability that a vehicle will be scrapped by the next year). With this approach the number of vehicles in each category of mobile sources is calculated according to the year of their first registration and the vehicles' propulsion systems (gasoline 4-stroke, gasoline 2-stroke, diesel > 80 kW, diesel < 80 kW).

1 A 3 a – Aviation

Projections for energy consumption in the aviation sector up to 2030 are based on a jet fuel forecast provided by the Austrian Institute of Economic Research (WIFO) within the framework of an energy demand forecast for the different CRF sectors in Austria (WIFO 2013).

1 A 3 e – Other transportation – pipeline compressors

Projections for energy demand in pipeline transport up to 2030 are based on expert judgment based on transport volumes as reported in climate change declarations on corporate emission. Relevant emissions were extrapolated on the basis of general assumptions on GDP trends within the framework of an energy demand forecast for the different CRF sectors in Austria (UMWELTBUNDESAMT 2013b).

3.1.3.2 Assumptions

1 A 3 a – Aviation

Scenario "with existing measures" (WEM)

Projections for energy consumption in the aviation sector up to 2030 are based on a forecast carried out by the Austrian Institute of Economic Research (WIFO) as mentioned above. This forecast is based on generally accepted parameters for annual GDP growth or domestic income.

After a slackening of economic growth in recent years, the average annual increase in energy demand in air traffic from 2011 to 2030 is assumed to be 2.6 % in the scenarios WEM and WAM. This is consistent with statements of Austro Control (officially responsible for airspace management in Austria) regarding an estimated average annual increase in aircraft movements for Austria in the future.

Scenario "with additional measures" (WAM)

The assumptions made for the WAM scenario are equal to the ones described above. The inclusion of GHG emissions of the aviation sector into the European Trading System is assumed to result in marginal changes: "Market-based policies, such as a cap-and-trade programme that includes transportation, may have little impact on reducing transportation demand unless carbon prices are very high. For example, the European Union has estimated the reduction in transportation demand from including aviation in its GHG Emissions Trading Scheme, and initial results show only small changes [...]" (McCollum et al. 2009, p.13).

1 A 3 b – Road Transport/1 A 3 c Rail Transport/1 A 3 d Navigation

- **Modal split development in inland passenger transport (excl. fuel export, international aviation and international navigation)**

Scenario "with existing measures" (WEM)

The performance of passenger transport has been constantly increasing since 1990. It is assumed that passenger kilometres (pkm) will increase further until 2030. Therefore, elasticities[3] for passenger transport (based on GDP growth as assumed up to 2030) have been calculated (Umweltbundesamt 2013b). This increase will not affect all transport modes in the same way. Passenger car transport will increase rapidly. This assumption includes assumptions about the future fleet of electric and plug-in hybrid cars (assumptions about trends in electric mobility are given below). Bus, rail and electric local public transport are also expected to see a slight increase. The following table shows – in consistency with the reporting obligations for GHG emissions – the pkm per transport mode (including pkm travelled by passenger cars which are allocated to fuel exports).

[3] A measure of responsiveness: The responsiveness of behaviour (measured by the variable Z) to a change in the variable Y corresponds to the change measured in Z in response to a change in Y. Specifically the following approximation is normally used: elasticity = (percentage change in Z)/ (percentage change in Y).

Table 12: Historical and forecast (2011–2030) increase in inland passenger kilometres in absolute numbers (in million pkm).

	passenger cars	buses	mopeds	motor cycles	rail	electric local public transport	pedestrians	bicycles	national aviation
1990	55 735	7 969	443	308	8 912	2 796	1 914	1 213	150
1995	58 237	8 700	369	510	10 124	3 300	1 857	1 264	161
2000	61 083	9 223	348	812	8 740	3 577	1 817	1 304	172
2005	89 556	9 319	332	1 005	9 061	3 770	1 793	1 345	211
2010	90 376	9 587	353	1 253	10 737	4 059	1 698	1 430	219
2015	89 677	9 597	355	1 179	11 393	4 266	1 603	1 515	221
2020	94 467	9 690	355	1 202	12 230	4 380	1 508	1 600	254
2025	99 966	9 765	355	1 209	13 112	4 390	1 413	1 685	289
2030	105 960	9 841	355	1 216	14 134	4 400	1 318	1 770	326

In the WEM scenario there are no measures which are likely to change the modal split in passenger transport in a considerable way.

The following diagram shows the modal split for passenger transport, giving the percentages of travellers using the different transport modes (incl. the pkm allocated to fuel exports, as required by the reporting obligations).

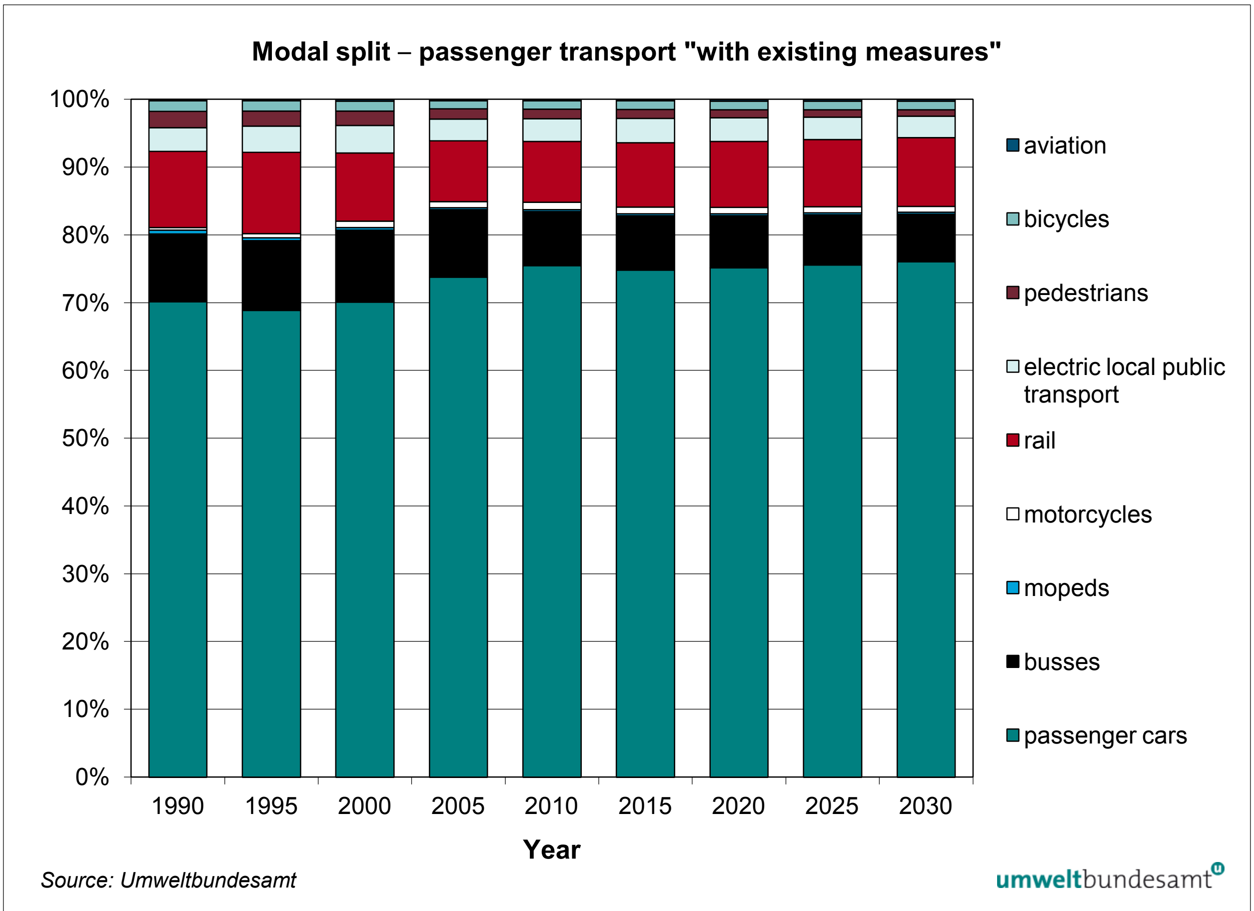


Figure 26: Historical and forecast (2011–2030) passenger transport: modal split – scenario "with existing measures".

Scenario "with additional measures" (WAM)

Elasticities in passenger transport are taken from the WEM scenario. However, the absolute numbers of pkm per transport mode are different to the WEM scenario because of the (additional) measures included in the WAM scenario (fuel tax increase, greening of consumption tax, mobility management and awareness initiatives, commuter tax reform), which are expected to lead to a slight decrease in individual motorised transport and to a slight increase in public transport. For a detailed description of the measures foreseen in the WAM scenario see chapter 4.

- **Modal split development in inland freight transport (excl. fuel export, international aviation and international navigation)**

Scenario "with existing measures" (WEM)

Transport performance (given in tonne kilometres (tkm) for heavy duty vehicles) has increased since 1990 and it is expected that it will increase unimpededly, assuming that GDP dependent freight transport elasticities will continue up to 2030 (UMWELTBUNDESAMT 2013b). Freight rail transport is expected to increase slightly. Freight volumes transported by light duty vehicles, navigation and aviation are expected to remain constant on a low level.

The following table shows – in consistency with the reporting obligations for GHG emissions – tkm per transport mode (including tkm travelled by trucks which are allocated to fuel ex-ports).

Table 13: Historical and forecast (2011–2030) increase in inland freight tonne kilometres (in million tkm).

	light duty vehicles	heavy duty vehicles	rail	navigation	aviation
1990	426	30 034	11 349	101	NE*
1995	485	45 839	12 321	83	NE*
2000	559	84 631	15 331	117	2
2005	630	116 988	17 253	157	3
2010	696	112 522	18 209	73	1
2015	712	150 510	19 995	92	2
2020	758	169 697	21 895	96	2
2025	836	190 538	23 835	101	2
2030	884	209 338	25 881	107	2

** NE: not estimated*

In the WEM scenario there are no measures which are likely to change the modal split in passenger transport in a considerable way.

The following diagram shows the modal split for freight transport, giving the percentages of freight shipped by the different transport modes (incl. the tkm allocated to fuel exports, as required by the reporting obligations).

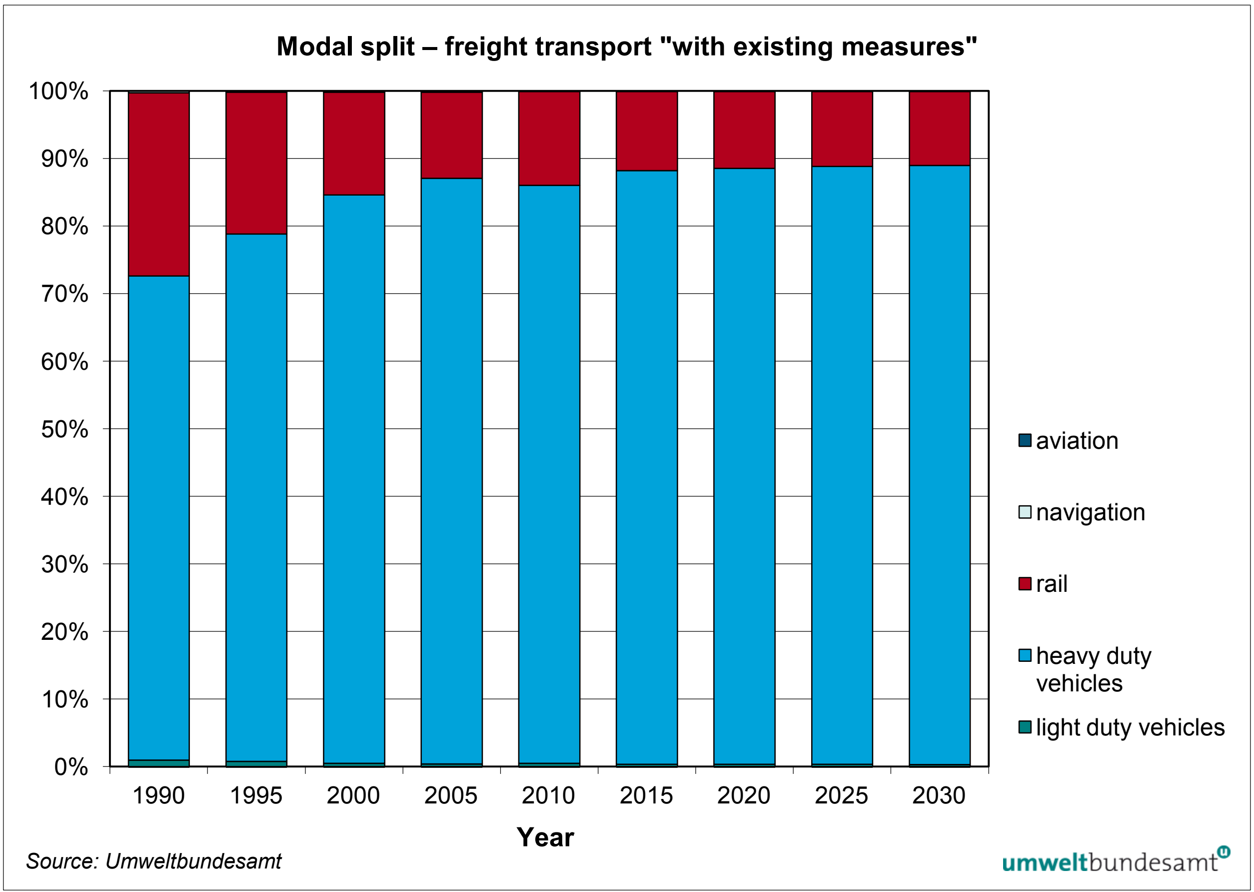


Figure 27: Historical and forecast (2011–2030) freight transport: modal split – scenario "with existing measures".

Scenario "with additional measures" (WAM)

Elasticities in freight transport are taken from the WEM scenario. However, the absolute numbers of tkm per transport mode are different to the WEM scenario because of the (additional) measures included in the WAM scenario (mainly fuel tax increase), which are expected to lead to a decrease in road tkm and a slight increase in inland navigation tkm. For a detailed description of the measures foreseen in the WAM scenario see chapter 4.2.2.1.

- **Development in alternative fuels**

Biofuels

Projections for the consumption of alternative fuels in transport are primarily based on the requirement to meet the European objective, i.e. a 10 % share of renewable energy in the transport sector in 2020. This is to be achieved primarily through the blending of biofuels with fossil fuels and an increased use of electric vehicles. Assumptions of the Energy Strategy Austria (BMWFJ & BMLFUW 2010) have also been used for the development of the scenarios.

In addition to biodiesel and bioethanol blends, the following additional the applications of biofuel are considered:

- Use of pure biodiesel (B100)
- Use of pure bioethanol (E85 – Super ethanol)
- Use of pure vegetable oil.

Scenario "with existing measures" (WEM)

The level achieved of biofuel blending with fossil fuels largely depends on the amount of fossil fuels sold on the market. By 2020, at least 10 % of total transport energy will have to come from renewable sources such as biofuels in each Member State, or from electricity produced from 100 % renewable energy sources. For details see measure 01_TRA Promotion of biofuels – Implementation of Directive 2003/30/EC in chapter 4.

As regards pure biofuels and their development by 2020, a reduction of pure biofuel quantities to zero is assumed because of a lack of measures in place and the fact that a market for pure fuels cannot be guaranteed. An achievement of the relevant objectives (10 % by 2020) can only be guaranteed by implementing directly controllable measures, which include blending of biofuels rather than quantities of pure biofuels on the market, since their sale largely depends on the market price.

Scenario "with additional measures" (WAM)

The assumptions here are equal to the ones in the WEM scenario.

Other fuels

Scenario "with existing measures" (WEM)

Projections for CNG (natural gas), LPG and hydrogen as alternative fuels up to 2030 are more conservative than in the Energy Strategy Austria (BMWFJ & BMLFUW 2010) since the vehicle registration data indicate no immediate breakthrough for these energy sources.

Scenario "with additional measures" (WAM)

The assumptions here are equal to the ones in the WEM scenario.

- **Developments in electric mobility**

The estimated scenarios are based on ideal circumstances (political, economic, technical, as well as ideal market conditions) for the introduction of electric vehicles.

Projections for developments in electric mobility are based on a study conducted by the Environment Agency Austria about scenarios for developments and trends in electric vehicles in Austria up to 2020 and 2050 (UMWELTBUNDESAMT 2010). A comprehensive supply-demand analysis was performed for the period up to 2020. Within the first half of the next decade a lack of supply of electric vehicles is expected to be the main obstacle for an increase in electric mobility. The results of the study provided the basis for the WAM scenario, which then also served as a guideline for a more conservative estimate of electric mobility development as described in the WEM scenario.

The share of renewable electricity in electric mobility is particularly high in Austria and a powerful lever in the achievement of the mandated goal of a 10 % share of renewable energy in transport by 2020, as the renewable electrical energy used is calculated by a factor of 2.5. Therefore, the amount of electricity generated from renewable sources will be a critical aspect of electric mobility (BMWFJ & BMLFUW 2010).

Current projections only include electrified private transport. For the projections it was assumed that conventional diesel and gasoline cars would be substituted by the same number of electric vehicles. The increased power consumption by electric vehicles was included in the energy-producing sectors.

In road freight transport, electric trucks are no alternative to conventionally powered trucks because of the demands on their performance. Furthermore, rail transport already provides an alternative to road transport. Therefore, a shift from road to rail freight transport should be aimed for. For urban collection and delivery services, light duty hybrid trucks could be used more often, but they are currently available only for pre- and test runs.

1 A 3 e – Other transportation – pipeline compressors

EU ETS/non-ETS

Emissions from “Other Transportation” (1A3e), accounted for as non-ETS emissions up to 2012, will be covered by the ETS scheme from 2013 onwards, except for emissions of greenhouse gases other than CO_2.

3.1.3.3 Activities

1 A 3 a – Aviation

The economic downturn resulted in a 16 % decrease in national energy demand (national LTO and cruise traffic) between 2007 and 2010.

In the WEM scenario it is projected that it will take the national aviation sector five years to reach the GHG emissions level of the peak year 2007. For GHG emissions from national aviation a 31 % increase over 2010 levels is projected until 2020 and a 68 % increase until 2030.

1 A 3 b – Road Transport

Since the end of the 1990s the gap between Austrian fuel sales and computed domestic fuel consumption has become wider. Since 2003 it has accounted for roughly 30 % of total fuel sales. A possible explanation for this discrepancy is “fuel export in vehicle tanks”, which is a result of the relatively low fuel prices in Austria (in comparison to the neighbouring countries). A large number of motorists tend to fill up their cars with fuel in Austria and consume it abroad. This has been confirmed by two national studies (MOLITOR et al. 2004; MOLITOR et al. 2009).

The “fuel export” phenomenon is relevant for climate policy, e.g. the Kyoto commitment, because emissions are allocated according to national fuel sales. GHG emissions from “fuel exports” are thus assigned to Austria and included in the national total.

Since 2005 energy demand has decreased in road transport, reaching a low in 2009 (as a result of the economic downturn).

In the WEM scenario it is projected that up to 2030 GHG emissions will not reach the level of the peak year 2005. For GHG emissions from road transport, a 5 % increase over 2010 levels is projected until 2020 and a 6 % increase until 2030. The share of GHG emissions from fuel exports is expected to increase further until 2030 (assuming that traffic volumes are going to rise and that the difference between fuel prices paid in Austria and those paid in the neighbouring countries will remain constant.

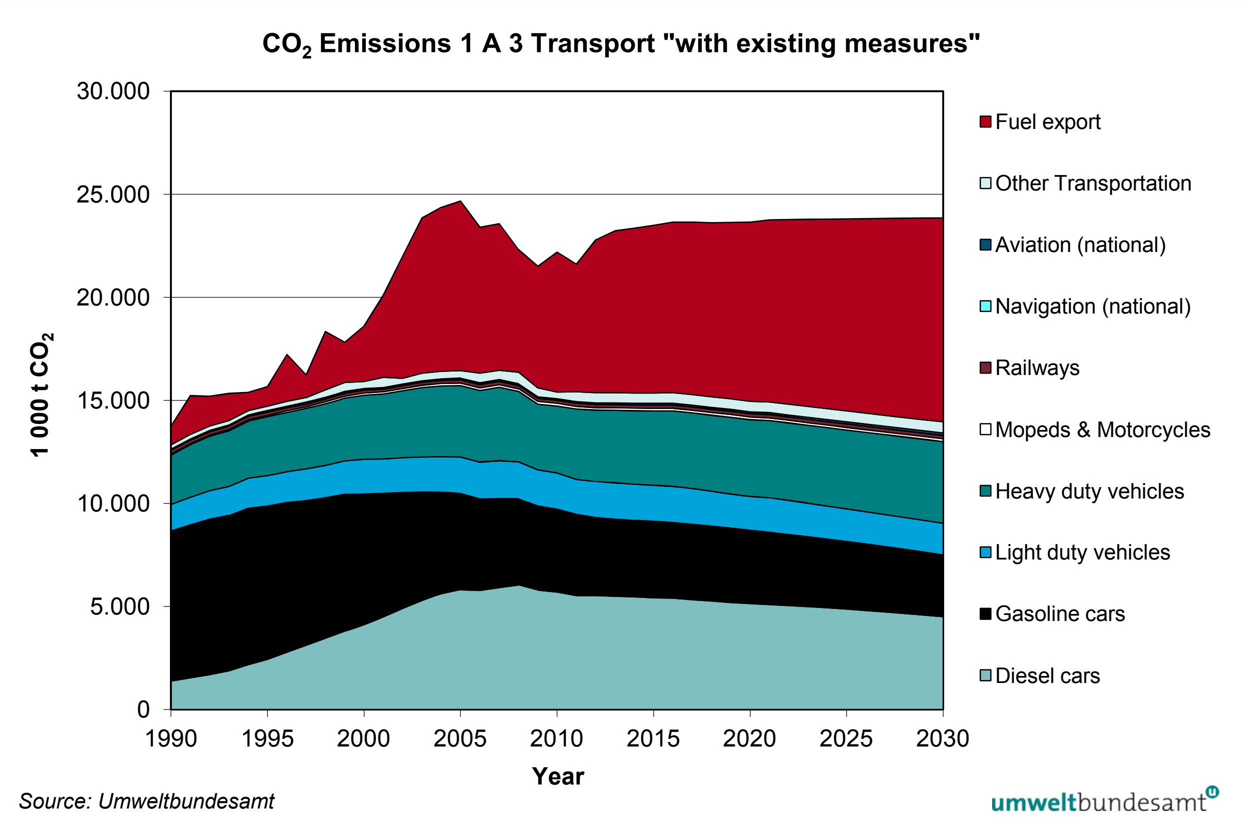


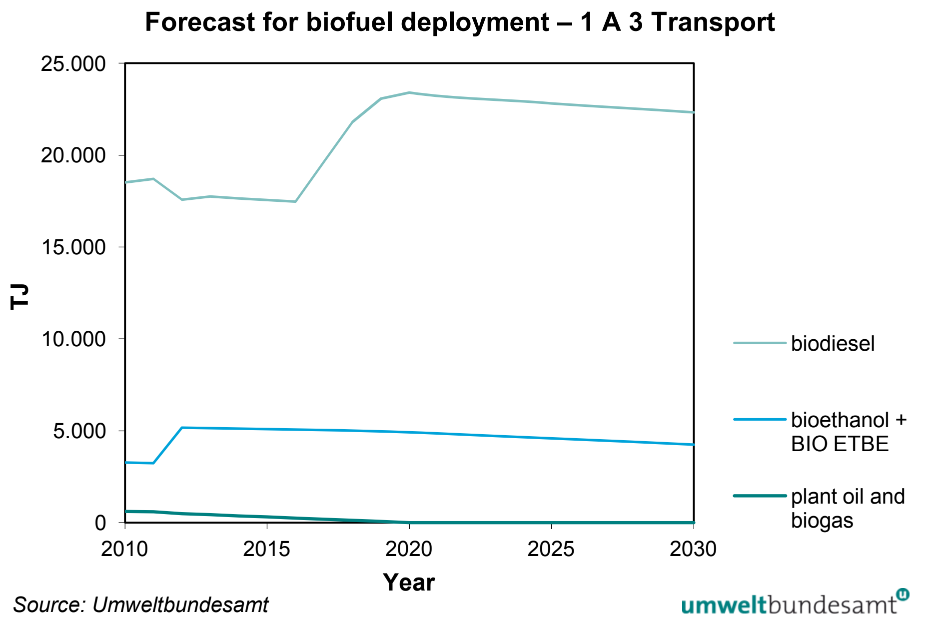
Figure 28: Historical and forecast (2011–2030) CO_2 emissions from transport – scenario "with existing measures".

● Biofuels – developments and trends

Since 2005 biogenic fuels (biodiesel, bioethanol, and vegetable oil) have been used in the Austrian Road Transport sector. Biodiesel and bioethanol are mainly used for blending fossil fuels, whereas vegetable oil is distributed in its pure form.

The following graph shows a forecast of the trends and developments in biodiesel, bioethanol, vegetable oil and biogas deployment up to 2030. There are no differences between the assumptions for the WEM and WAM scenarios. Details on energy consumption by fuel type can be found in Annex 2.

Figure 29: Forecast for biofuel deployment in Austria – scenarios WEM and WAM.

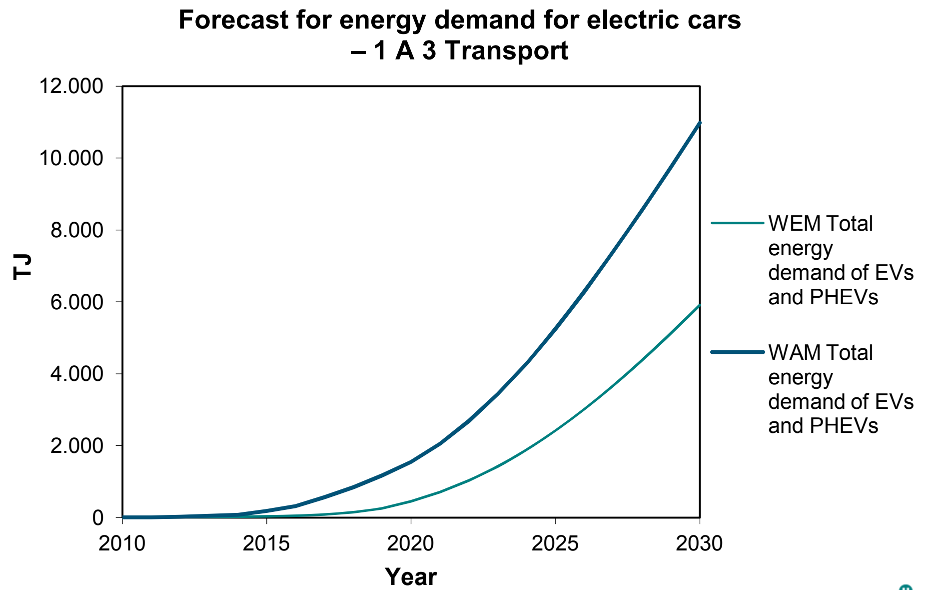


Source: Umweltbundesamt

- **Development of electric mobility**

The following graph shows the estimated energy demand for electric vehicles (EVs, passenger cars) and plug-in hybrid electric vehicles (PHEVs) in road transport in Austria up to 2030 for the WEM and WAM scenarios.

Figure 30: Forecast for electromobility in Austria – scenarios WEM and WAM.



Source: Umweltbundesamt

1 A 3 e – Other transportation – pipeline compressors

The economic recession at the end of 2008 also affected pipeline transport. Energy demand decreased dramatically until 2010. For the years from 2010 onwards, energy demand is expected to reach to pre-crisis levels in 2011 and increase by approximately 12 % until 2030.

3.1.3.4 Sensitivity Analysis

For general assumption on sensitivity analysis see chapter 1.3.

Two scenarios and their resulting CO_2 emissions are compared to each other:

- *WEM scenario*: Is the present scenario with fuel price differences as compared to neighbouring countries remaining constant from 2011 onwards and assuming an average GDP growth of 1.5 % per year.
- *Scenario WEMsens1:* fuel price differences as compared to neighbouring countries remain constant from 2011 onwards, average annual GDP growth is only 2 %.
- *Scenario WEMsens2:* fuel price differences as compared to neighbouring countries remain constant from 2011 onwards, average annual GDP growth is only 0.8 %.

The results of scenario WEMsens1 show that a higher annual GDP growth rate results in an increase of total CO_2 emissions from the transport sector. This is mainly caused by intensified economic activities between Austria and its neighbouring countries and, consequently, increased export quotas and an increase in road transport performance all over Austria. On the one hand, this results in an increase in the share of fuel exports, on the other hand in a general increase in the performance of the road freight transport sector (especially of heavy duty diesel vehicles).CO_2 emissions are expected to rise accordingly.

The results of scenario WEMsens2 show that a lower annual GDP growth rate results in a decrease in total CO_2 emissions from the transport sector.

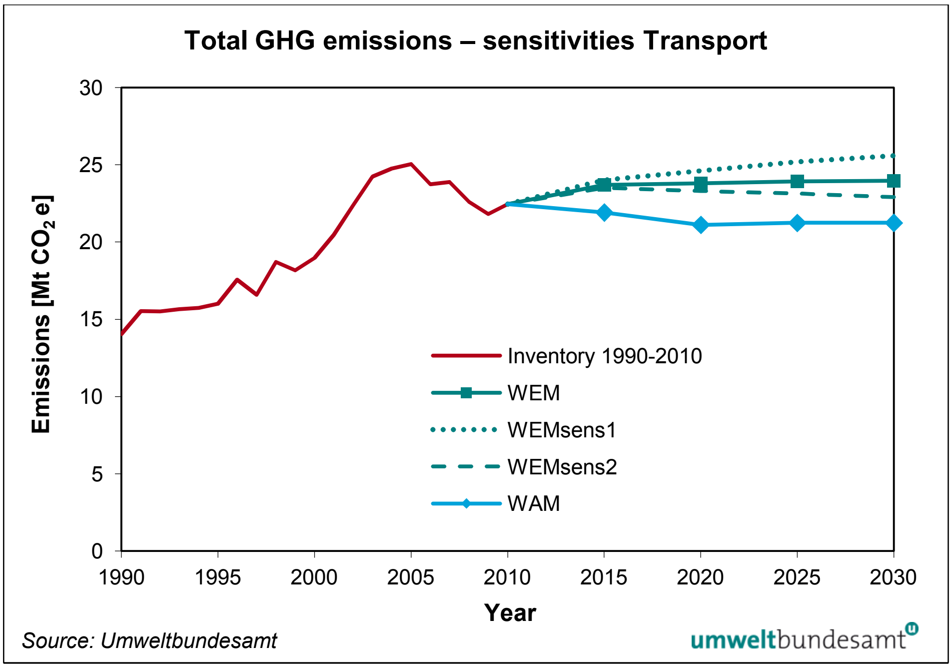


Figure 31: Trends and projections (2011–2030): total GHG emissions for the different scenarios and sensitivities, transport sector

3.1.3.5 Uncertainty

Numerous exogenous factors have an influence on the projections:

- fuel price development and trend
- fuel export development and trend (fuel purchased in Austria and consumed abroad because of lower fuel prices in Austria compared to the neighbouring countries)
- fuel efficiency development in newly registered vehicles.

3.1.4 Other Sectors (CRF Source Category 1.A.4)

The sector "1.A.4 Other Sectors" includes all greenhouse gas emissions from 1.A.4.b residential/households, 1.A.4.a commercial (incl. services, institutions), as well as emissions from stationary facilities and mobile sources in agriculture and forestry (1.A.4.c), and other off-road vehicles.

3.1.4.1 Methodology used for sectoral emission forecast

To calculate energy consumption separately for stationary sources in the sub-sector residential and commercial, a comprehensive building model (INVERT/EE-Lab) is used. For the stationary sources in 1A4c (e.g. greenhouses, drying facilities) the macroeconomic model DEIO (WIFO 2013) is used.

Emissions from the mobile sources in 1A4b and 1A4c are described in chapter 3.1.3, and are added to the total sum of 1A4.

Emission factors have been taken from the national emission inventory system. The methodology and references are discussed in Austria's National Inventory Report (UMWELTBUNDESAMT 2012a).

A short introduction to the model used can be found below.

The energy demand model for heating systems in buildings: Methodology

This model, operated by the Energy Economics Group (EEG) of the Vienna University of Technology, is referred to as INVERT/EE-Lab. It is a comprehensive dynamic bottom-up simulation tool (TU WIEN 2013).

The model evaluates the effects of different promotion schemes (investment subsidies, feed-in tariffs, tax exemptions, fuel input subsidy, CO_2 taxes, soft loans, and additional set-aside premium) on the energy carrier mix, as well as CO_2 reductions and the costs of certain strategies to society when they are promoted. Furthermore, the INVERT/EE-Lab model is designed to simulate different scenarios (price scenarios, insulation scenarios, different consumer behaviour patterns etc.) and their respective impact on future trends of renewable as well as conventional energy sources on a national and regional level.

The core of the tool is a myopical, stochastic optimisation algorithm which optimises the objectives of "agents" that represent decision-makers in building related decisions. INVERT/EE-Lab models the stock of buildings in a highly disaggregated manner. Therefore the simulation tool reflects the characteristics of an agent-based simulation.

The forecast model starts with the year 2002, based on a complete survey of all Austrian buildings for the year 2001. For model calibration the basic sampling period from 2003 to 2007 has been extended to 2010 by using current National Energy Balance data of Statistik Austria. Based on the trend in energy demand (primary fuels) in this sector, a model calibration of non-monetary parameters has been performed.

The basic decision algorithm

The basic decision-making/selection process is done on an annual basis. For each building segment it is decided if the system (building shell and heating/ dom. hot water system) remains as it is or if a new heating technology or a measure to improve the building shell is required.

The overall costs (monetary costs, societal costs or greenhouse gas emissions) of each new technology/measure are compared with the respective running costs for the existing structure, and the most cost-effective technology/measure is chosen.

The objective implemented in the model (for all scenarios) is to minimise monetary costs.

Modelling energy demand

Energy demand is modelled by taking into account the demand for energy services, as well as energy efficiency. The two energy services considered are space heating and hot water supply. Behavioural aspects with respect to space heating (such as the level of indoor temperature, ventilation habits) are considered by using a service factor. This parameter describes the relationship between the actual and the theoretical (calculated) energy consumption for space heating.

The model calculates the service factor as a function of the thermal quality (specific heat load) of the building and the degree of automation of the heating system (central heating system vs. single stove heating system).

The final energy demand for hot water supply is modelled on the basis of the number of people living in a dwelling, the service demand for domestic hot water (volume of hot water at 50 °C) per person and day and on the annual efficiency of the water heating system. The model incorporates the ageing of heating systems and domestic hot water systems, which means that in the model, the annual efficiency decreases from one year to another.

Overview of technology options

The technology options available are divided into “single measures” and “combined measures”. Single measures include: change of heating system or domestic hot water system only, installation of new windows, insulation of outside walls only/ceiling only/floor only. Combined measures include: change of heating system and domestic hot water system, insulation of outside walls and new windows, thermal improvement of the whole building shell, insulation of outside walls and ceiling, complete renovation.

Within each technology segment, a broad range of new systems can be selected for implementation, namely 20 different space heating options (with the possibility of hot water integration) and 5 different stand-alone hot water systems.

Solar hot water generation and solar combi systems (solar space heating and hot water system) are integrated into the model. For building shell alterations, up to 10 different insulation materials for different parts of buildings and 6 different window types are implemented in the model. The thickness of insulation is calculated by using an optimisation algorithm (with upper and lower boundaries).

Austrian stock of buildings and heating systems

The buildings currently implemented in the model represent a detailed, disaggregated picture of the Austrian building stock. They include:

- *Residential buildings:* 4 types of buildings, 8 construction periods and renovated and unrenovated buildings;
- *Non-residential buildings:* 7 types of buildings, up to 4 construction periods und up to 3 different building sizes per building type.

3.1.4.2 Assumptions

Despite decreasing population growth rates in Austria, the number of permanently occupied dwellings (principal residence) is expected to increase by about 12 % from 2010 to 2030 (see Annex 1 and 2). This is due to the fact that the trend towards single households is stronger than the overall population growth.

As regards the number of buildings, an overall increase of 14 % is expected from 2010 to 2030, whereas the number of buildings with more than two apartments is expected to rise by about 15 % in this period. Residential buildings with one or two apartments, which make up the majority (about 90 % of the total residential building stock) in Austria, are expected to increase by around 14 % from 2010 to 2030. The strongest increase (with about 19 % until 2030) is expected for commercial (non-residential) buildings.

The total gross floor area in residential buildings is assumed to increase by 16 % until 2030, whereas for commercial buildings the total gross floor area is expected to increase by about 20 % from 2010 to 2030.

Price assumptions are especially important in this sector because they may influence decisions as to which fuels will be preferred for heating systems in the long term, as well as decisions regarding the quality and quantity of thermal renovation activities. Over a period of about twenty years this can have a noticeable effect on specific energy demands. Energy prices are expected to rise considerably for all fossil fuels (about 10–35 %) from 2010 to 2030. For bio fuels, wood logs, wood chips and wood pellets an increase around 25 % is expected by 2030.

Detailed assumptions can be found in Annex 1 and 2.

For some of the assumptions, there are differences between the WEM and WAM scenarios.

Scenario "with existing measures"

In Austria, the policy for subsidising heating systems is aimed at the installation of efficient und low emission (CO_2) boilers. Therefore the regional authorities grant financial support for biomass, district heat and solar heat. The subsidies granted differ between the local authorities. On average, subsidies are granted for district heating (15 % of total installation costs), log wood and wood chips (20 %), heat pumps (5–15 %), local heat and pellets (23 %) as well as solar heat (20–25 %). It is assumed that these percentages will remain constant over the forecast period in the WEM scenario.

The renovation rate indicates the proportion of buildings (or households) where improvement measures on the thermal building envelope (house front, windows, top and bottom floor ceiling) are accomplished. It is therefore an indicator of the renewal of buildings, which usually reduces their heating demand. The renovation rate for residential buildings is assumed to increase from 0.8 % in 2010 to 0.5 % in 2030 and for commercial buildings from 0.7 % in 2010 to 0.67 % in 2030. Individual rates differ for each type of building (see Annex 1 and 2).

Model-based results predict a rise in the boiler exchange rate from 1.7 % in 2008 to 2.5 %–2.7 % in 2030.

Moreover, the average heating demand for residential buildings is expected to decrease from 142 kWh/m² gross floor space in 2010 to 97 kWh/m² gross floor space in 2030, while the average heating demand for commercial buildings is expected to decrease from 174 kWh/m² to 119 kWh/m²

Scenario "with additional measures"

On average, subsidies are granted for district heating (15 % of total installation costs), log wood (20 %), wood chips and pellets (20-23 %) as well as solar heat (20-25 %). It is further assumed that these percentages will remain constant over the forecast period in the WEM scenario (for specific details see Annex 2).

The total renovation rate (up to 1 % by 2030) in the WAM scenario is noticeably higher for residential buildings than in the WEM scenario. Moreover, the boiler exchange rate for residential buildings is expected to increase to about 2.6 % until 2030.

In the WAM scenario the average heating demand is further reduced and expected to be 94 kWh/m² gross floor space for residential buildings in 2030. The average heating demand for commercial buildings is expected to decrease to 112 kWh/m² gross floor space by 2030.

In chapter 4 more information on measures included in the WAM scenario can be found.

3.1.4.3 Activities

Emissions were calculated on the basis of the consumption of coal, wood log and wood briquettes, wood chips, wood pellets, natural gas, liquefied petroleum gas (LPG) and heating oil, and separately for the sectors 1A4a commercial and 1A4b residential, which were modelled with INVERT/EE-Lab.

A short description of trends is presented separately for WEM and WAM.

Scenario "with existing measures"

There is a discernible trend towards renewable and alternative energies, which is partly noticeable in an increase in the use of wood pellets, solar heat and heat pumps. More specifically, the use of pellets is expected to see a nearly threefold increase in the period from 2010 to 2030. Alternative energies like solar heat and ambient energy are expected to increase by 165 % and 81 % (in residential buildings) until 2030. As regards log wood, energy consumption is expected to decline by around 34 %, due to operating stress and because it is more difficult to handle in comparison to other fuels.

On the other hand, there are driving forces for moving away from fossil fuels. In the residential sector, a 57 % reduction in the use of heating gasoil is expected until 2030, as well as a 14 % decline in natural gas consumption and a 77 % decrease in coal use.

Whereas overall energy consumption without electricity is expected to decline by 18 % in the residential sector, total energy demand without electricity will only decrease by 3 % in the commercial sector (until 2020). This leads to a less pronounced decrease in fossil fuels like heating gasoil (– 62 %) and coal (– 52 %) and natural gas (– 17 %) in commercial buildings until 2030. Wood chips are expected to rise by 148 %. With respect to the low use of pellets in 2010, an approximately 2.2 times higher consumption is assumed for 2030. Similar to the trend in the residential sector, the use of log wood is expected to decline by about 55 % until 2030. A considerable gain in energy demand is expected for solar heat (46 %) and ambient energy (682 %). Detailed data are included in Annex 1 and 2.

Scenario "with additional measures"

Due to additional measures bringing about a quicker increase in the renovation rate, the overall demand for energy in the subsectors 'residential' and 'commercial' is expected to be further reduced. Therefore, the specific changes in energy consumption until 2030 are expected to be less pronounced than in the WEM scenario.

For detailed information see Annex 1 and 2.

3.1.4.4 Sensitivity Analysis

GDP variations (see chapter 1.3. 'general sensitivity analysis') do not produce a huge effect on the emissions in this sector (see Figure 32). Therefore some additional sensitivity analyses were carried out (see Figure 33).

The INVERT/EE-Lab model provides the projected results for the energy demand calculated for stationary sources in residential and commercial buildings. To verify the stability of the modelled WEM outcome, a sensitivity analysis was conducted to examine the results obtained by changing the following parameters:

- Sens – EP 0: constant energy prices until 2030 (from 2010 onwards)
- Sens – EP 2: doubling of energy price growth rate until 2030
- Sens – FQ 0.8: 20 % reduction of funding quota
- Sens – FQ 1.2: 20 % increase of funding quota.

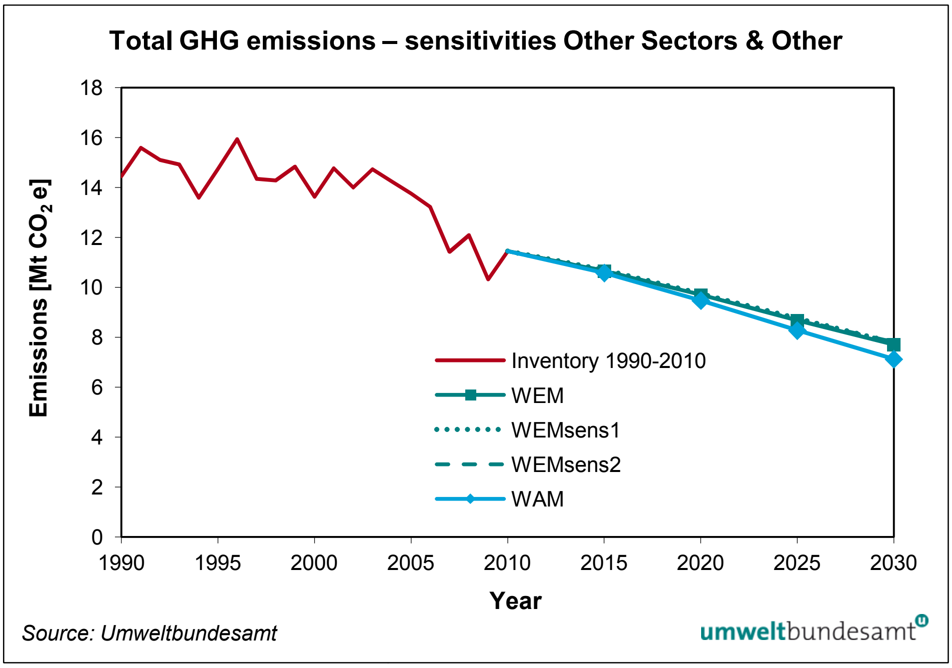


Figure 32: Trends and projections (2010–2030): total GHG emissions for the different scenarios and sensitivities, sector 'other sectors & other'

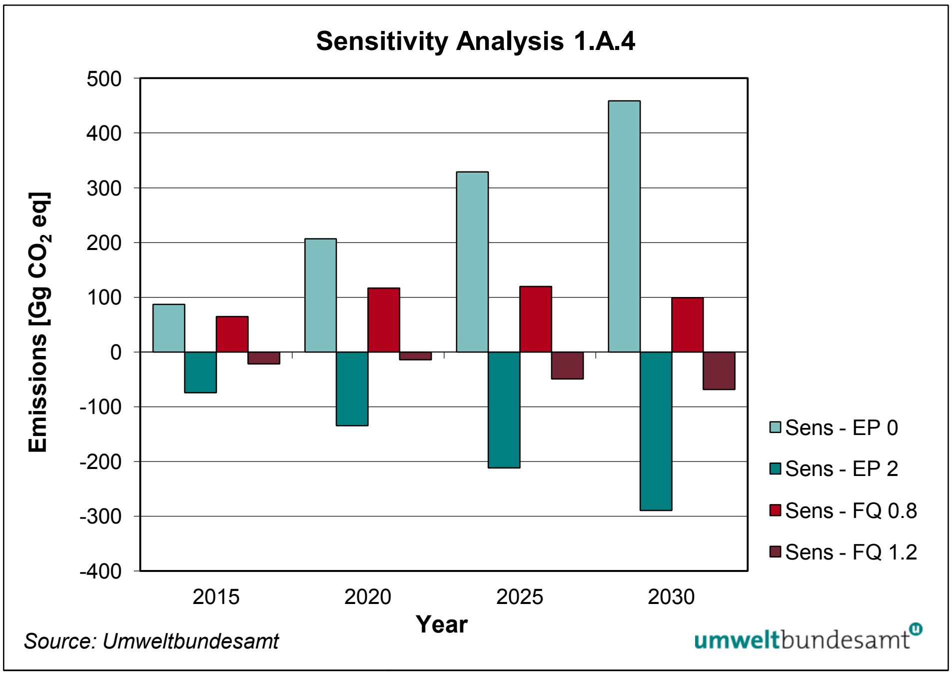


Figure 33: 1.A.4 Other Sectors (stationary sources), results of sensitivity analysis.

The variation of the amount of subsidies shows that the influence of those two parameters alone is low. The greenhouse gas emissions vary by 1.5 % at the most. A more significant impact is produced by the alteration of energy prices. Doubling the energy price growth rate will reduce GHGs by about 4 % in 2030, whereas constant energy prices will lead to a gain of around 7 % in greenhouse gas emissions.

A detailed analysis of the robustness of the used model (INVERT/EE-Lab) was described in the GHG projections 2009 (UMWELTBUNDESAMT 2009a). The main result of this analysis was that minor changes of the parameters have a minor influence on the total greenhouse gas emissions in this sector.

3.1.4.5 Uncertainty

The sensitivity analysis shows that variations of assumptions for the price of fossil energy influence emission projections significantly (see previous chapter), whereas the development of the oil price, which has multiple effects on other fuels, is the main uncertainty parameter.

Another uncertainty lies in the implementation and acceptance of measures which influence the overall heating demand, e.g. the renovation rate and the boiler exchange rate.

Economic development (gross value added), especially in the commercial sector, directly influences the energy demand. Furthermore, a bad economic situation inhibits or postpones the implementation of renovation measures, which may result in smaller reductions of greenhouse gas emissions.

Less uncertainty is associated with population growth in Austria, with permanently occupied dwellings and the number of buildings.

3.1.5 Other (1.A.5)

This category contains emissions of mobile military sources. These emissions have been included in the calculations for the transport sector (3.1.3); methodological issues and emissions can be found in this chapter. In this source category all emissions from mobile military sources are summarised, e.g. emissions from military jet fuel.

3.1.6 Fugitive Emissions from Fuels (1.B)

This sector covers fugitive CH_4 emissions from brown coal open cast mining (1.B.1), fugitive CO_2 and CH_4 emissions from combined oil and natural gas production, fugitive CH_4 emissions from oil refineries, fugitive emissions from natural gas distribution, transmission and storage (1.B.2). No specific measures are foreseen in the Austrian climate strategy to reduce emissions from this sector.

3.1.6.1 Methodology used for sectoral emission forecast

The methodology applied for calculating projected emissions is the same as the one used in the Austrian inventory (UMWELTBUNDESAMT 2012a).

CH_4 emissions from storage are calculated by multiplying the amount of stored natural gas by a national emission factor. CH_4 emissions from natural gas distribution networks are calculated by multiplying the distribution pipeline length by the implied emission factor 2010. The length of the distribution network has been extrapolated on the basis of the projected final consumption of natural gas, the historical network length and the final consumption of natural gas. The growth of the network has been extrapolated until 2030, assuming that the number of end consumers will grow continuously.

CH_4 emissions from natural gas pipelines are calculated by multiplying the pipeline length by a national emission factor.

CO_2 and CH_4 emissions from oil and natural gas production are reported by the *Association of the Austrian Petroleum* Industry for 2003 to 2010. Projected emissions are calculated by multiplying the oil or natural gas production by the averaged implied emission factors 2006–2010.

3.1.6.2 Assumptions

No policies and measures are considered in the emission forecast.

In 2006 the last brown coal open surface mine closed in Austria and it has been assumed that there will be no coal mining in the period up to 2030.

The main pipeline length is assumed to be extended by 300 km until 2020. The medium range network is assumed to grow proportionally.

The distribution network is assumed to increase proportionately to the final consumption of natural gas. Even if the projected final consumption of natural gas shows a decrease, it is assumed that the number of end consumers and therefore the distribution network will increase at the same average rate.

Forecasts for natural gas storage are based on plans for storage site extensions at from the Austrian Oil Exploration Company (RAG, Rohöl-Aufsuchungs AG). Capacities are set to be extended to 5.7 billion m³ until 2017.

3.1.6.3 Activities

Data on natural gas consumption, refinery intake and natural gas production are taken from energy projection (WIFO 2013).

Historical and forecast pipeline and distribution lengths and natural gas storage are presented in Table 14.

Table 14: Historical and forecast (2010–2030) activity data: natural gas distribution, transmission and storage.

	Pipeline length [km]	Gas network length [km]	Natural gas stored [Mm³]
1990	3 628	11 672	1 500
2000	5 966	24 099	1 665
2010	6 798	28 733	3 070
2015	7 419	31 049	4 655
2020	8 055	33 366	5 700
2025	8 055	35 683	5 700
2030	8 055	37 999	5 700

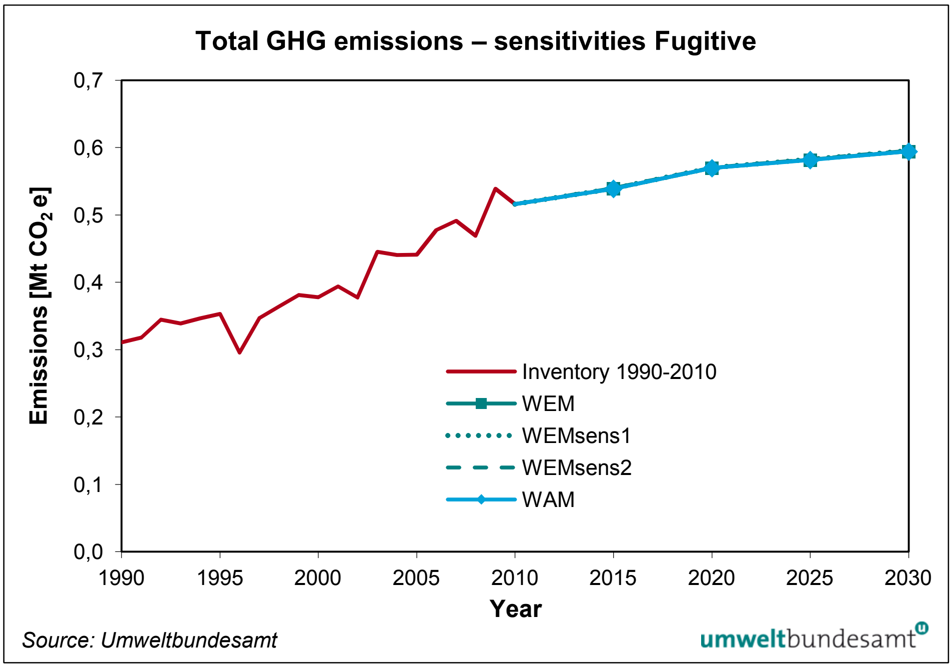
3.1.6.4 Sensitivity Analysis

For general assumptions on sensitivity analysis see chapter 1.3.

The calculated difference in total GHG emissions between the scenarios WEM and WEM sens1/2 is less than 0.2 % (2020 and 2030).

For natural gas exploration the WEM sens scenario does not show any changes.

Figure 34: Trends and projections (2010–2030): total GHG emissions for the different scenarios and sensitivities, sector 'fugitive emissions'



3.1.6.5 Uncertainty

The uncertainty in projections for fugitive emissions is closely linked to the uncertainty in the Energy Industries sector (see chapter 3.1.1.4). A higher level of uncertainty has to be expected when predicting CO_2 emissions from natural gas refineries since they depend on the composition of explored natural gas.

3.2 Industrial Processes (CRF Source Categories 2)

The main emissions in this sector come from the cement industry, the lime industry, lime stone use in iron and steel production and from the use of halocarbons and SF_6. Detailed assumptions have been made for these sources.

Figure 35 shows greenhouse gas emissions for three categories of industrial processes. The sectors 'mineral products' and 'metal production' are expected to show a minor decrease until 2014, to be followed by a stable increase after 2015. Emissions from the chemicals industry are expected to remain static, whereas emissions from F-gases are expected to follow an increasing trend until 2020, which is to be followed by a slight decrease until 2030.

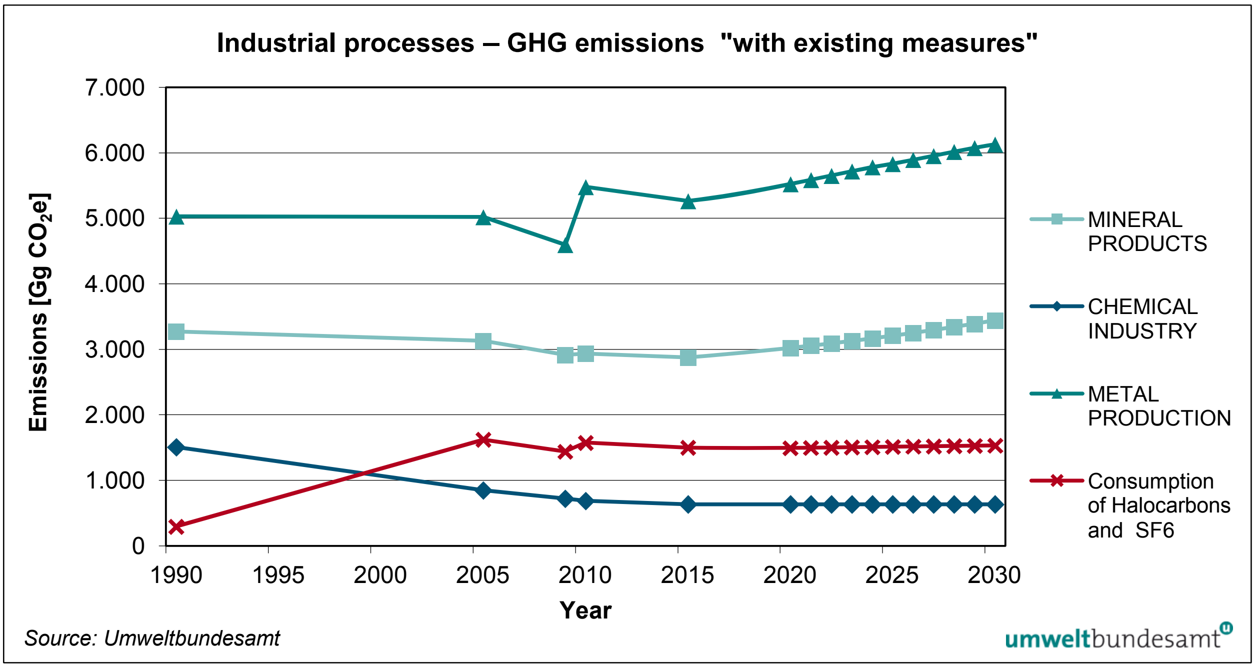


Figure 35: GHG emissions and projections (2011-2030) from industrial processes – WEM scenario.

3.2.1 Mineral Products (2.A)

3.2.1.1 Methodology used for sectoral emission forecast

The methodology used here is the same as the one used in the Austrian Inventory and the emission factors and methodology are discussed in detail in the Austrian Inventory Report (UMWELTBUNDESAMT 2012a).

3.2.1.2 Assumptions

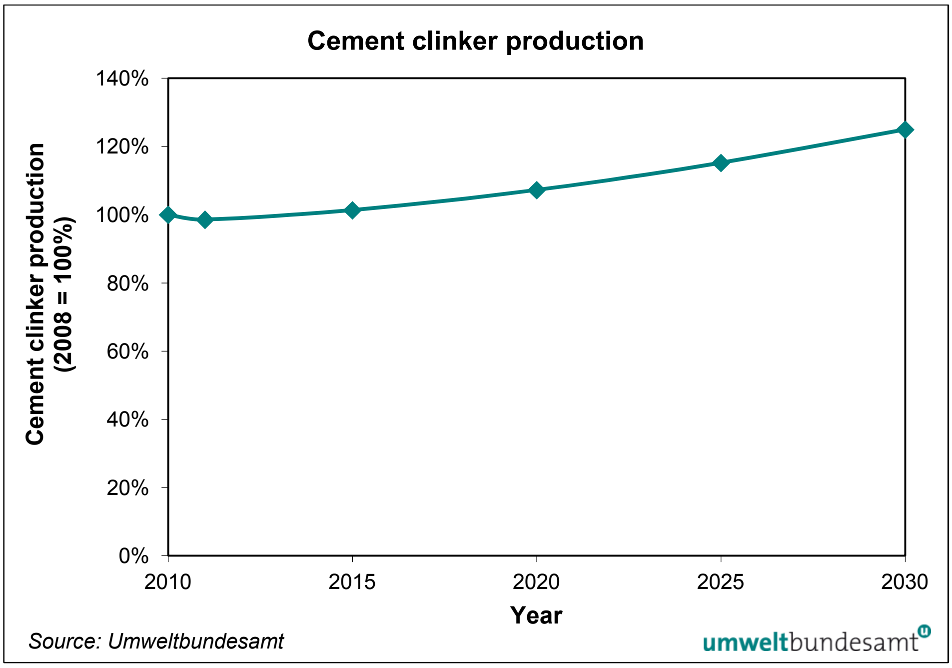
Activities for the cement industry and for other sources (i.e. lime stone use, ceramic industry and soda ash use) have been derived from the total energy input, which has been allocated to the different sources according to their historical share in the total energy inputs. In the lime industry, the demand for lime stone in the iron and steel industry has been considered.

There are no differences between the assumptions made for the scenarios “with existing measures” and “with additional measures”.

3.2.1.3 Activities

Figure 36 presents the assumptions made for the production of cement clinker.

Figure 36: Assumption for the production of cement clinker.



Assumptions made for the scenario “with additional measures” are the same as those made for the scenario “with existing measures”.

3.2.2 Chemicals Industry (2.B)

3.2.2.1 Methodology used for sectoral emission forecast

The methodology used here is the same as the one used in the Austrian Inventory and the emission factors and methodology are discussed in detail in the Austrian Inventory Report (UMWELTBUNDESAMT 2012a).

3.2.2.2 Assumptions & Activities

Activities for the production of ammonia are assumed to have remained constant. Other production activities (nitric acid) have been combined with these activities.

Assumptions made for the scenario “with additional measures” are the same as those made for the scenario “with existing measures”.

3.2.3 Metal Production (2.C)

3.2.3.1 Methodology used for sectoral emission forecast

The methodology used to calculate the emission factors is discussed in the Austrian Inventory Report (UMWELTBUNDESAMT 2012a). This source category covers CO_2 emissions from iron and steel production (2.C.1) and from ferro-alloy production (2.C.2) as well as PFC emissions in aluminium production (2.C.3) and SF_6 used in aluminium and magnesium foundries (2.C.4).

During the process of primary aluminium smelting, PFCs are formed through a phenomenon known as the anode effect. Additionally, CO_2 emissions arise from the consumption of the anode in primary aluminium production. SF_6 is used as inert gas in case of fires in light metal foundries.

3.2.3.2 Assumptions

(a) Primary aluminium production plants in Austria closed down in 1992 and will not be reopened (only secondary Al production without SF_6)

(b) The Austrian Ordinance on fluorinated gases (Federal Law Gazette II No. 447/2002) bans the use of SF_6 as a protective gas in magnesium production. Thus, for emission projections, it has been assumed that SF_6 is not used.

(c) Production of pig iron and production of crude steel from basic oxygen furnaces have both been calculated on the basis of coal and coke inputs, which were calculated on the basis of a macroeconomic model from WIFO (WIFO 2013).

Assumptions made for the scenario "with additional measures" are the same as the ones made for the scenario "with existing measures".

3.2.3.3 Activities

Figure 37 presents the assumptions made for the production of crude steel (basic oxygen furnace – BOF).

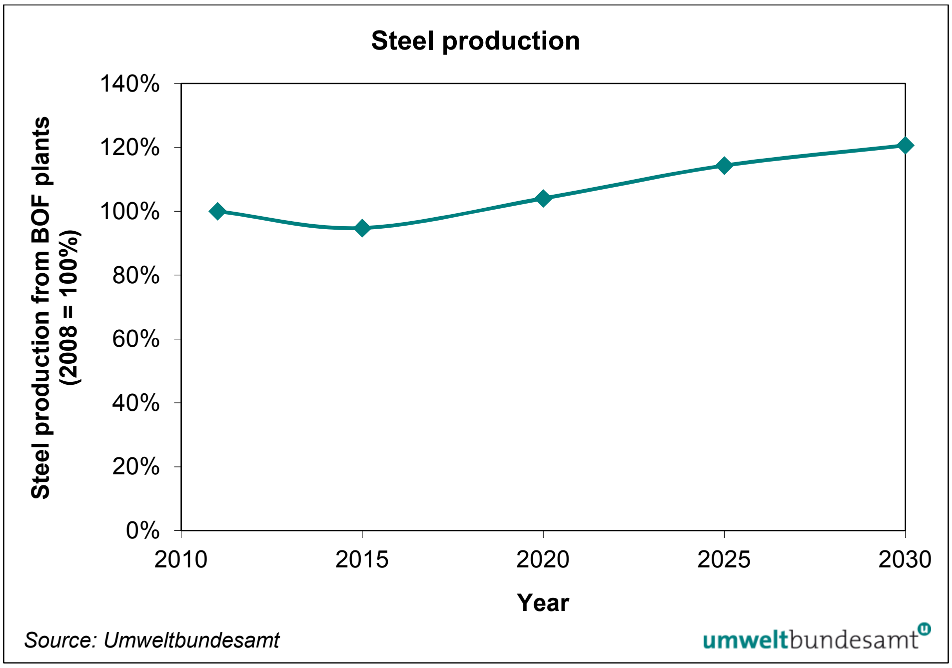


Figure 37: Assumptions for the production of steel (only basic oxygen furnace plants).

3.2.4 Halocarbons and SF_6 (2.E & 2.F)

There is no production of halocarbons and SF_6 (2.E) in Austria and the scenario assumes that there will be none during the period up to 2030.

Halocarbons and SF_6 (fluorinated gases) have been used in Austria in a wide range of applications, the most important one being the use of HFCs as refrigerants in refrigeration and air conditioning systems (2.F.1); other important sources include the use of HFCs as blowing agents in the production of foams (2.F.2), HFC, PFC and SF_6 as etching or insulation gases or in semi-conductor manufacturing (2.F.7) and SF_6 (2.F.9) in soundproof windows. Minor sources include the use of HFCs as fire extinguishing agents (2.F.3), HFCs as propellants in aerosols (2.F.4), SF_6 as insulating gas in electrical equipment (2.F.8), HFCs as solvent (2.F.5) and SF_6 in research, shoes and tyres (2.F.9).

Although fluorinated gases are not used in large amounts (around 1 kt per year), they contribute approximately 2 % of the total GHG emissions due to their high GWPs. In Austria's Third National Communication to the UNFCCC (2001) fluorinated gases were expected to reach 3 % of the total GHG emissions by 2010 and as much as 5 % by 2020 in the business-as-usual scenario. This forecast was based on the fact that HFCs are used in many applications as substitutes for ozone layer depleting "Montreal gases" and that, without reduction measures, their use would strongly increase. Because of this expected scenario, the Federal Environment Ministry started a consultation procedure in spring 2001 with the aim to produce a draft ordinance on reducing and phasing out HFCs, PFCs and SF_6 in all relevant applications on the basis of the Federal Chemicals Act. The Austrian Ordinance on fluorinated gases was adopted in 2002 (Federal Law Gazette II No. 447/2002) and amended in 2007 (Federal Law Gazette II No. 139/ 2007). On European level the European Parliament and the Council of the European Union adopted the Regulation on certain fluorinated greenhouse gases (842/2006/EC) and the Directive relating to emissions from air-conditioning systems in motor vehicles (2006/40/EC).

3.2.4.1 Methodology of the sectoral emission forecast

The emission calculation is based on results of the Austrian GHG inventory, and performed with the same level of detail. The projections until 2020 are generally based on (GSCHREY 2010).However, they have been modified so as to be fully consistent with the latest revision of IPCC Category 2.F as described in Austria's National Inventory Report (NIR) 2013 (UMWELTBUNDESAMT 2012a).

For most sub-categories, projected emissions until 2020 were calculated from 2010 emissions by taking into account growth rates for the different sectors and by including relevant technological improvements, both based on the above named study (industry inquiries and/or expert judgments). For the years 2025 and 2030, trends were extrapolated.

3.2.4.2 Assumptions

Scenario "with existing measures"

(a) The provisions of the Austrian Ordinance on bans and restrictions for HFCs, PFCs and SF_6 remain fully applicable.

(b) The European Regulation on certain fluorinated greenhouse gases (Regulation EC 842/2006) and the Directive relating to emissions from air-conditioning systems in motor vehicles (EU 2006/40/EC) are fully implemented.

The assumptions used to project emissions of fluorinated gases are as follows:

Stationary Refrigeration and Air Conditioning: The ban on the use of HFCs in stationary equipment with charges < 150 g (unless exported) is in force. Consequently, there is a ban on HFCs in domestic refrigerators and freezers as the refrigerant charge normally is approximately 100 g. The use of HFCs is allowed in refrigeration and air conditioning systems containing a refrigerant charge of 150 g–20 kg, as well as in commercial refrigeration equipment and industrial refrigeration equipment.

One can thus assume that the use of (and thus emissions from) HFCs in

- domestic refrigeration has been phased out and that only emissions from disposal occur
- production of commercial refrigeration (including some exported domestic refrigeration equipment) will remain constant
- all other sub-categories will remain unchanged, while assuming growth rates of 1-1.5 % for refrigeration and air conditioning and 3 % for heat pumps.

Mobile Air Conditioning: The MAC Directive (EU 2006/40/EG) requires the introduction of refrigerants with a GWP < 150 in new passenger cars during the period 2011–2017. Calculations are based on the assumption that industry will introduce the use of HFC-1234yf as an alternative refrigerant as the GWP of this substance is 4.

Foam Blowing: The Austrian Ordinance bans the use of fluorinated gases in this subcategory (XPS foams with a layer thickness of more than 8 cm HFCs with a GWP < 300 were still allowed until 2007). However, emissions from waste disposal occur (long lifetime of XPS/PU plates).

Fire Extinguishers: A constant emission factor of 1.5 % is assumed as well as constant annual HFC consumption of until 2030.

Aerosols: The Austrian Ordinance bans the use of fluorinated gases in this subcategory except for medical uses but exceptions are possible. The EU F-Gas Regulation bans the use of HFCs in novelty aerosols from 2009 onwards. It is thus assumed that HFC emissions from metered dose inhalers will not be affected. These are assumed to grow at a rate of 6 % per annum, given the levels over the period 2000–2008.

Semiconductors: Projections are based on emissions in 2010 and include the expected growth of the industry by 1 % p.a. to 2030. A voluntary agreement declared by the the semiconductor industry has been taken into account which commits them to the European goal for PFC emission reductions (reduce absolute PFC emissions in 2010 by 10 % below the baseline of emissions in 1995). Furthermore, the national F-Gas Ordinance requires the implementation of appropriate technical devices in order to reduce F-gas emissions from this sector to no more than 70 % of the annual consumption of these substances. This emission reduction target was reached in 2002, while the level was 80 % in 2010; it is assumed that this level will be sustained throughout the whole time period.

Electrical equipment: It is assumed that the sector will further grow as it did in the last five years.

Other uses of SF_6: The Austrian Ordinance bans the use of SF_6 in other applications (e.g. footwear and car tyres). Thus no further consumption in this subcategory has been assumed. Only emissions from sound-proof glazing are taken into account, but as the use of SF_6 for the production of sound-proof glazing has been prohibited, the only emissions expected to arise are those from SF_6 banks and disposal.

Scenario "with additional measures"

For the WAM scenario the potential of one additional measure concerning "Stationary Refrigeration and Air Conditioning" was subtracted from the WEM scenario:

Introduction of taxes for highly effective GHGs

Austrian policy name:
Einführung einer Besteuerung hochwirksamer Treibhausgase

Type: national policy

This measure aims at reducing F-gases in cooling systems. Most F-gases are used in commercial and industrial cooling systems or in stationary air conditioners. It has been found that several barriers prevent the introduction of new and less effective GHGs, e.g. a lack of market propagation of alternative refrigerants. A study found that the abatements costs amount to less than € 13 per t CO_2 equivalent.

It is expected that taxation of F-gases will lead to substitution with less effective and cheaper GHGs, such as CO_2, in new cooling systems.

The implementation of this measure is planned for 2014 through an amendment of the Austrian tax law.

Quantification/Projected GHG emissions/removals:

The estimated reduction in this scenario will be 90 Gg CO_2 equivalents in 2020 (45 Gg CO_2 equivalents in 2015).

3.2.5 Sensitivity Analysis

For general assumptions on sensitivity analysis see chapter 1.3.

The results of the two scenarios show that a higher annual GDP growth rate results in an increase of total GHG emissions from industrial processes. This effect is mainly caused by an increase in the GDP.

For halocarbons and SF_6 there are no major parameters influencing the projected emission trend. Thus, no separate sensitivity analysis has been performed in this sector.

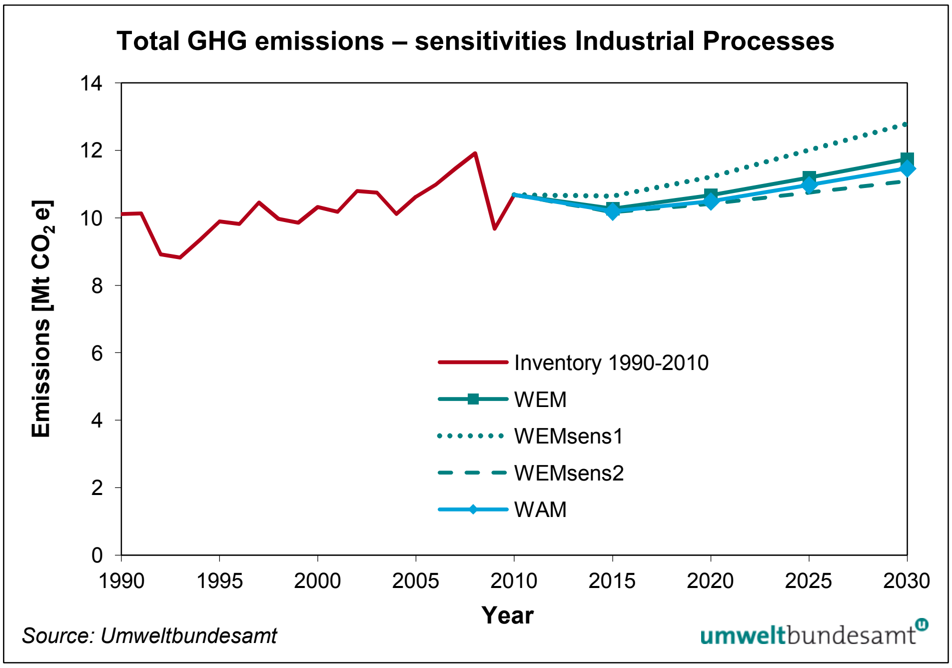


Figure 38: Trends and projections (2010–2030): total GHG emissions for the different scenarios and sensitivities, sector 'industrial processes'

3.2.6 Uncertainty

The main uncertainties are described in chapter 3.1.2.5.

For halocarbons and SF_6

Several assumptions have been made as to how the policies and measures considered in this report will influence annual consumption of fluorinated gases and leakage rates. As past experiences are not available, assumptions about changes in leakage rates have a particular influence on the overall uncertainty of forecast emissions.

3.3 Solvent and Other Product Use (CRF Source Category 3)

Solvents are chemical compounds which are used to dissolve substances such as paint, glue, ink, rubber, plastic, pesticides, or they are used for cleaning purposes (degreasing). After their application (or other procedures of solvent use) most of the solvents are released into air. The use of N_2O from other product use (anaesthesia and aerosol cans) is also considered in this sector.

3.3.1 Methodology of the sectoral emission forecast

CO_2 emissions from Solvent and Other Product Use

Emission projections for 2011-2030 are calculated using the emissions of the latest inventory year (2010; submission 2012) and by extrapolating the trends (2000–2010) from activity data in each subsector.

The basic data for the Austrian air emission inventory (OLI) 2012 (data 2010) were provided by surveys (WINDSPERGER et al. 2002a, 2002b, 2004; WINDSPERGER & SCHMID-STEJSKAL 2008) as well as import-export statistics (foreign trade balance) and production statistics provided by Statistik Austria.

In order to determine the quantity of solvents used for the various applications in Austria, a bottom-up and a top-down approach were combined. The top-down approach provided the total quantities of solvents used in Austria, whereas the amount of solvents used in different applications and the solvent emission factors were calculated on the basis of the bottom-up approach. By linking together the results from the bottom-up from the top-down approach, the quantities of solvents used per year and the solvent emissions from the different applications were determined.

The trend in quantities of solvents (substances) and solvent-containing products, i.e. the relationship between imports and exports, was extrapolated from 2000–2010 data series. The production of solvents is assumed to be a constant value (value of 2010). It is further assumed that the prospected error/deviation caused by extrapolation and using constant values is comparatively small compared to the total level of uncertainty.

The emission factors used for the forecast were the same as in 2010, as the positive impact of enforced laws and regulations in Austria is expected to be only minimal in subsequent years. Emission factors are calculated by solvent use per substance category at NACE-level-4 for all industrial sectors, and are based on information from surveys in households and industry as well as structural business statistics.

N_2O Emissions from Solvent and Other Product Use

The basic data for the Austrian air emission inventory (OLI) 2011 (data 2010) were provided by the Austrian Industrial Gases Association (Österreichischer Industriegaseverband, ÖIGV) and default emission factors according to IPCC Guidelines. The methodology recommended inthe IPCC Guidelines was applied.

For projections of N_2O emissions from “Other Product Use” the population growth rate was used.

3.3.2 Assumptions

Scenario “with existing measures”

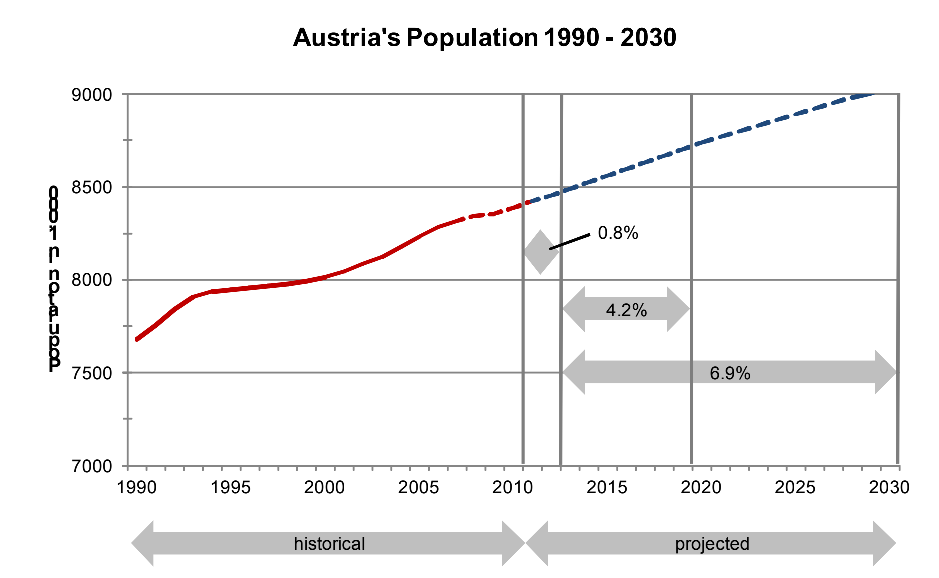
Most of the demand for solvents comes from the paint and coatings industry but also from households (cleaners, disinfectants, personal care products) and from the printing industry. Besides paint used in the sub-sector ”Construction and buildings“, most consumer products are coated with paint. Furthermore, solvents are used in many industrial cleaning applications such as cleaning for maintenance purposes and cleaning which has to be done in the manufacturing process. Solvents are also used for the cleaning of high-precision mechanical parts such as ball bearings.

For the emission forecast it is assumed that the growth rate of CO_2 emissions for the period 2010–2030 correlates with the population growth rate because of the wide range of solvent applications (as mentioned above).

Scenario "with additional measures"

No additional measures are planned in this category.

3.3.3 Activities



Source: STATISTIK AUSTRIA 2010 & ÖROK 2010

umweltbundesamt

Figure 39: Historical and forecast (2011–2030) population growth in Austria

From a demographic perspective, Austria's population growth shows a positive net migration (difference between immigrants and emigrants), with the rate of natural increase (difference between births and deaths) accounting for only a comparatively small contribution of population growth. The population increase during the period 1990–2010 was about 9 %.

Austrian population projections are based on a study prepared by STATISTIK AUSTRIA 2010 and commissioned by the Austrian Conference on Spatial Planning (ÖROK)[4]. According to this study (and based on the reference year 2008), the population growth rate is about 1 % for the period 2010–2012, about 7 % for the period 2010–2030 and about 4 % for the period 2010–2020.

3.3.4 Sensitivity Analysis

For the projections of CO_2 and N_2O emissions from the sector "Solvent and Other Product Use" no sensitivity analysis has been performed.

3.3.5 Uncertainty

A simple method has been used for projecting CO_2 emissions in the sector "Solvent and Other Product Use". One therefore has to expect that the level of uncertainty will be considerably high.

---

[4] Österreichische Raumordnungskonferenz (ÖROK)

3.4 Agriculture (CRF Source Category 4)

3.4.1 Sector Overview

In this sector, the focus is on sources of methane (CH_4) and nitrous oxide (N_2O) emissions. This chapter gives an overview of the European and Austrian farm policy, provides information on basic economic and technological assumptions and describes the methodologies used for the sectoral forecast 2015–2030.

Common Agricultural Policy

In 2008 the EU agriculture ministers reached a political agreement on a ‘Health Check’ of the Common Agricultural Policy (EC 2011). Among a considerable range of measures, the most important change is the abolition of the EU milk quota system, due to be implemented in 2015. Additionally, the EU programme for rural development is of major importance for the Austrian agricultural sector, because transfers from this source outweigh intended transfer reductions from the “first pillar of the CAP“, e.g. commodity-related instruments.

International food markets

European farm commodity markets are interlinked with international food markets in many ways. Policy efforts to bring domestic market prices closer to equilibrium prices lead to a narrower gap between EU domestic prices and world market prices. Domestic supply – apart from heavily regulated products like milk – is therefore increasingly determined by the fluctuation of world market prices.
Global food demand (driven by an improved macro-economic environment, larger populations, urbanisation and changes in dietary patterns) and technological progresses are be expected to be the major driving forces of agricultural production in the next decade.

National energy policies

The Austrian energy policy is committed to the substitution of non-renewable energy sources by renewable ones. Raw materials produced by agriculture constitute one of the main alternative energy sources. Two major legal documents are of interest in this context: the Austrian law for the provision of green electricity (Ökostromgesetz) and the European Biofuels Directive, recently repealed by the EU Directive on Renewable Energy (Directive 2009/28/EC). The measures specified in both pieces of legislation are designed to have an impact on agricultural production via a price system.

3.4.2 Methodology used for the sectoral forecast

Emissions are calculated on the basis of the methodology used for the Austrian Greenhouse Gas Inventory. A comprehensive description can be found in the Austrian National Inventory Report 2012 (UMWELTBUNDESAMT 2012a).

Activity data

Projected activity data of the WEM scenario are a result of calculations carried out with the Positive Agricultural Sector Model Austria (PASMA), which was developed by the Austrian Institute of Economic Research (WIFO) (SINABELL et al.

2011a). The model maximises sectoral farm welfare and is calibrated on the basis of historical crops, forestry, livestock, and farm tourism activities, using the method of Positive Mathematical Programming (PMP). This method assumes a profit-maximising equilibrium (e.g. marginal revenue equals marginal cost) in the base run and derives coefficients of a non-linear objective function on the basis of observed levels of production activities.

In the WAM scenario several policy measures have been considered endogenously, e.g. increased efficiency of mineral fertilizer application, specific treatment options of manure storage and application etc.

Economic assumptions

Several assumptions (basically for input prices) were made to run the model outlined above. Prices were derived from OECD-FAO outlooks on agricultural markets (OECD-FAO 2010). Other exogenous economic assumptions for Austria (like the GDP or population size) are not necessarily essential for the model used in this analysis because the partial equilibrium model of the agricultural sector mainly depends on prices of outputs and inputs. Since Austrian agriculture is an integrated part of the common market, carry-over effects from European demand patterns are noticeable and determine the results.

Technological progress

Assumptions on technical progress in plant and animal production are based on (SINABELL & SCHMID 2005). By derogation from this source, estimates of increasing milk yields per dairy cow have been somewhat reduced according to the estimates discussed by an expert panel in January 2011.

Milk output at sector level is evaluated as the sum of regional milk yields multiplied by the number of dairy cows in each region minus a 3 % loss. Average milk production at sector level is the result of three processes:

a. productivity gains per cow in each region,
b. regional shift of the cow population and
c. the relation of non-organic cows to organic cows (with 5 % lower yields).

The use of mineral fertilisers is calculated in two ways: First the consumption of urea is given, exogenously based on a linear trend of past observations. Then the level of all other nutrient inputs is determined by a model based on nutrient balances.

Forecasts for mineral fertiliser reflect the effects of changes in land use (e.g. more legumes (pulses) where organic farming is expanding) and in the livestock herd (manure). With technical progress in crop production less fertiliser will be needed eventually to produce the same amount of output.

The differences between the two scenarios can be summarised as follows:

Scenario "with existing measures" (WEM)

The WEM scenario includes policy measures related to the implementation of the CAP reform 2008 in Austria. Information on these measures in detail is presented in chapter 4.

Main results:

As a consequence of the abolition of the milk quota, the quantity of milk output and beef will increase in Austria. Efficiency gains from higher milk yields per cow are not high enough to stabilise the cattle herd at the levels of 2010. On the contrary, the milk price is expected to be high enough to support an increase in the number of cows. As a consequence, slightly more calves will be born and more bulls fattened. The results are of course sensitive to assumptions about price relationships. If bull production in the neighbouring countries becomes more competitive it is likely that more calves will be exported from Austria. This would limit the production possibilities for bull fattening in Austria. Currently there are no indications that this will be the case.

Scenario "with additional measures" (WAM)

In the WAM scenario additional policy measures (as discussed by Austrian stakeholders) were implemented.

The animal numbers assumed for this scenario are the same as in the WEM scenario except for cows: due to the implementation of the policy measure "decoupling of suckling cow premium" the animal numbers of suckling cows were reduced by 10 % (2020) and half of them were accounted for as dairy cows. The amount of mineral fertiliser application was reduced, assuming a more efficient use. Forced anaerobic treatment of manure in biogas plants helps to reduce methane emissions from manure management.

A detailed description of policy measures is presented in chapter 4.

Emission calculation

Emissions are calculated on the basis of the methodology used for the Austrian Greenhouse Gas Inventory. A comprehensive description of uncertainties can be found in the Austrian National Inventory Report 2012 (UMWELTBUNDESAMT 2012a).

3.4.2.1 Enteric Fermentation (4.A)

Feed intake parameters and the methane conversion rate are the same as the ones used in the national greenhouse gas inventory (UMWELTBUNDESAMT 2012a). GE intake of dairy cows was calculated on the basis of projected milk yields (see Annex 2).

Projected activity data of the WEM scenario are a result of calculations carried out with the Positive Agricultural Sector Model Austria (PASMA), developed by the Austrian Institute of Economic Research (WIFO) (SINABELL et al. 2011a). The model maximises sectoral farm welfare and is calibrated on the basis of historical crops, forestry, livestock, and farm tourism activities, using the method of Positive Mathematical Programming (PMP). This method assumes a profit-maximizing equilibrium (e.g. marginal revenue equals marginal cost) in the base run and derives coefficients of a non-linear objective function on the basis of observed levels of production activities.

The animal numbers assumed for the WAM scenario correspond to the WEM scenario except for cows: due to the implementation of the policy measure "de-coupling of suckling cow premium" in the WAM scenario, the animal numbers of suckling cows are reduced by 10 % (2020) and half of them are accounted for as dairy cows.

Data on livestock projections are presented in Annex 2.

3.4.2.2 Manure Management (4.B)

In this source category CH_4 and N_2O emissions occurring during the storage of livestock manure are considered.

The feed intake parameters are the same as those applied in the national greenhouse gas inventory (UMWELTBUNDESAMT 2012a). Austria-specific VS and N excretion values of dairy cows have been calculated on the basis of projected milk yields (see Annex 2).

In the scenario "with additional measures", special attention is given to the anaerobic digestion of animal manures: it is assumed that 20 % of livestock manure will be anaerobically treated from 2020 onwards. Additionally, assumptions about lower N excretion rates due to phase feeding for pigs, an increased use of slurry tank covers and an increased share of grazing cows are considered (see chapter 4).

3.4.2.3 Rice Cultivation (4.C)

There is no rice cultivation in Austria and there will be none in the period up to 2030.

3.4.2.4 Agricultural Soils (4.D)

In this source category emissions of N_2O resulting from anthropogenic N inputs to soils are included.

Emissions are calculated on the basis of the methodology used for the Austrian Greenhouse Gas Inventory (UMWELTBUNDESAMT 2012a).

Mineral fertiliser application data of the WEM scenario have been taken from (SINABELL et al. 2011a). In the WAM scenario the amount of mineral fertiliser application was reduced, assuming a more efficient use of fertilisers (for measures in detail see chapter 4).

3.4.2.5 Prescribed Burning of Savannas (4.E)

There is no prescribed burning of savannas in Austria and the scenario assumes that there will be none until 2030.

3.4.2.6 Field Burning of Agricultural Residues (4.F)

A federal law restricts the burning of agricultural residues on open fields in Austria. It is only permitted occasionally and on a very small scale.

The contribution of emissions from the category *Field Burning of Agricultural Waste* to the total emissions is very low. Thus a simplified approach has been applied: the 2010 value has been used as activity data for all projected years.

3.4.3 Sensitivity Analysis

In the sensitivity analysis the assumption is made that the programme of rural development will be abolished. The results are in line with findings of (SINABELL et al. 2011b):

- mountain farming will decline and relatively more land will be abandoned and afforested;
- production will become more intensive because incentives for low input farming are no longer available;
- outputs will decline generally because there are no longer incentives to maintain production in less favoured regions;
- organic farming will be a profitable production sector – although on a lower scale;
- production will concentrate on regions with advantageous conditions.

More specifically, the results of the sensitivity analysis (as compared to the WEM scenario) are as follows:

Table 15: Sensitivity analysis, sector 'agriculture'.

indicator	**change as compared to WEM**	
	year	**%**
LU cattle conventional	2010	0.2
	2015	1.1
	2020	1.6
	2030	0.1
LU cattle organic	2010	– 5.3
	2015	– 11.2
	2020	– 16.0
	2030	– 18.1
mineral fertiliser	2010	– 10.4
	2015	– 13.8
	2020	– 16.1
	2030	– 15.9

3.4.4 Uncertainty

PASMA model results

- The model results indicate that the declining trend of the numbers of cows will come to an end and that the number of dairy cows will stabilise at a higher level. There is considerable evidence that milk production will increase after the abolition of the milk quota in 2015. However, there is some uncertainty if this increase necessarily involves an increase in the number of cows because the milk currently used for feeding calves could be used for dairy products under the quota regime.
- The decline of non-cattle livestock production is mainly due to the fact that higher feed costs are not compensated by productivity gains. The relative prices therefore indicate that meat production in general will be limited by higher feed costs.
- Given that the Austrian milk yield per cow is relatively low, one could plausibly argue that more efficient milk producers increase the milk yield faster than assumed in our scenarios. This could result in a declining animal number.
- The model analysis builds on assumptions on given prices for outputs and inputs. The output prices are derived from OECD-FAO 2010 while the input prices are consistent with WIFO 2010. Compared to OECD-FAO 2010 the input prices used in this analysis are slightly higher and therefore production in Austria is less competitive than in a scenario with lower energy costs. This partly explains the decline in crop production.

3.5 Land Use, Land-Use Change and Forestry (CRF Source Category 5)

This chapter includes information on and descriptions of the methods of greenhouse gas projections as well as references to activity data projections concerning 'forest land remaining forest land' (CRF 5.A.1), which is the most important sub-category of CRF Source Category 5.

No forecast is available for any LULUCF sub-category other than 'forest land remaining forest land' (5.A.1) in CRF category 5 – therefore the data reported for the future years are historical data.

3.5.1 Forest land remaining forest land (5.A.1)

3.5.1.1 Methodology for the sectoral forecast

PROGNAUS (PROGNosis for AUStria) (LEDERMANN 2006) is a yield and silvicultural science-based model developed and first applied in 1995. Since then, it has been updated continuously. PROGNAUS consists of several sub-models, including a basal area increment model (MONSERUD & STERBA 1996), a height increment model (NACHTMANN 2006), a tree recruitment model (LEDERMANN 2002) and a model describing tree mortality (MONSERUD & STERBA 1999). The performance of PROGNAUS was tested in several studies (e.g. STERBA & MONSERUD 1997, STERBA et al. 2002). Furthermore, PROGNAUS was applied to evaluate different forest management regimes (LEDERMANN & STERBA 2006).

Conversion of the modelled future stem wood growth and increment in m^3 o. b. to t C of the total trees was done in accordance with the estimates of historical values.

The change in C stocks of dead wood and litter/soil organic matter pools up to 2020 was kept constant at the latest available historical values.

3.5.1.2 Assumptions

Special importance was attached to the silvicultural relevance of tending activities through intensive preliminary cuttings and thinning. Final cutting was assumed to have happened those stands whose growth in economic value was negative. In addition to silvicultural aspects, economic and ecological facts were considered in the calculations. The harvesting costs were estimated via different harvesting models and compared to the revenues calculated from diverse price scenarios[5].

Harvests on forest inventory plots with a positive profit margin (harvest cost free) were upscaled to the attainable harvesting potential. Ecological aspects were considered in the harvesting potential insofar as the selection of the harvesting method and the parts of the trees to be harvested were determined. The results were converted into cubic metres of stem wood over bark (m^3 o.b.) on the basis of timber assortment classifications, and finally translated into Gg C of the whole tree biomass – separately for the three years 2010, 2015 and 2020.

Due to the type of projected harvesting activities, it is assumed that an increase in harvesting intensity due to higher prices will not lead to changes in increment, which (according to the latest NFIs) has remained quite stable during the last decades. An increase in prices leads mainly to additional preliminary cuttings of smaller dimensions in stands.

Table 16: Projection parameters for LULUCF (silviculture scenario).

	Price scenarios	2010	2015	2020
data on harvest:				
million m^3 o.b.	71 €/m³	26.7	27.8	29.0
	81 €/m³	28.0	29.1	30.4
	100 €/m³	29.0	30.2	31.5
	162 €/m³	30.5	31.7	33.1
Gg CO_2e	71 €/m³	32 300	33 400	34 800
	81 €/m³	33 700	34 800	36 700
	100 €/m³	34 800	36 300	37 800
	162 €/m³	36 700	38 100	40 000
data on increment:				
million m^3 o.b.	71–162 €	29.8	29.8	29.8
Gg CO_2e	71–162 €	– 37 700	– 37 700	– 37 700
increment minus harvest:				
Gg CO_2e	71 €/m³	– 5 400	– 4 300	– 2 900
	81 €/m³	– 4 000	– 2 900	– 1 000
	100 €/m³	– 2 900	– 1 400	100
	162 €/m³	– 1 000	400	2 300

[5] 71 €: average biomass price 2004–2006; 81 €: biomass price at the end of 2006; 100 €: assumption of a moderate increase in biomass prices compared to 2004–2006; 162 €: assumption that biomass price will double (same development as oil price over period 1985–2005).

3.5.1.3 Activities

According to the national inventory report, systematically measured statistics – such as the national forest inventory (NFI; BFW 2011) – are considered to have the highest reliability when it comes to reporting on forest area and land use changes from and to forests, as well as stock, increment and drain (felling) (NIR; UMWELTBUNDESAMT 2012a).

The results of the NFI (2000/02) form the basis for modelling Austrian forest carbon stock changes in the years 2015 and 2020.

Projections are based on the result of a "wood and biomass supply study" which was conducted by the Federal Research Centre for Forests in the years 2007 and 2008, based on NFI data as referred to above. This study includes projections for 2020, using the growth and harvest models implemented in a simulation program known as PROGNAUS. The results of this study were presented in a press release on 22 January 2009 (http://www.lebensministerium.at/article/articleview/73127/1/26609/).

3.5.1.4 Sensitivity Analysis

For the projections for the source category 5.A.1 no sensitivity analysis has been performed.

3.5.1.5 Uncertainty

No specific uncertainty analysis has been carried out for these forecasts.

However, as can be seen from Table 20, possible variations of wood prices will have a significant impact on future harvest rates and thus on emissions/removals in sector 5.A.1.

In addition, the following aspects of emission factors contribute significantly to the uncertainty associated with sector 5.A.1 'biomass estimates': conversion factors for converting stem wood to biomass as well as equations for estimating branch and root biomass. The uncertainty over historical figures for net biomass removals listed in 5.A.1, as reported under UNFCCC (for years covered by NFIs), is of the order of ± 40 %. The uncertainty related to the reported historical forest soil C stock changes is significantly higher.

3.6 Waste (CRF Source Category 6)

This chapter includes information on the methods used for greenhouse gas projections, as well as assumptions on activity data projections in view of anticipated waste management and waste treatment activities. The projections described in this chapter include projections from Solid Waste Disposal on Land, Wastewater Handling, Waste Incineration and Other Waste (Compost Production).

All measures taken into account in the projections pertain to the scenario "with existing measures". No additional measures are planned. The scenario "with additional measures" is thus the same as the scenario "with existing measures".

Waste management and treatment activities constitute sources of methane (CH_4), carbon dioxide (CO_2) and nitrous oxide (N_2O) emissions.

3.6.1 Solid Waste Disposal on Land (6.A)

3.6.1.1 Methodology used for the sectoral emission forecast

For the calculation of methane (CH_4) arising from the solid waste disposal on land the IPCC (Intergovernmental Panel on Climate Change) Tier 2 (First Order Decay) method, taking into account also historical data on disposal, has been applied. This method assumes that the degradable organic component (DOC) in waste decays slowly throughout a few decades (IPCC 2006). The Tier 2 method is recommended for the calculation of landfill emissions on the national level; it consists of two equations: one of them calculates the amount of methane accumulated up to the year of the inventory. The second equation calculates the methane emitted after subtracting the recovered and the oxidised methane amounts.

Equation (1):
CH_4 generated in year t [Gg/yr] = $\sum_x [(A \cdot k \cdot MSW(x) \cdot L_0(x)) \cdot e^{-k(t-x)}]$

x = starting year of data records until t
t .... year of inventory
x .... years for which input data should be added
A............... $(1 – e^{-k})/k$; $(0<A<1)$ normalisation factor which corrects the summation
k .... methane generation rate constant $[a^{-1}]$; k = ln2/t•1/2
t•1/2........... half-life
MSW(x) ..... municipal solid waste (MSW) deposited in year x [Gg/a]
L_0 (x).......... methane generation potential = [MCF(x) • DOC(x) • DOC_F • F • 16/12 [Gg CH_4/Gg MSW_{wet}]
MCF(x) ...... methane correction factor in year x (fraction) [6]
DOC(x) ...... degradable organic carbon (DOC) in year x (fraction) [Gg C/Gg MSW]
DOC_F......... fraction of DOC dissimilated
F............... fraction by volume of CH_4 in landfill gas
16/12 .... conversion from C to CH_4

Equation (2):
CH_4 emitted in year t [Gg/yr] = (CH_4 generated in year t – R(t)) • (1 – OX)

R(t) .... CH_4 recovered in inventory year t [Gg/yr]
OX............ oxidation factor (fraction)

The formula is applied to different waste types separately. The Austrian Inventory distinguishes between two main categories 'residual waste' and 'non residual waste'. 'Residual waste' corresponds to mixed waste from households and similar establishments covered by the municipal waste collecting system. It is directly deposited in landfills. 'Non residual waste' is other waste containing biodegradable compounds, which includes waste from industrial sources and is divided into different waste types (wood, paper, textiles, residues etc.). 'Non residual waste' especially covers residues from the sorting and pre-treatment of waste (accounting for 99 % of the total 'non residual waste' amount). A detailed description can be found in the National Inventory Report.

Historical activity data are based on a country-specific source. The parameters and values used in the emissions calculation are described in UMWELTBUNDESAMT 2012a).

[6] MCF = 1 accounts for the fact that all landfills in Austria are managed ones.

3.6.1.2 Assumptions

In the forecast of future waste generation and disposal amounts predictable future trends in waste management (resulting from the implementation of legal provisions, especially those foreseen in the Landfill Ordinance, at national level) are considered. Specific assumptions are based on information provided by relevant national experts. They are in line with the assumptions made for the CRF Sector 6.D.

Activity data: see 3.6.1.3

Parameters: The parameters/values used for emission projections are the same as those used in the (historical) Austrian greenhouse gas inventory (see UMWELTBUNDESAMT 2012a).

3.6.1.3 Activities

Since 2009 waste has not been allowed on landfills without pre-treatment (in accordance with the Landfill Ordinance), so 'residual waste' (defined as waste from households which is directly deposited in landfills) has no longer been deposited. Therefore, the main fraction relevant for current and future **waste disposal** consists of residues from the pre-treatment of waste (covered by the main category 'non residual waste').

1. landfill fractions (residues/stabilised waste) from mechanical biological treatment → this fraction is expected to decrease steadily, in conformity with the assumption made for sector 6D (Other waste treatment).
2. the landfilled fraction (sorting residues) from the mechanical treatment of waste → this fraction is assumed to be constant over the whole time series.

As the First Order Decay Method is applied for emissions projections, data on historical waste disposal are also taken into account in the calculation (covering both 'residual' and 'non residual' waste).

Year	Residual Waste [Gg/a]	Non-residual Waste [Gg/a]	Total Waste [Gg/a]
1990	1 995.7	648.7	2 644.4
2005	241.7	389.7	631.4
2008	129.3	319.9	449.3
2010	0	244.8	244.8
2015	0	202.4	202.4
2020	0	167.6	167.6
2025	0	144.3	144.3
2030	0	121.1	121.1

Table 17: Historical (1990-2010) and forecast (2015–2030) activity data for landfilled "Residual waste" and "Non-residual Waste".

3.6.1.4 Sensitivity Analysis

No sensitivity analysis has been performed in this sector.

3.6.1.5 Uncertainty

According to the Austrian National Inventory Report 2012 (UMWELTBUNDESAMT 2012a), the uncertainty in emission factors for 6 A Solid Waste Disposal is 25 % and 12 % for activity data, respectively.

Although emission calculations for the projections are based on the same methodology as in the Inventory Report, the uncertainty associated with the projected activity data must be a good deal higher, while the uncertainty in emission factors might be of a similar range.

3.6.2 Wastewater Handling (6.B)

3.6.2.1 Methodology used for the sectoral emission forecast

The same methods as described in the National Inventory Report 2012 (UMWELTBUNDESAMT 2012a) were used for estimating future N_2O and CH_4 emissions from wastewater treatment.

N_2O emissions arising from wastewater treatment plants, i.e. wastewater originating from households and commercial sources connected to a sewage system, are calculated using a country-specific method based on IPCC 2006 GL. The calculation of N_2O emissions resulting from households not connected to the public sewage system follows the Revised 1996 IPCC GL. N_2O emissions from urban waste water in Austria are calculated on the basis of the overall nitrogen load in waste water. For waste water treated in sewage treatment plants, the amount of nitrogen that is denitrified is also taken into account. For the calculation of N_2O emissions from the treatment of industrial wastewater a simplified assumption is made.

CH_4 emissions from domestic wastewater disposal in cesspools and septic tanks are calculated pursuant to the IPCC method, using mainly IPCC default values.

A detailed description of the methodologies applied can be found in the National Inventory Report (UMWELTBUNDESAMT 2012a).

3.6.2.2 Assumptions

To estimate future N_2O emissions the following assumptions were made:

- The annual protein intake remains constant at the current level (107 g/capita/day).
- The denitrification rate will remain stable at the current level (2010: (80 %) as no further improvements in the cleaning capacity are expected (the corresponding legal provisions anticipate a denitrification rate of 70 %[7]).
- The level of connection to sewage treatment plants will continue to increase slightly. In 2010 92.8 % of the population was connected to the municipal sewage system. It is assumed that in the year 2015 about 94.2 % and from 2020 onwards 95.0 % of the waste water will be treated in sewage plants. Given the settlement structure in Austria, 100 % cannot be achieved.

[7] Federal Law Gazette 186/1996

CH_4 emissions are calculated by taking into account the number of inhabitants who use septic tanks and cesspools (where anaerobic conditions exist) to handle their waste water.

Table 18: Historical (1990-2010) and forecast (2011–2030) indicators of waste water management in Austria.

	1990	2005	2008	2010	2015	2020	2025	2030
Inhabitants [1 000]	7 678	8 225	8 337	8 388	8 555	8 733	8 889	9 034
Annual protein intake per capita [g/day/capita]	103	107	107	107	107	107	107	107
Wastewater treatment [%]	59	89	93	93	94	95	95	95
Denitrification [%]	10	73	79	80	80	80	80	80

3.6.2.3 Activities

Data on future developments in population growth have been taken from (ÖROK 2010) and are also reported in Annex 1.

3.6.2.4 Sensitivity Analysis

No sensitivity analysis has been performed in this sector.

3.6.3 Waste Incineration (6.C)

In this category, CO_2 emissions from the incineration of waste oil and clinical waste are included, as well as CO_2, CH_4 and N_2O emissions from municipal waste incineration without energy recovery. All CO_2 emissions from Category 6 Waste are caused by waste incineration.

In Austria, waste oil is incinerated in specially designed so-called “USK facilities”. Emissions from waste oil combustion for energy recovery (e.g. in the cement industry) are reported under the CRF sector 1.A – Fuel Combustion. In general, municipal, industrial and hazardous wastes are combusted for energy recovery in district heating plants or on industrial sites. Emissions are therefore reported in the CRF sector 1.A – Fuel Combustion. In Austria, there was only one waste incineration plant without energy recovery which had been in operation until 1991, with a capacity of 22 000 tonnes of municipal waste per year. This plant was rebuilt as a district heating plant which went in operation in 1996. Consequently, since the re-opening of this plant (from 1996 onwards), emissions have been reported in the CRF sector 1 A – Fuel Combustion.

3.6.3.1 Methodology used for the sectoral emission forecast

For this calculation the simple CORINAIR methodology has been applied: the quantity of waste oil is multiplied by an emission factor for CO_2, CH_4 and N_2O. Emission factors are consistent with the emission factors used in the Austrian Inventory (UMWELTBUNDESAMT 2012a).

Table 19: Emission factors of IPCC Category 6 C – Waste Incineration.

Waste Type	CO_2 [kg/Mg]	CH_4 [g/Mg]	N_2O [g/Mg]
Clinical Waste	836	100	12
Waste Oil	3 224	2	24

3.6.3.2 Assumptions

It is assumed that the incineration of waste oil and clinical waste without energy recovery has been constant from 2010 onwards. All existing and planned waste incineration plants include energy recovery and emissions are therefore reported in the CRF sector 1.A – Fuel Combustion.

3.6.3.3 Activities

Since 2005, the Austrian Waste Incineration Ordinance has been setting strict limits for air pollution for all types of waste incineration, without setting quantity limits. All operators which have a permit for the incineration of a specific type of waste need to be registered in a federal database. The numbers of waste incineration plants which are not considered in sector 1.A are as follows:

- Waste oil: 8 plants
- Clinical waste: 1 plant

Constant values (500 Mg of clinical waste and 500 Mg of waste oil) are predicted for incineration activities without energy recovery until 2030.

3.6.3.4 Sensitivity Analysis

No sensitivity analysis has been performed in this sector.

3.6.4 Other Waste Treatment (6.D)

3.6.4.1 Methodology used for the sectoral emission forecast

Sector 6.D. includes emissions from composted biogenic waste and waste treated in mechanical-biological treatment (MBT) plants. Composted biogenic waste comprises bio-waste (biogenic waste collected from households) and green waste (municipal garden and park waste) treated in composting plants (centralised composting), as well as composted bio-waste produced ‘at source’, (home composting).

CH_4 and N_2O emissions are calculated by multiplying the quantity of waste by the corresponding emission factor (see Table 20).

Table 20: Emission factors for compost production.

[kg/t humid waste]	CH_4	N_2O
Biogenic waste composted	0.75	0.1
Mechanical-biologically treated waste	0.6	0.1

3.6.4.2 Assumptions

It is assumed that collected bio-waste, as well as home-composted amounts of waste, will increase in accordance with expected population growth rates over the forecast period. Amounts of municipal garden and park waste are expected to remain constant.

As regards the amount of waste undergoing mechanical-biological treatment (MBT) in Austria, it is assumed that activities will decline due to closures and reconstructions of MBT plants (triggered by a planned MBT Ordinance). Activity data projections are based on a detailed analysis of existing MBT plants and expected plant-specific developments and trends in input amounts, assuming that the planned MBT Ordinance will enter into force in 2014 (with a transition period until the end of 2019). Projections for input amounts have been made for the years 2015, 2020, 2025 and 2030 (see Table 21); the values in between have been interpolated.

It is assumed that some plants will close down in in response to stricter regulations on waste air purification. At the same, other treatment options such as thermal treatment and dry stabilisation methods are expected to grow in importance.

The emission factors used for the projections are in accordance with the Austrian National Inventory Report (UMWELTBUNDESAMT 2012a; see also Table 21).

3.6.4.3 Activities

On the basis of the assumptions made, the following activity data forecast has been performed:

Table 21: Historical (1990-2010) and forecast (2011– 2030) activity data for compost production.

[Gg]	1990	2005	2008	2010	2015	2020	2025	2030
Biowaste and green waste	418	2 612	2 851	2 942	2 987	3 035	3 077	3 117
Mechanical biological treatment	345	623	619	555	451	361	301	241

3.6.4.4 Sensitivity Analysis

No sensitivity analysis has been performed in this sector.

4 POLICIES & MEASURES

The content of the chapter policies and measures (PaMs) and the appending Monitoring Mechanism Reporting Template is not only in compliance with the implementing provisions adopted under 280/2004/EC (Commission Decision 2005/166/EC) but also with the UNFCCC "Guidelines for the preparation of national communications by Parties" (FCCC/CP/1999/7).

4.1 The framework for Austria's climate policy

In order to provide information on the legal and institutional steps to prepare the implementation of international commitments, the following paragraphs list significant milestones of the Austrian climate policy[8].

- Two committees were set up by the Federal Minister of Environment, i.e. "The National CO_2 Commission" in 1990 and "The Interministerial Committee to Coordinate Measures to Protect the Global Climate (IMC)" in 1991. The National CO_2 Commission was later reorganised and became the Austrian Council on Climate Change (ACCC) (Österreichischer Klimabeirat). The ACCC is a scientific platform whereas the IMC pursues administrative activities.
- Energy Reports were published in 1990, 1993, 1996 and 2003, outlining the national strategy to achieve the so-called Toronto target.
- After the negotiation of the Kyoto-Protocol under the UNFCCC the "Kyoto Forum" was established within the Federal Ministry of Agriculture, Forestry, Environment and Water Management in 1999.
- In 2002 the "Austrian Climate Strategy 2010" was released as a national climate change programme in order to reach the Kyoto target (BMLFUW 2002).
- The Austrian Climate Strategy 2010 was reviewed and the revised Climate Strategy II was published in 2007 (BMLFUW 2007).
- The Minister for the Environment and the Minister for Economic Affairs initiated a stakeholder process to establish a new Energy Strategy for Austria in response to the legally binding European commitments on renewable energy and climate change by 2020. The Energy Strategy was adopted in 2010.
- Klimaschutzgesetz-KSG (Federal Law Gazette I No. 106/2011) (Climate Change Act, CCA).

  In November 2011 the Austrian Climate Protection Act for the compliance with the GHG emissions targets and the promotion of effective measures for climate change mitigation was implemented. It stipulates maximum emission quantities for each sector for the period 2008-2012 (according to the targets of the Climate Strategy 2007, BMLFUW 2007). An amendment of the Climate Protection Act 2011 which is currently reviewed will define the maximum quantities per sector for 2013 – 2020, based on the Annual Emissions Allocation for Austria under the Effort Sharing Decision. Two new bodies have been established by the new law, namely the Climate Change Committee (ministries,

---

[8] More detailed information can be found in the Fifth National Communication of the Austrian Federal Government: http://unfccc.int/resource/docs/natc/aut_nc5.pdf

provinces, social partners) and the Climate Change Advisory Board (NGOs, political parties, sciences), both chaired by the Ministry of Agriculture, Forestry, Environment and Water Management.

The CCA determines procedures where sectorial negotiation groups develop measures which cover i.a. the following topics:

- Increase of energy efficiency
- Increase the share of renewable energy sources in the end energy consumption
- Increase of total energy efficiency in buildings
- Inclusion of climate change mitigation in spatial planning
- Management of mobility
- Waste avoidance
- Protection and extension of natural carbon sinks
- Economic incentives for climate change mitigation.

The measures must lead to a measurable, reportable and verifiable reduction of GHG emissions or to an enhancement of carbon sinks that are reported in the National GHG inventory. The Federal Minister of Agriculture, Forestry, Environment and Water Management has to submit an annual report on the progress of complying with the emission targets to the Austrian Parliament and the National Climate Protection Committee. Should the emission limits be exceeded, a separate agreement between the federal government and the federal provinces will be signed in 2013.

In Austria, legislation is shared by the federal government and the federal provinces *(*Bundesländer). Hence, there are many climate change programmes at regional level in addition to the national climate strategy. Accordingly, coherent monitoring and evaluation of policies and measures is complex and challenging. Due to a lack of comparable information on the different policies and measures it has not been possible to quantify all policies and measures included in the scenarios of this report.

However, a thorough documentation of the evaluation of impacts of policies and measures (in order to enhance transparency and comparability in policies and measures reporting and evaluation) is currently the subject of discussions and research at the EU as well as the national and regional levels. Efforts have been made to enhance comparability by using the Monitoring Mechanism Reporting Template as recommended by the European Commission since 2009 (see Annex 1), and the "Additional guidance for Member States for the reporting of policies and measures under the EU reporting Monitoring Mechanism Decision in 2013" provided by the EEA.

4.2 Sectoral methodologies

In general, sectoral definitions as requested by the UNFCCC reporting guidelines have been used. Each section describes the methodologies applied for quantifying the most important policies and measures, but still not all measures could be quantified, due to lack of data, the complexity and interlinkages with other policies, or due to uncertainty.

The following sections need to be read in conjunction with the “Monitoring Mechanism Reporting Template” in Annex 1. The reporting template presents the information required by Decision 280/2004/EC for all policies and measures included either in the scenario WEM or in the scenario WAM in tabular form. In general, the measures included in the scenarios are based on the reports on energy scenarios until 2030 (AEA, 2013 and TU WIEN 2013), as well as results from negotiations (WIFO, WEGENER CENTER, UMWELTBUNDESAMT, 2012 and AEA 2012) on the level of civil servants and other stakeholders on measures under the CCA (Klimaschutzgesetz) are considered.

It should be emphasised that the quantification of the GHG emission reduction effect of a policy or measure per year presented in the reporting template is not an exercise of adding up individual effects. Interactions between measures cannot be avoided; expressing the total effect of measures by simply adding up figures relating to individual measures tends to result in an overestimation of the total effect of measures.

The allocation of measures is undertaken according to the CRF categories, whereby Energy Industries (1A1) and Manufacturing Industries and Construction (1A2) are merged, as most measures concern both subsectors. If measures concern more than one sector, they are included in the sector for which the policy is more relevant, further details can be found in the reporting template.

Compared to the submission in 2011, reporting policies and measure were improved. The changes include revised text, updated descriptions, deleted measures to avoid duplication, newly added measures and reallocation of policies, and re-organised ranking and numbering of policies. These changes were driven on the one hand by reviewing the last submission and recognising the need for improvement, and on the other hand, by the current important development of implementing the Climate Change Act in Austria, where new information and reports are produced concerning future developments in the climate policy field.

4.2.1 Energy Industries (1.A.1) & Manufacturing Industries and Construction (1.A.2)

Policies & measures relevant for the sector energy industries are given in Annex 1.

Where possible the GHG emission reduction effect of individual policies and measures has been estimated. However, for some measures (e.g. emission trading) the reduction effect could not be estimated; whereas for others, it was only possible to estimate the reduction effect achieved by 2020.

For the quantification of policies and measures in this sector, it has been assumed that additional/reduced green electricity production results in a reduced/ additional domestic electricity production in fossil fuel power plants. Emission reductions have been calculated on the basis of an emission factor of 0.4 t CO_2/ MWh.

In the following, the assumptions for the respective policies and measures are described in greater detail.

4.2.1.1 WEM measures-Energy/Industry:

01_EN EU Emission Trading Scheme

Austrian policy name: Europäischer Emissionshandel

EU-legislation	National Implementation	Start
2009/29/EC directive amending directive 2003/87/EC to improve and extend the greenhouse gas emission allowance trading scheme of the Community	Federal Law Gazette I No. 118/2011 (Emissions Allowance Trading Act)	2005/2011
Kyoto Protocol project mechanisms 2004/101/EC	Federal Law Gazette II No. 465/2011 (Regulation of Allocation)	2011
Commission decision on avoiding double counting of greenhouse gas emission reductions 2006/780/EC		
Directive 601/2012/EC on the monitoring and reporting of greenhouse gas emissions		

ETS in the first and second trading period:

The basis of the EU Emissions Trading Scheme (EU ETS) is the Emissions Trading Directive 2003/87/EC, which entered into effect by 1 January 2005. This Directive has been transposed into Austrian law by the Emissions Allowance Trading Act (Emissionszertifikategesetz EZG, Federal Law Gazette (FLG) I No. 46/2004 as amended). In order to link the EU ETS with the flexible Kyoto mechanisms, the EU passed the Linking Directive 2004/101/EC. The Linking Directive has been transposed into Austrian law by an amendment of the EZG.

At national level the number of allowances to be allocated in the relevant trading period was determined by the National Allocation Plans (NAP).

Changes in the ETS for the next period (2013-2020)

The ETS directive 2003/87/EC was revised with directive 2009/29/EC. This revision puts an emphasis on sale of certificates by auction rather than only on the maximum allowances. The allocation of certificates for the energy supply sector is no longer for free (apart from a few exceptions). For the sectors industry and heat generation the allocation is still free on an interim basis. Here sectors with a significant risk of carbon leakage will get up to 100 % free allocation, whereas for other sectors allocation will decrease each year starting from 80 % in 2013 to 30 % in 2020. The revised directive was transposed in the Emissions Allowance Trading Act 2011 (FLG I No. 46/2004 that replaced the original Emission Allowance Trading Act).

Between May 2011 and February 2012 the new amount of allowances for 2013 to 2020 were determined. For this period 212 installations in Austria are considered to take part in the ETS. Because of the extension of the EU directive 2009/29/EC, 27 new industrial installations are included in the ETS.

According to the draft National Implementation Measures (NIMs) submitted by Austria to the European Commission in 2012, 188 facilities will receive cost free allocations. In 2013 the preliminary allocation[9] amounts to 24.02 million certificates, in 2020 22.34 million certificates were planned. This corresponds to 67 %

[9] Without application oft the linear factor (for electricity generators) and the cross sectoral correction factor (for other installations).

(2013) and 62 % (2020) of the emissions in the base period. For the energy sector cost-allocation amounts to 31 % (2013) and 20 % (2020) compared to the base year which is due to the fact that electricity generation is not any longer entitled to receive free allocation.

02_EN Green Electricity Act 2012 and Feed-In tariff ordinance WEM

Austrian policy name: Ökostromgesetz 2012 und Einspeisetarifverordnung

EU-legislation	National Implementation	Start
RES Directive 2009/28/EC (repealing RES-E Directive 2001/77/EC and Biofuel Directive 2003/30/EC),	Federal Law Gazette I No. 75/2011 (Green Electricity Act 2012, Amendment)	2012
Internal electricity market 2009/72/EC (repealing 2003/54/EC), and 2006/32/EC	Federal Law Gazette I Nr. 149/2002, Federal Law Gazette I Nr. 104/2009	2002
End-use efficiency and energy services 2006/32/EC repealing SAVE Directive (Directive 93/76/EEC),	Federal Law Gazette II No. 307/2012 (Feed-in tariff ordinance)	2012

The Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources was implemented through the Green Electricity Act. The Act not only addresses the main issues raised by the Directive, but serves to harmonize the system for promoting electricity production from renewable energy sources by granting fixed feed-in tariffs for various forms of biomass transformation and power production, for wind power, hydropower, geothermal energy and photovoltaics.

The share of green electricity for the end user shall amount to 15 % by 2015. Therefore, the amendment of the Green Electricity Act 2012 intends to increase the funding for the expansion of renewables. Also feed-in tariffs shall increase the share of green electricity production.

The expansion targets for 2020 for renewables are the following:

- Hydropower +1,000 MW
- Wind power +2,000 MW
- Photovoltaics +1,200 MW
- Biomass and biogas + 200 MW.

All in all, the share of renewables in electricity consumption from the public grid shall rise to 15 % by 2015. Among other amendments, the guaranteed feed-in time period was raised to 13 years in general and to 15 years for power plants based on biomass and biogas fuels.

Quantification/Projected GHG emissions/removals:

Due to this Act 18,524 TJ more electricity will be produced in green electricity plants by 2015, and 37,905 TJ by 2020, resulting in yearly emission reductions of 412 kt CO_2-eq. in 2015 and 421 kt CO_2-eq. 2020 (using an emission factor of 0.4 kt CO_2-eq./GWh).

03_EN: Consequences of the EU Water Framework Directive

Austrian policy name: Auswirkungen der EU Wasserrahmenrichtlinie

EU-legislation	National Implementation	Start
EU water framework directive 2000/60/EG	FLG I Nr. 114/2008 (amendment of Green Electricity Act)	2008

The implementation of the EU Water Framework Directive led to a reduction of electricity production of small hydropower plants and run-off river power plants since 2011. The reduction will amount to 510 GWh (small hydropower) and 230 GWh (run-off river power) by 2020.

Nevertheless, it was assumed that at the same time the power plants were optimized to partly compensate the loss.

Quantification/Projected GHG emissions/removals:

Due to the implementation of the EU Water Framework Directive the production from hydro power plants is expected to diminish by a total of 1,200 GWh until 2027. Thus the yearly effect is an increase of emissions by 28 kt CO_2-eq. (using an emission factor of 0.4 kt CO_2-eq./GWh).

04_EN: Implementation of the National Energy Efficiency Action Plan 2011

Austrian policy name: Nationaler Energieeffizienzaktionsplan 2011

EU-legislation	National Implementation	Start
Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC	N.A	2009, 2011, 2014

Since the implementation of EU Directive on energy end-use efficiency and energy services (2006/32/EC) every Member State has to regularly report about the efforts made in terms of energy efficiency.

In the second NEEAP 2011 (national energy efficiency action plan), Austria defines its targets regarding the reduction of energy consumption as follows: It aims at stabilizing the end energy consumption in 2020 on the level of 2005 which means a maximum of 1,100 PJ. By 2016 Austria wants to save 80.4 PJ. The highest reductions in end energy consumption were already achieved in the building and heating sector (80 % of the reductions). The major part of these reductions was realized by measures of the federal provinces.

The next NEEAP has to be submitted in 2014.

Quantification/Projected GHG emissions/removals:

It was not possible to estimate the reduction potential of this measure, also because there are strong interlinkages with measures targeting energy efficiency in the building sector.

05_EN UFI Domestic Environmental Support Scheme (UFI)

Austrian policy name: Umweltförderungsgesetz

*Type: national policy (*Federal Law Gazette I No. 35/2012 (last amendment), Federal Law Gazette No. 185/1993)

The main objective of this subsidy is to provide economic incentives for companies to implement measures in the field of energy efficiency, climate and environmental protection. The following categories are of relevance for the energy supply subsector: biomass district heating systems, biomass-powered combined heat and power plants, heat distribution, power production from biomass and waste of biogenic origin, and geothermal energy.

Most subsidies were granted for biomass projects (21 %), solar plants (15 %) and commercial energy saving measures (13 %). In 2010, 93 % of the subsidies were focused on change mitigation. This led to yearly reductions of 360 kt CO_2 eq[10], as the focus was laid on climate relevant measures. The total environment related investment costs for renewable energy projects amounted to 298.2 million €, subsidised by 48.6 million €. In general, these projects were undertaken both within and outside the ETS sector.

The UFI also comprises the Austrian Climate and Energy Fund (KLI.EN) which is a fund especially set up for climate and energy related projects in order to meet the Kyoto Protocol targets (Federal Law Gazette I No. 40/2007). Financial support is provided for projects and programmes that include: use of renewable energies such as projects related to research on renewable energy, replacement of heating systems, photovoltaics, renovation of buildings (tourism and commercial), energy efficiency, etc. Support is provided for companies, research institutions or municipalities as well as for individuals, depending on the respective programme.

Quantification/Projected GHG emissions/removals:

The estimated reduction potential for 2015 is 300 kt CO_2 eq by 2015 and 250 kt CO_2 eq by 2020.

06_EN Promotion of combined heat and power (CHP) (Federal Law Gazette I No. 45/2008)

Austrian policy name: Kraftwärmekopplungs-Gesetz

EU-legislation	National Implementation	Start
Combined Heat and Power (CHP) Directive Promotion of cogeneration 2004/8/EC	Federal Law Gazette I No. 111/2008	2008
Internal electricity market 2009/72/EC (repealing 2003/54/EC)		

This measures has expired, and an extension is under discussion.

With regard to combined heat and power production, Directive 2004/8/EC of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market was transposed into national law by Federal Law Gazette I No. 111/2008. The main purpose of this law/Directive is to increase energy efficiency and improve the security of supply by creating a framework for the promotion and development of high efficiency cogeneration of heat and power, based on useful heat demand and primary energy savings on the internal energy market.

The amounts of future subsidies for new CHP plants cannot be estimated, as this measure has expired. An extension is under discussion, but additional effects are estimated to be low, because it can be assumed that the installation will be built anyway.

Funding for CHP plants is also included in the UFI (National Environmental Support Scheme), Feed-In tariffs for CHP (Green Electricity Act 2011).

[10] Source: http://www.lebensministerium.at/umwelt/klimaschutz/ufi/ufi.html (accessed 13.03.2013)

4.2.1.2 WAM measures-Energy/Industry

Some of the WAM measures for this sector have been quantified, but most of them are not, for which reason the sum of quantified policy effects is much lower than the WAM-WEM difference gathered from projections.

07_EN Energy Efficiency Act draft 2012 (WAM)

Austrian policy name: Energieeffizienzgesetz Entwurf 2012

EU-legislation	National Implementation	Start
RES Directive 2009/28/EC (repealing RES-E Directive 2001/77/EC and Biofuel Directive 2003/30/EC),	planned	2013/2014
End-use efficiency and energy services 2006/32/EC repealing SAVE Directive (Directive 93/76/EEC),		
Energy efficiency Directive 2012/27/EU, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC		

The draft of the Energy Efficiency Act is currently under assessment and shall be implemented in 2013/2014. It distinguishes three different consumer groups: Energy suppliers, companies and the federal government.

The draft of the Energy Efficiency Act includes among others:

- Mandatory introduction of energy management systems and energy audits for companies.
- Energy suppliers are supposed to provide services: Steering of systems, investment in systems, energy substitution and energy recovery.
- Energy suppliers are obliged to increase energy efficiency by about 1.5 % annually.
- Energy efficiency action plans including the monitoring of binding goals and measures
- Additional voluntary agreements with very committed companies.

Quantification/Projected GHG emissions/removals:

The quantifications of projected GHG emissions/removals have been made for the whole energy and industry sector and amount to 150 kt CO_2 eq.[11] in 2020.

08_EN: Green Electricity Act – beyond 2020

Type: national policy

Status: planned based on experts' judgement

In comparison to the WEM scenario, in the WAM scenario it was assumed that the support for green electricity is not limited until 2020, but is on-going until 2030.Old power plants will be replaced by new ones. Moreover, it was assumed that new wind power and photovoltaic installations will be supported further on until 2030 which leads to an increase of 2,000 MW of wind power and 950 MW photovoltaics (AEA, 2013).

Quantification/Projected GHG emissions/removals:

This measure will only be effective after 2020, which is why there is a reduction potential.

[11] Source: BMLFUW (2013)

4.2.1.3 Relevant measures not specified in scenarios

09_EN Research Initiative for industrial processes and pilot plants

Austrian policy name: Forschungsinitiative Industrielle Prozesse und Pilotanlagen

EU-legislation	National Implementation	Start
Energy Roadmap 2050: COM(2011) 885	Federal Law Gazette I No. 52/2009	2012-2013
	Federal Law Gazette No. 434/1982	

The initiative of the Federal Ministry of Economy, Family and Youth (BMWFJ) aims at increasing technological progress in terms of moving towards a low-carbon economy (European Energy Roadmap 2050). The research initiative focuses on:

- The use of renewable energy
- Development of new CO_2-free processes to produce hydrogen
- Industrial input of CO_2 as a resource for the production of tradable goods and in industrial processes.

The initiative shall encourage the development of prototypes and pilot plants for large scale industries in order to contribute to a positive CO_2 – balance.

Quantification/Projected GHG emissions/removals:

No significant emission reductions by 2020 are expected, as it represents an investment in technology and research, which might be effective at a later stage.

4.2.2 Transport (CRF Source Category 1.A.3)

In this chapter the WEM and WAM measures relevant for the transport sector will be specified. At the end of the chapter a list of measures that are not included in the current scenarios but belong to relevant EU CCPMs can be found.

Measures and GHG potentials used in the WEM scenario are briefly described in the following.

01_TRA Promotion of biofuels – Implementation of Directive 2003/30/EC according to the Austrian Fuel Ordinance 2012

Austrian policy name: Forcierung von Biokraftstoffen –
Umsetzung Biokraftstoffrichtlinie 2003/30/EG gemäß Kraftstoffverordnung 2012

EU-legislation	National Implementation	Start
RES Directive 2009/28/EC (Amendment)	Federal Law Gazette II Nr. 398/2012 (Amendment)	2013
RES-E Directive 2001/77/EC	Federal Law Gazette II Nr. 168/2009	2009
Biofuel Directive 2003/30/EC	Federal Law Gazette II Nr. 417/2004	2004
Fuel Quality directive 2009/30/EC	Federal Law Gazette Nr. 267/1967	

Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport specifies benchmarks for the use of biofuels and other renewable fuels in the transport sector. In Austria, the directive was implemented in 2004 through an amendment of the Austrian Fuel Ordinance. According to this ordinance, the obliged party has to substitute 2.5 % of the amount of diesel and petrol (measured by energy content) put on the market since October 1st 2005. This minimum share was increased to 4.3 % on 1 October 2007 and again to 5.75 % on 1 January 2009. During 2011 the target of substitution (5.75 %) was surpassed and reached 6.75 % (UMWELTBUNDESAMT 2012).

The addition of biofuels depends mainly on the amount of fossil fuel sold on the market. Therefore, the projected additions differ in the WEM- and WAM-scenario. Nevertheless, they both consider the achievement of the 10 % goal of renewable energies in the transport sector. This goal is regulated in the RES Directive 2009/28/EC (Directive on the promotion of the use of energy from renewable sources) which amends the Biofuel Directive 2003/30/EC.

The amendment of the Fuel Ordinance 2012 (entered into force on 1 January 2013) aims at increasing the share of biofuels to at least 7.34 % by 2020 (the share depends on the sort of fuel: 6.5 % for petrol and 9.1 % for diesel).

Biofuels have been placed on the Austrian market since 2005 mainly by mixing biodiesel with conventional diesel. Since October 2007 bio-ethanol has been added to petrol. At the beginning of 2009 4.7 % by volume of biodiesel and bioethanol were added nationwide. At the same time it became possible to increase the maximum volume percentage of biodiesel to 7 %. In addition, transport fleets of municipalities and companies were switched to pure biofuels or a share of more than 40 % of biofuels, respectively. This was especially forced by the klima:aktiv programme of the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW – see also measure "management of mobility – consulting and supporting programmes).

Quantification/Projected GHG emissions/removals:

2020: 2,100 kt CO_2 eq (incl. fuel export)/1,400 kt CO_2 eq (excl. fuel export)

02_TRA: Economic incentives – fuel tax increase in 2011 ("Klimabeitrag")

Austrian policy name: Ökonomische Anreize – MöSt-Erhöhung 2011 („Klimabeitrag")

EU-legislation	National Implementation	Start
Framework for the taxation of energy products and electricity (2003/96/EC)	Mineralölsteuergesetz Federal Law Gazette I No. 630/1994 (last amendment 2012)	2011

The mineral oil tax is a fee directly related to consumption, which means that a fixed amount per litre of fuel consumed has to be paid. In 2011 the mineral oil tax was raised according to the CO_2 supplement of 20 €/t CO_2. Consequently, the tax increased the petrol price by € 0.04 (€ 0.048 including VAT) and the diesel price by € 0.05 (€ 0.06 incl. VAT) per litre.

Increasing the fuel tax aims at a reduction of individual motorised transport and a shift towards public transport. Moreover, it aims at reducing GHG emissions from fuel export.

Quantification/Projected GHG emissions/removals:

2020: 1,200 kt CO_2 eq (incl. fuel export)/40 kt CO_2 eq (excl. fuel export)

03_TRA Mobility management and awareness – klima:aktiv mobil programme

Austrian policy name: Mobilitätsmanagement und Bewusstseinsbildung – klima:aktiv mobil Programm

Type: national policy

Policies and measures for mobility management are specifically supported within the frame of the klima:aktiv mobil programme of the Federal Ministry of Agriculture and Forestry, Environment and Water Management. It started in 2005, and focused in the beginning on commercial and business mobility management, now it includes also other target groups, like schools, kindergardens, youth groups, parent associations, enterprises, public institutions, leisure and tourism agencies, cities, provinces and regions, as well as investors, building and property developers. The program sets concrete targets for the GHG reductions in implemented projects; the consultation is carried out through consultation programmes:

- ➔ Mobility management for commercial, building promoter and fleet owners: 372,600 t CO_2 reduction/year (status 11/2012, source: Austrian Energy Agency)
- ➔ Mobility management for leisure, tourism and youth: 62,850 t CO_2 reduction/year (status 11/2012, source: Austrian Energy Agency)
- ➔ Mobility management for cities, municipalities and regions: 98,800 t CO_2 reduction/year (status 11/2012, source: Austrian Energy Agency).

In 2007, the klima:aktiv mobil programme widened its focus, which allows also small and medium enterprises next to businesses and municipalities to benefit from financial support. This climate protection initiative also includes an awareness raising programme.

Quantification/Projected GHG emissions/removals:

2020: 500 kt CO_2 eq (domestic effects only)

04_TRA: Economic incentives – Greening the truck toll

Austrian policy name: Ökonomische Anreize – Ökologisierung der LKW-Maut

EU-legislation	National Implementation	Start
Taxation of heavy goods vehicles 2006/38/EC	Federal Law Gazette I No. 109/2002), last amendment in 2008)	2002

Since 1 January 2010 the Federal Toll Law and the Ordinance of Toll Tariffs led to a division of the mileage based lorry toll into 3 different groups in line with the EURO classes. Since 1 January 2012 there are 4 tariff groups and new tariffs because emission class EURO 6 was included. This measure is based on EU Directive 2006/38/EC on the charging of heavy goods vehicles for the use of certain infrastructures (amendment of Directive 1999/62/EC) on the charging of heavy goods vehicles for the use of certain infrastructures).

The potential of this measure was investigated (HAUSBERGER 2009) and transferred into the GLOBEMI model. The reduction potential of this measure is decreasing over the time and amounts to 1.8 % in 2010, 1.6 % in 2015 and 1 % in 2030.

Quantification/Projected GHG emissions/removals:

2020: 400 kt CO_2 eq (incl. fuel export)/200 kt CO_2 eq (excl. fuel export)

05_TRA: Economic incentives – Greening of the consumption tax (NoVA)

Austrian policy name: Ökonomische Anreize – Ökologisierung der Normverbrauchsabgabe (NoVA)

EU-legislation	National Implementation	Start
Regulation on CO_2 from cars 2009/443/EC	Ökologisierungsgesetz 2007 (BGBl. I Nr. 46/2008)	2008

The Ecologisation Act 2007 (FLG I No. 46/2008) changed the Standard Fuel Consumption Tag Act (FLG No. 695/1991) in order to push the purchase of cars with low emissions and eco-friendly motors. In 2011 the Standard Fuel Consumption (SFC) Tax was amended by the federal government for the last time.

For a new car that emits less than 120 g CO_2/km the SFC tax was reduced by € 300. For cars whose CO_2 emissions exceed 180 g CO_2/km and 210 g CO_2/km a surcharge of € 25 per g/km was added. Since 2013 these surcharges already apply from 170 g CO_2/km on. On the other hand, the commuting allowance was increased by 5 %.

If vehicles do comply with the limit values of NO_x (for petrol engines < 60 mg NO_x/km; for diesel engines < 80 mg NO_x/km) and if they do not emit more than 0.005 g PM/km, then the SFC tax is cut by no more than € 200.

Until August 31st 2012 the SFC tax was reduced by € 500 for vehicles with eco-friendly driving motors (hybrid, use of super ethanol E85, biogas, natural gas, liquefied gas and hydrogen). The total tax reduction must not exceed €500 and cannot be used as a tax credit.

A measurable effect will be noticeable as part of the fleet modernisation.

Quantification/Projected GHG emissions/removals:

2020: 100 kt CO_2 eq (domestic effects only)

06_TRA: Promotion of corporate rail connections for freight transport

Austrian policy name: Anschlussbahnförderung im Güterverkehr

Type: national policy

This promotion aims at supporting investments in corporate feeder lines in order to maintain and expand the railway network. The improvement of rail infrastructure at company/industrial sites aims at shifting transport activities from road to rail. By promoting and financing feeder lines on company sites the share of rail freight transport should be increased.

The railway infrastructure service company (SCHIG) responsible for implementation, the Federal Ministry for Transport, Innovation and Technology and the climate and energy fund (KLI.EN) have estimated the CO_2 emission reduction potential by 2020.

Quantification/Projected GHG emissions/removals:

2020: 70 kt CO_2 eq (domestic effects only)

07_TRA: Mobility management and awareness raising – fuel saving intitiative

Austrian policy name:
Mobilitätsmanagement und Bewusstseinsbildung – Spritsparinitiative

Type: national policy

Fuel consumption shall decrease by applying advice for fuel-efficient driving. In comparison to the conventional style of driving GHG emissions can be reduced by 5-15 %. This klima:aktiv mobil initiative aims at promoting fuel-efficient driving.

Nationwide competitions and pilot campaigns for companies owning large fleets were organised and already showed energy savings.

In addition training programmes for all types of vehicle drivers have been launched and more than 20,000 people participated in these programmes.

Since 2008 fuel-efficient driving is a compulsory part of the training in driving schools. For this reason more than 980 trainers have been qualified. Within the Austrian training in driving schools 90,000 learner drivers have participated in a fuel-efficiency training. Besides, the programme also helps to inform people about alternative fuels and motors, e.g. in terms of guidelines for fleets. 20 driving schools have been rewarded for their outstanding engagement in the driving training and operation of the school.

Quantification/Projected GHG emissions/removals:

2020: 60 kt CO_2 eq (domestic effects only)

08_TRA: More efficient car use/telematics – existing speed limits of IG-L (Air Quality Directive)

Austrian policy name: Effizientere KFZ Nutzung/Telematikeinsatz – Bestehendes Tempolimit gemäß IG-L (Immissionsschutzgesetz-Luft)

EU-legislation	National Implementation	Start
Air quality Directive 2008/50/EC	Federal Law Gazette I No 115/1997 (amended 2009, 2010)	1997/NA

The Air Control Act which also includes the EU directives for air pollution control intends to permanently protect from harmful air pollutants and, as a precaution, to reduce the immission of air pollutants.

Hence, the speed limits on certain parts of the Austrian motorway were temporarily reduced to 100 km/h. Based on an analysis of the mileage based speed a difference of driving speed of 6.2 km/h was used as an input for the model NEMO (Dippold et al. 2012). Starting from the calculated potential in the NEMO model, the CO_2 emissions and the energy use were calculated in the GLOBEMI model. Traffic volume and traffic speed of the related parts of the motorway were used to calculate the emissions.

Quantification/Projected GHG emissions/removals:

2020: 30 kt CO_2 eq (domestic effects only)

09_TRA Trend electromobility – Implementation Plan for electric mobility

Austrian policy name: Trend Elektromobilität – Umsetzungsplan Elektromobilität

Type: national policy

On the basis of a study about the development of e-mobility (UMWELTBUNDESAMT 2010) it was assumed for the WEM scenario that general measures to promote e-mobility have been undertaken (financial support for research projects, for model regions, development of a master plan for e-mobility), for which the Action Programme "Electro Mobility" and the results of the ministerial steering group "Electro Mobility" create a good basis (BMLFUW & WIKO, 2010). But there will be a lack of willingness to accept the technology on the demand-side.

For this reason the demand is weaker in the WEM scenario than in the WAM scenario. Consequently, the incentives are lower for the automobile industry to invest in R&D for serial production of electric vehicles. In the conservative WEM scenario the fleet of electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) (passenger cars) is estimated to amount to 60,000 vehicles. This corresponds to 1 % of the Austrian fleet or to 8 % of the newly purchased vehicles.

Quantification/Projected GHG emission removals:

2020: 92 kt CO_2 eq (domestic effects only)

4.2.2.1 WAM Transport measures

WAM measures suitable for modelling were taken from a list of measures, which resulted from the negotiations to implement the Austrian Climate Change Act (CCA) in 2012. This law, enforced in November 2011, foresees the allocation of sectoral GHG benchmarks for the compliance period after 2012.

The measures are ranked according to their absolute reduction potential, starting with the highest potential. A comparison of quantified emission reduction due to WAM measures shows that they are quite in line with projections (WAM minus WEM).

10_TRA Economic incentive: fuel tax increase in 2015 and 2019

Austrian policy name: Ökonomische Anreize – MöSt Erhöhung 2015 und 2019

Type: national policy

Status: planned based on experts' assumptions

The measure "increase of fuel tax" was included in the WAM scenario in two steps. The first increase was simulated with an increase on 1 January 2015 of 5 Euro Cent (excluding VAT) for petrol and diesel. The second increase of the fuel tax was calculated with an increase on 1 January 2019 of additional 5 Euro cent (excl. VAT) for petrol and diesel. Abroad an increase of the fuel tax of 2 Euro cent between 2019 and 2030 was taken into account.

Quantification/Projected GHG emissions/removals:

2020: 2,100 kt CO_2 eq (incl. fuel export)/200 kt CO_2 eq (excl. fuel export)

11_TRA: Economic incentives – Further greening of the consumption tax (NoVA)

Austrian policy name: Ökonomische Anreize – Weitere Ökologisierung der NOVA

Type: national policy, although it is thematically linked to the Regulation on CO_2 from cars 2009/443/EC

Status: planned based on experts' assumptions

For the already considered greening of the consumption tax in the WEM scenario (05_TRA) a further greening in two steps is foreseen, going beyond the adaption enforced by 01.01.2013. The malus benchmark would account for 105 g CO_2 eq/km by 01.01.2015 and 95 g CO_2 eq/km by 01.01.2020.

Quantification/Projected GHG emissions/removals:

2020: 300 kt CO_2 eq (domestic effects only)

12_TRA: More efficient car use – nationwide speed limits

Austrian policy name: Effizientere KFZ-Nutzung – Tempolimits flächendeckend

Type: national policy

Status: planned based on experts' assumptions

In the WEM scenario it was already assumed that 0.2 % less CO_2 is emitted as a consequence of the Air control Act 2009. In the WAM scenario it was foreseen that the general speed limit on motorways and highways was reduced to 100 km/h, on main roads and country roads to 80km/h. Displacements to subordinated streets are not expected and therefore not considered.

Quantification/Projected GHG emissions/removals:

2020: 200 kt CO_2 eq (domestic effects only)

13_TRA: Mobility Management and awareness – Promoting mobility management including Master Plan Bicycle & Pedestrian Master Plan

Austrian policy name: Mobilitätsmanagement und Bewusstseinsbildung – Forcierung Mobilitätsmanagement inkl. Masterplan Radfahren & Masterplan Fußgänger

Type: national policy

This measure targets mobility management and the promotion of eco-friendly mobility, such as cycle and pedestrian traffic. The potentials were calculated based on the substitution of kilometres by car with kilometres by bicycle or on foot. The Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) estimates the following emission reduction potentials by 2020:

- 100,000 t CO_2 from the master plan cycle traffic
- 50,000 t CO_2 from the master plan pedestrian traffic
- 50,000 t CO_2 the programme "general mobility management".

Shifts to public transportation were not considered.

Quantification/Projected GHG emissions/removals:

2020: 200 kt CO_2 eq (domestic effects only)

14_TRA: Trend electromobility –
Promoting electric vehicles according to the Austrian Energy Strategy

Austrian policy name: Trend Elektromobilität – Forcierung Elektromobilität gemäß Energiestrategie

Type: national policy

The WAM scenario is oriented towards ideal political and economic circumstances for the introduction and development of e-mobility in Austria. It is assumed that all stakeholders strive for a nationwide expansion of e-mobility. Under these optimistic circumstances the fleet of electric vehicles (which includes electric and plug-in hybrid cars) could count approx. 250,000 vehicles (BMWFJ & BMLFUW 2010; UMWELTBUNDESAMT 2010). This would imply that by 2020 5 % of the Austrian fleet is electrified and the share of new registrations of electric vehicles could increase to approx. 20 %.

Quantification/Projected GHG emissions/removals:

2020: 364 kt CO_2 eq (domestic effects only) =
92 kt CO_2 eq WEM potential + 271 kt CO_2 eq WAM potential

15_TRA: Economic incentives – commuter tax reform (job ticket)

Austrian policy name: Ökonomische Anreize – Reform der Pendlerpauschale (Jobticket)

Type: national policy

Status: implemented as of 1 January 2013

This measure provides a tax free public transport ticket for all employees as long as the employer is willing to pay for the ticket. It includes also employees that do not receive a commuter tax allowance since their travelling distance is less than 20 km (one-way).

Quantification/Projected GHG emissions/removals:

2020: 70 kt CO_2 eq (domestic effects only)

16_TRA: Economic incentives – implementation of the new infrastructure costs Directive 2011/76/EG in Austria

Austrian policy name:Ökonomische Anreize – Umsetzung der neuen Wegekosten-RL 2011/76/EG in Österreich

EU-legislation	National Implementation	Start
EU Directive 2011/76/EC	planned	

This measure considers the new EU directive on the charging of heavy goods vehicles for the use of certain infrastructures 76/2011/EC. A new external cost supplement is added to the lorry toll. It was assumed that heavy vehicles that belong to EURO 4 and EURO 5 class will be substituted by EURO 6 class vehicles by 2020. Heavy vehicles from EURO class 0-3 are not affected by this measure because they have comparable low mileages. They will still be used especially for short distances.

The potential was estimated in the GLOBEMI simulation with changed emission factors. Emission factors from the WEM scenario were used, such as emission factors for EURO 4, 5 and 6. For this reason all changes in the fleet could be simulated realistically. The potential of the WAM scenario was only considered from 2020 on. Indirect effects on railway traffic were included but are regarded as negligible.

Quantification/Projected GHG emissions/removals:

2020: 4 kt CO_2 eq (domestic effects only)

17_TRA: Improvements in freight transport – Implementation of the National Action Plan Danube Navigation (NAP)

Austrian policy name: Verbesserungen im Güterverkehr – Umsetzung Nationaler Aktionsplan Donauschifffahrt (NAP)

Type: national policy

This measure describes the implementation of the National Action Plan for Danube shipping (NAP) which is the basis for the Austrian shipping policy until 2015. Besides infrastructural measures and shifting measures, one part of this plan is the Danube river information system (DoRIS) which is in line with the European programme NAIADES. These measures are also in accordance with the European strategy for the Danube region (priority area 1a: “to improve mobility and multimodality: inland waterways”). One of the relevant goals is to increase freight traffic on the Danube by 20 % by 2020 compared to the level of 2010. This goal was simulated in the WAM scenario by increasing the mileage of shipping and the substitution of lorry transportation.

Quantification/Projected GHG emissions/removals:

2020: 0.2 kt CO_2 eq (domestic effects only)

4.2.2.2 Other relevant transport measures not specified in projections

The following measures give an overview of how several EU directives are implemented in Austria. As they are already state of the art, they are not included in the WEM or WAM scenario. Quantifications for the measures listed below are not available.

18_TRA CO_2 Labelling for passenger cars

Austrian policy name: PKW-Verbraucherinformationsgesetz

EU-legislation	National Implementation	Start
New Passenger Car Labelling on fuel economy rating 1999/94/EC	Federal Law Gazette I No. 34/2006 (amendment)	2006
	Federal Law Gazette I No. 26/2001	

The directive was transposed into national law in 2006, and requires traders to publish fuel consumption and CO_2 emissions of all passenger car types for sale. This shall serve customers for information purposes and as a decision tool for a climate friendly passenger car.

19_TRA: promoting the purchase of clean and energy-efficient cars

Austrian policy name: PKW-Beschaffungsvorgabe

EU-legislation	National Implementation	Start
Clean Car Directive 2009/33/EC	Federal Law Gazette I No. 2010/15	2010

This measure requires contracting authorities to take into account lifetime energy and environmental impacts, including energy consumption and emissions of CO_2 and of certain pollutants, when purchasing road transport vehicles with the objective of promoting and stimulating the market for clean and energy-efficient vehicles and improving the contribution of the transport sector to the environment, climate and energy policies of the Community. For this reason technical specifications have to be elaborated by the contracting authority regarding the whole lifetime of the vehicle. These specifications must be considered for the purchase.

20_TRA: Implementation of EURO 5 and EURO 6 standards

Austrian policy name: Umsetzung EURO 5 und 6 standards

Regulation (EC/715/2007) sets emission limits for air pollutants, such as carbon monoxide (CO), non-methane hydrocarbons and total hydrocarbons, nitrogen oxides (NO_x) and particulates (PM for the different types of vehicles). It already has four preceding regulations, whereby emission limits always get tighter. This measure has shown to be successful in reducing air pollutants and particulate matter, but only has a marginal impact on CO_2 emissions.

A quantification of the impact of this regulation cannot be given.

21_TRA: Raising the market share of engines with low fuel consumption (ACEA agreement)

Austrian policy name: freiwilliges Commitment der Automobilindustrie

Since the targets under the voluntary agreement were not met by the automotive sector, the agreement has not been extended. The reason why this measure is included is that according to the MM decision expired measures have to be reported as well.

4.2.3 Other sectors (1.A.4)

The policies and measures included in the scenario “with existing measures” for the category “Other Sectors” are listed in Annex 1.

Measures included in this sector concern the energy consumption in buildings, and have interlinkages with the energy supply sector. Given the large number of measures, policies and measures have been grouped.

Significant national policy instruments that promote the implementation of measures are the Housing Support Scheme (“Wohnbauförderung“ – WBF), and Technical Building & Construction Regulations of the regional authorities (Bundesländer), the Austrian Climate and Energy Fund (“Klima- und Energiefonds“ – KLI.EN), the Domestic Environmental Support Scheme (“Umweltförderung im Inland“ – UFI), and the programme klima:aktiv. The last three are funded by the national government.

4.2.3.1 WEM measures

In the WEM scenario it was assumed that the standard for new buildings from 2014 onwards has to be improved every 2 years until 2021 when a "nearly zero energy" building standard shall be achieved. This refers to the implementation of Directive 2010/31/EU on the energy performance of buildings and guideline 6 of the Austrian Institute for Constructional Engineering (OIB). In the WEM scenario public buildings already fit the standard in 2019. The funding guidelines of the housing support scheme will be adapted in order to fulfil the requirements of the building codes of the provinces two years in advance. After 2020 new buildings must fall below 20 % of the building regulation to be eligible for funding by the housing support scheme.

The funding for the renovation of existing buildings and new buildings include all relevant funding programmes of the federal government and the federal provinces. In the WEM scenario 2013 it is assumed that the building cheque of the federal government (€ 100 million annually) will expire. Afterwards the funding volume for new buildings will be constant. The budget for building renovations results from the difference between the total funding (households: –1 % p.a.) and the funding for new buildings. Therefore, the budget for the renovation of buildings will decline from €280 million in 2013 to €120 million in 2030.

The WEM measures have been grouped in order to quantify the emission reduction potential:

- 01_B Efficient new buildings (effizienter Neubau)
- 02_B Thermal insulation of buildings (thermische Gebäudesanierung)
- 03_B Change of heating systems (Heizsystemerneuerung).

When it comes to implementing the group of measures mentioned above, in Austria the "15a BV-G Agreement" of the Federal Constitutional Law between the federal government and the federal provinces is an important tool which regulates the funding for buildings "Wohnbauförderung" (housing support scheme).

This constitutional treaty between the federal provinces and the federal government came into effect in 2006 (FLG II Nr. 19/2006) and provided for further improved standards as a prerequisite for receiving subsidies and for a shift of subsidies in favour of the thermal renovation of existing dwellings.

Most federal provinces in Austria support the replacement of old fossil fuelled heating systems by highly efficient systems based on renewable energy (solar, biomass) or natural gas (with condensing boiler technology). In addition, the federal provinces continue to promote the combination with existing or new (often biomass-fired) district heating. Thermal minimum standards for new buildings are defined in the Technical Construction Regulations of the federal provinces.

With regard to the quality of the renovations new enhanced minimum standards shall be developed for the amendment planned for 2014.

01_B: Efficient new buildings (effizienter Neubau)

Austrian policy name: Effizienter Neubau

Type: National policy

Here the effects of subsidised heating systems (renewable) and compulsory building regulations for the thermal insulation quality in new buildings are described.

This group of measures targets the energy efficiency of new buildings by reducing the energy consumption. The group of measures includes: toughening the construction standards of 2010 and providing financial support for new buildings. Here the effects of subsidised heating systems (renewable) and compulsory building regulations for the quality of thermal insulation in new buildings are included. With these measures an estimated reduction of 2 PJ of fossil fuels can be achieved, inducing a decrease of approximately 119 kt CO_2 equivalents by the year 2030.

Quantification/Projected GHG emissions/removals:

The implementation of efficient new buildings is expected to reduce emissions of fossil fuels by about 27 kt CO_2 equivalents by 2015 and 77 kt CO_2 equivalents by 2020.

By 2030, with these measures an estimated reduction of 2 PJ of fossil fuels can be achieved, inducing a decrease of approximately 119 kt CO_2 equivalents.

02_B: Thermal insulation of existing buildings

Austrian policy name: Thermische Gebäudesanierung

Type: National policy

This group of measures analyses the effects of the promoted thermal renovation of buildings. A WOM scenario was taken as a fictitious reference scenario where thermal renovation had no effects.

Here, the effects of increased thermal renovation activities in buildings are described. Measures are targeted at improvements of the thermal building envelope (house front, windows, top and bottom floor ceiling) and thus of the overall renovation rate, which entails a reduction in energy consumption by 10.8 PJ (6.4 PJ fossil fuels) by the year 2020. The consumption of fossil fuels, natural gas, coal and electricity is decreased by 7 PJ (2020) and by 11 PJ (2030). In addition, there are savings in renewables and district heating: 4 PJ (2020) and 5 PJ (2030). In the sector residential and commercial, the calculated reduction of GHGs is approximately 426 kt CO_2 equivalents by 2020.

With these measures an estimated reduction of 11 PJ of fossil fuels can be achieved, inducing a decrease of approximately 635 kt CO_2 equivalents by the year 2030.

Quantification/Projected GHG emissions/removals:

This group of measures leads to an emission reduction of 268 kt CO_2 eq in 2015, 426 kt CO_2 eq by 2020 and 635 kt CO_2 eq by 2030.

The following measures are considered hereunder:

(1) OIB guideline 6 (Energy savings and thermal insulation)

Austrian Policy Name: OIB Richtlinie 6 – Oktober 2011 (Energieeinsparung und Wärmeschutz)

EU-legislation	National Implementation	Start
Recast of the Energy performance of buildings (Directive 2010/31/EC) amending 2002/91/EC	OIB guideline 6	2012-2013 (depending on the legislation of the federal provinces)

The new edition of OIB guideline 6 of the Austrian Institute for Constructional Engineering (released in October 2011) implements the EU Directive on the energy performance of buildings (Directive 2010/31/EC). The federal provinces are responsible for the translation into their respective regional laws. As already mentioned above the OIB guideline requires that new buildings improve the building standard every 2 years to comply with the target of the EU directive in 2020. The focus no longer lies just on the thermal heat demand of buildings but also on warm water, ventilation, cooling, demand for electricity and photovoltaics impacts on the total energy efficiency.

Moreover, the new energy certificate for buildings includes parameters such as total energy efficiency factor, CO_2 emissions and demand for primary energy on the cover sheet. Minimum requirements are specified for the thermal heat demand and end energy consumption.

(2) National and funding programmes

Austrian Policy Name: Bundes- und Förderprogramme

In the WEM scenario it was assumed that the following funding and national programmes will be continued in order to improve the energy efficiency of buildings:

- Klima:aktiv:
  - e5-communities: consultancy for communities to promote climate protection
  - energy saving: education, information and advice for consumers and commercial enterprises to reduce energy consumption
  - and renewable energy: providing know-how and support of networking for committed companies and associations
- Domestic Environmental Support Scheme (UFI):
  - KLI.EN: This is a fund included in the Environmental Support Scheme which supports energy efficiency measures for buildings (for more details see PaM 05_EN)
- Renovation of federal buildings and construction of new federal buildings
- Building renovation initiative for commercial and industrial buildings to improve their energy performance: This measure includes funding for heat recovery, efficient energy use in industrial processes, optimization or exchange of the heating system.
- Consultancy service and information campaigns.

(3) Building renovation initiative for private buildings to improve the energy performance (renovation cheques)

Austrian policy name: Sanierungsscheck zur Verbesserung der Energieeffizienz von Privat-Gebäuden

EU-legislation	National Implementation	Start
Recast of the Energy performance of buildings (Directive 2010/31/EC) amending 2002/91/EC	Federal Law Gazette I No. 35/2012 (last amendment)	Start 2013 End 2014
	Federal Law Gazette I No. 185/1993	1993

This measure is an incentive by the federal government to promote the renovation of private buildings. The already existing building renovation initiative is planned to be extended to become more attractive for private households. Therefore, the successful offer of “renovation cheques” will be continued for two further years (2013-2014).

Funding is available for thermal renovation of buildings older than 20 years. The measure includes: insulation of front walls and ceiling, exchange of windows and front doors, exchange of the heating system.

It focuses on owners and renters of apartments in multi-storey buildings as well as of single/double family houses.

The reduction potential of this measure is expected to amount to 190-220 kt CO_2 by 2020[12]. Although a large share of this reduction potential can be attributed to the WAM scenario.

(4) Building renovation initiative for commercial and industrial buildings to improve energy performance

Austrian policy name: Sanierungsoffensive zur Verbesserung der Energieeffizienz von betrieblichen Gebäuden

EU-legislation	National Implementation	Start
Recast of the Energy performance of buildings (Directive 2010/31/EC) amending 2002/91/EC	Federal Law Gazette I No. 35/2012 (last amendment)	Start 2013 End 2014
	Federal Law Gazette I No. 185/1993	1993

This measure is an incentive of the federal government to promote the renovation of commercial and industrial buildings, for which the national environmental support scheme fund (UFI) provides 30 million EURO.

Funding is available for the thermal renovation of buildings older than 20 years. The measure includes: heat recovery, efficient energy use in industrial processes, optimization or exchange of the heating system.

It focuses on companies and commercial organisations, such as registered associations and professional organisations.

The reduction potential of this measure has not been estimated.

03_B: Change of heating systems (Heizsystemerneuerung)

This group of measures includes measures that affect the impacts of the change of heating systems in the WEM scenario. The WEM scenario was compared to a fictitious WOM scenario where heating systems were not replaced or subsidised.

The replacement of heating systems and the increased energy efficiency leads to a total reduction of 7 PJ by 2020 and 14 PJ by 2030, respectively. Fossil fuels account to an overall reduction of 8 PJ by 2020 and 21 PJ by 2030. The non-climate-effective biomass demand increases by 10 PJ (2020) and 22 PJ (2030). Finally, heating electricity demand is reduced by 9 PJ (2020) and 16 PJ (2030).

Measures are expected to result in savings of 21 PJ fossil fuels by 2030 – however, with an increase in non-climate-effective biomass demand by 22 PJ. With this group of measures a reduction of 311 kt CO_2 equivalents can be reached by 2015, 707 kt CO_2 eq by 2020, and 1,651 Gg CO_2 eq. by 2030.

[12] Source: BMLFUW, 2013: Internal paper “Maßnahmentabelle Bund, Stand 18.01.2013”

In the following, the considered measures are described:

(5) Stepping up the replacement of heating systems (Heizkesseltausch)

An increase in the boiler exchange rate through various measures (defined in the Austrian climate strategy) will be achieved by financial support and making people aware of the fact that old, inefficient heating system should be replaced.

(6) District heating and district cooling Act

Austrian policy name Fernwärme- und Kälteleitungssausbaugesetz
*(*Federal Law Gazette I No. 58/2009 (Amendment), Federal Law Gazette I No. 113/2008)*:*

The district heating and district cooling Act (DHDC) amendment was implemented in 2009. It aims at achieving cost effective CO_2 emission reductions and enhancing energy efficiency. The construction of district cooling systems shall decrease the electricity demand for air conditioning and use existing heat and waste heat potential, especially from industries. Renewable energy sources shall be included and district heating shall be expanded in rural areas. Further, the expansion in agglomerations shall be forced. The expansion of the DHDC is subsidised with 60 million Euros annually.

Quantification/Projected GHG emissions/removals:

This law shall lead to a permanent reduction of 3,000 kt CO_2 which is referenced in the concerned law (Federal Law Gazette I No. 58/2009.

(7) Funding for wood heating systems and solar heating systems

Austrian policy name: Ausbau der Förderung von Holzheizungen für private Haushalte (Pellets und Hackgut) und Erweiterung der Förderung großer Solarthermie-Anlagen

*Type: national policy (*Federal Law Gazette I No. 35/2012 (last amendment), Federal Law Gazette I No. 185/1993)

This funding initiative intends to enforce the installation of environmentally friendly heating systems in private households. It is financed by the National Environmental Support Scheme (UFI) via the KLIEN funds.

Financial support can be requested in case where old oil-fired boilers are replaced by heating systems based woodchips or pellets. In addition, solar heating systems are supported as well.

This funding initiative in 2012 shall now be extended in 2013.

Quantification/Projected GHG emissions/removals:

This initiative is expected to save 69-79 kt CO_2 by 2020.[13]

[13] Source: BMLFUW, 2013: Internal paper “Maßnahmentabelle Bund, Stand 18.01.2013”

(8) Federal Provinces' provisions for heating equipment and regional measures

Austrian policy name: Länderbestimmungen zu Heizanlagen und regionale Maßnahmen (IG-L)

Type: National policy (Federal Law Gazette I No. 77/2010, Federal Law Gazette I No. 115/1997)

In Austria, the Federal Ambient Air Quality Act (Immissionsschutzgesetz FLG I No. 115/1997, last amendment FLG I No. 77/2010) foresees under §27 that the limitation of emissions from heating systems to achieve the objectives of this Act (§ 1) is to be determined by federal state measures.

In the WEM scenario the measures implemented in the nine federal provinces are taken into aemissions/removalsccount, these include, for example, the definition of the heating type; hereby, the manufacturer shall demonstrate compliance with low emission values and minimum efficiencies.

A quantification of this measure has not been possible.

(9) Adaptation of the mineral oil tax for heating oil

*Austrian policy name: Mineralölsteueranpassung für Heizöl (*Federal Law Gazette I No. 111/2010)

In 2011, the Federal Law Gazette I No. 111/2010 (Budgetbegleitgesetz FLG I No. 111/2010) changed the mineral oil tax law (Mineralölsteuergesetz) by increasing the fuel oil taxes with a sulphur content of maximum 10mg/kg to 0.098 € per liter.

Fuel exemptions are foreseen for biodiesel (fuel oil which is fully or mostly produced from biogenic substances).

04_B Ecodesign requirements for energy using products

Austrian policy name: Ökodesign-Verordnung

Type: CCPM

EU-legislation	National Implementation	Start date
Eco-design Directive 2009/125/EC (amending 2005/32/EC)	Federal Law Gazette II No. 187/2011 (Amendment)	2011
	Federal Law Gazette II No. 126/2007	2007

The eco-design Ordinance is the national implementation of the EU Eco-design directive 2009/125. It consists of defining minimum eco-design requirements for specific energy-using products. These products have to be certified with the CE label and have to meet the minimum requirements defined in the EU directive.

Thereby, the whole product life cycle is regarded, starting with the choice of raw material until the final waste disposal. The product design must consider environmental impacts (resource use and energy consumption, emissions and recyclability) and safety-related requirements.

In the first phase of the eco-design directive implementation primarily consumption goods (household appliances) were affected. In the amendment there is now the tendency that the focus switches to services and industries, such as heating systems, ventilations and air conditions, machines, pumps and transformers.

Quantification/Projected GHG emissions/removals:

A quantification of the reduction potential is not available.

05_B: End-use efficiency and energy services (Directive 2006/32/EC)

Austrian policy name: Endenergieeinsatz und Energiedienstleistungen

EU-legislation	National Implementation	Start date
Directive 2006/32/EC on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC	2nd National Energy Efficiency Action Plan	2011
	1st National Energy Efficiency Action Plan	2007

This directive aims at making the end use of energy more economic and efficient. Member States must adopt and achieve an indicative energy saving target of 9 % by 2016 in the framework of a national energy efficiency action plan (NEEAP). Furthermore, energy saving targets for the public sector has to be set and harmonised indicators and benchmarks for energy efficiency have to be established. In Austria the end-use efficiency and energy services Directive also directly influences the Art. 15a Agreement between the federal government and the provinces, as many topics do not belong to the legislative competences of the federal government.

Austria submitted the second NEEAP in 2011, where all relevant measures in Austria are described which contribute to the implementation of the directive. The increase in energy efficiency has a very high priority and the objective is to stabilize the energy end use by 2020 at the level of 2005. The energy end use shall therefore not exceed a maximum of 1,100 PJ in 2020

As many of this measures target the energy consumption in private and public buildings, this measure has been taken into account in the building sector. A quantification of the emission reduction for this single measure was not possible, as interlinkages with other measures are too strong. In the WEM scenario it is assumed that Austria will meet the objectives set out in the Directive.

Quantification/Projected GHG emissions/removals:

A quantification of the reduction potential is not available.

06_B: Recast Directive of energy performance of buildings

Austrian policy name: Energieausweisvorlagegesetz für Gebäude

Type: CCPM

EU-legislation	National Implementation	Start date
Recast of the Energy performance of buildings (Directive 2010/31/EC) amending 2002/91/EC	Federal Law Gazette I No. 27/2012 (Amendment)	2012
	Federal Law Gazette I No. 137/2006	

The recast of the Directive on the energy performance of buildings (2010/31/EC) was released in order to improve the efficiency of the previous building regulation and to counteract deficiencies in national implementations. The mechanisms remained the same:

- Definition of calculation methods for the total energy efficiency and minimum requirements

- Specifications for the creation, submission and notice of the energy performance certificate
- Inspections of heating and cooling systems.

New elements are compiled of requirements for building technology systems, requirements for low-energy buildings and the compulsory creation of financial incentives by the member states.

Austria has implemented the Buildings Directive and introduced several measures such as the 'Energy Certification Providing Act' ('Energieausweisvorlagegesetz – EAVG') and the Austrian Institute of Construction (OIB) Engineering Guidelines have been adopted to maximise energy efficiency in new and existing buildings in Austria.

The energy certification has to include the thermal heating demand and the total energy efficiency factor of the building. When selling a building or an apartment the owner is obliged to present the energy certificate of the building. The energy certificate must not be older than 10 years and must be forwarded at least 14 days after the sale. It is expected that the energy certificate will influence potential buyers' decisions, and therefore be an incentive for sellers to take measures in order to achieve a positive energy performance. A quantification of emission reduction has not been possible.

Quantification/Projected GHG emissions/removals:

A quantification of the reduction potential is not available.

07_B: Energy labelling of household appliances

Austrian policy name: Produkteverbrauchsangabenverordnung

Type: CCPM

EU-legislation	National Implementation	Start date
Directive 2010/30/EC on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products	Federal Law Gazette II No. 232/2011	2011

Directive 2010/30/EC on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products was implemented in Austria in 2011 (FLG II No. 232/2011). The regulation specifies different energy classes, starting from A+++ (the best class) to D (the poorest class). As in the amendment of the Eco-design Directive, the scope was expanded to a larger group of energy consuming products.

The energy label helps consumers to compare products in terms of their energy consumption.

New specific requirements have been established for the following products: dish washers, fridges, washing machines, televisions, air conditioners, dryers and electric lamps.

Quantification/Projected GHG emissions/removals:

A quantification of the reduction potential is not available.

4.2.3.2 WAM measures for other sectors (1A4)

In the WAM scenario, measures have been integrated which remain to be implemented, but have already been decided upon or their implementation can be regarded as assured. It should be noted at this point that the 2013 WAM scenario is far from containing all possible measures. Therefore the WAM scenario cannot be interpreted as an upper limit for renovation potential or for the use of renewable energy.

Quantification: For the WAM scenario a reduction potential of 62 kt CO_2 eq for 2015 and 222 kt CO_2 eq for 2020 has been calculated by using the model INVERT/EE-Lab[14]. A distribution of this total reduction among the two measures mentioned below was not possible.

The following additional measures have been integrated in the WAM scenario compared to the WEM scenario.

08_B: Stepped-up thermal insulation (Sanierung)

Austrian policy name: Forcierte thermische Sanierung

Type: national policy

EU-legislation	National Implementation	Start date
Recast of the Energy performance of buildings (Directive 2010/31/EC) amending 2002/91/EC	Amendments to the relevant legislation and Agreement Art. 15a	2014

Renovation measures in residential buildings and non-residential buildings by granting subsidies (housing support scheme – "Wohnbauförderung") by further development of minimum requirements for eligibility for subsidies, whereby four indicators are considered: heating demand, primary energy consumption, CO_2 emissions and total energy efficiency. In the WAM scenario the subsidies were adapted so that a thermal insulation rate of 1.2 %p.a. can be achieved by 2020. The capping of the grant budget for the renovation of buildings has been lifted (from 2013), the "renovation check" of the federal government will continue to be available until 2020 (effective in 2012).

The thermal insulation of residential buildings from the construction period before 1945 or hall-like buildings in the non-residential sector will be based upon the implementation of the building codes. This will reduce (from 2014), the average U-value after renovation in residential buildings from before 1945 to 0.45 kWh/m² K to outside air (0.6-0.9 kWh/m² K at WEM 2013 scenario) and 1.5 kWh/m² K (2 kWh/m² K in WEM) at hall-like buildings (AEA 2012).

Renovation guidelines in the relevant legislation: In a first step, the legal possibilities of a commitment to restore the top floor ceiling and the exchange/conversion of old heating systems are checked. It is assumed that this measure will apply through corresponding laws and transition periods only by 2015. Until the year 2020 it is assumed that with this measure successively 5 to 10 % of the potential can be realized, which will result in a CO_2 eq reduction potential of 42-86 kt for non-residential buildings by 2020 (AEA 2012).

A reduction potential of 190-220 kt CO_2 eq by 2020 is attributed to this measure.

[14] INVERT/EE-Lab (Energy Economics Group of the Technical University of Vienna, TU WIEN 2013): domestic heating and hot water supply

09_B: Promote efficient and climate friendly heating systems

Austrian policy name: Förderung klimafreundlicher Heizsysteme

Type: national policy

EU-legislation	National Implementation	Start date
Recast of the Energy performance of buildings (Directive 2010/31/EC) amending 2002/91/EC	Amendments to the relevant legislation	2014

The following group of measures foresees the implementation of a law regarding the obligation to use highly efficient heating systems.

- Mandatory installation of highly efficient systems in combination with solar energy in new residential buildings (also multi-storey buildings) for warm water heating by 2014
- Mandatory installation of highly efficient systems (including solar energy) for federal buildings
- Mandatory use of solar energy in non-residential buildings by 2014.

In this case, new residential and federal buildings have to reach a solar thermal coverage ratio of at least 17 % (combined system) from 2015 onwards. In non-residential buildings the heat generation system shall be modified to cover at least 75 % of the hot water demand from 2015 onwards.

A reduction potential of 70-80 kt CO_2 eq by 2020 is attributed to this measure.

4.2.3.3 Other relevant measures but not specified in projections

10_B Amendment of the tenancy law to facilitate thermal renovation

Austrian policy name: Änderung des Mietrechts zur Erleichterung thermischer Sanierungen

*Type: national policy (*Planned amendment of Federal Law Gazette No. 520/1981 (amended by Federal Law Gazette I No. 25/2009)

The aim of this PaM is to change the law of tenancy (Mietrecht) in order to facilitate thermal renovation. Especially the financing of renovations shall be improved by introducing minimum reserves that depend on the state and age of the building (change of condominium act).

Quantification/Projected GHG emissions/removals:

The potential emissions/removals of this measure amount to 25-35 kt CO_2 by 2020.[15]

[15] Source: BMLFUW, 2013: Internal paper "Maßnahmentabelle Bund, Stand 18.01.2013"

4.2.4 Fugitive Emissions from Fuels (CRF Source Category 1.B)

It is assumed that no measures will be implemented in this sector.

4.2.5 Industrial Processes (CRF Source Category 2)

Policies & measures relevant for the sector "industrial processes" are described in Annex 1.

The measures listed here target only F-gas emissions, as other measures relevant for the industry sector are covered in the energy sector, where measures focus on energy efficiency and the use of renewable energy sources, which also affect GHG emissions from industrial processes.

4.2.5.1 WEM F-gas measures

01_IP: Implementation of the EU F-gas regulation

Austrian policy name: Umsetzung der F-gas Richtlinie

Type: CCPM measure

EU-legislation	National Implementation	Start
Industrial Process: F-gas regulation (Regulation 842/2006/EC)	Amendment Federal Law Gazette I No 103/2009	2009

Includes a number of measures to reduce emissions such as the regular service and maintenance of refrigeration and air conditioning equipment, recovery of equipment containing F-gases, training and certification of personnel involved in the installation, servicing and maintenance of equipment and systems; reporting on imports, exports and the production of F-gases, as well as the labelling of products containing F-gases and a ban on the use of SF_6 in magnesium die casting effective from 1 January 2008, except where the quantity used is below 850 kg per year, and a ban on the use of SF_6 for the filling of tyres (effective from July 2007).

In 2009, the F-Gas regulation was implemented in Austria. It covers requirements and guidelines for training and certification of personnel involved in the installation, servicing and maintenance of equipment and systems, etc. It aims at reducing the emissions of F-gases by properly educated personnel and system maintenance, as well as the labeling of products containing F-gases.

Quantification/Projected GHG emissions/removals:

The impacts of this policy were not estimated.

02_IP Prohibition and restriction of the use of (partly) fluorinated hydrocarbons and SF6

Austrian policy name: Industriegasverordnung

Type: CCPM

EU-legislation	National Implementation	Start
Industrial Process: F-gas regulation (Regulation 842/2006/EC)	Federal Law Gazette II No. 139/2007 (amendment)	2002

In Austria this measure has been implemented by Federal Law Gazette II No. 139/2007 (Amendment) and Federal Law Gazette II No. 447/2002, but is thematically related to the EU F-gas regulation (see measure IP_01)

The use of HFCs, PFCs and SF_6 for all sectors covered in the National Inventory is banned or restricted. Where, exceptionally, their use is envisaged, strict reporting and documentation is required. The use of SF_6 as filling gas for the sound insulation of windows, shoes, and tyres was prohibited. In addition, restrictions of the use of SF_6 in foam materials were tightened. Measures in public procurement (abandonment of products containing F-gases) and public funding (criteria for federal financial support to housing construction) were implemented in the agreement 15a B-VG (Austrian Federal Constitutional Law; between the federal government and the federal provinces). The amendment of 2007 mainly focused on changes regarding the use of F-gases in refrigerants and extinguishing agents.

Quantification/Projected GHG emissions/removals:

The impacts of this PaM were not quantified.

03_IP Reducing HFC emissions from air conditioning in motor vehicles (WEM)

Austrian policy name: Verringerung von HFC Emissionen durch Klimaanlagen von Kraftfahrzeugen

Relation to EU legislation and national implementation, start/end date:

EU-legislation	National Implementation	Start
Industrial Process: HFCs in mobile air conditioning Directive 2006/40/EC	Federal Law Gazette I No. 275/2007 (Amendment)	2007
	Federal Law Gazette No. 267/1967	

This measure is the national implementation of the EU directive for HFCs in mobile air conditioning units. Car manufacturers are no longer allowed to use refrigerants with a GWP (global warming potential) higher than 150 in new passenger cars. This affects the period from 2011 – 2017.

The objective is that refrigerants in motor vehicles with a high GWP shall be banned successively.

Quantification/Projected GHG emissions/removals:

A quantification of the reduction potential of this measure is not available.

4.2.5.2 WAM F-gas measures

The quantification of WAM measures listed below concerns only F-gases, for which reason it cannot be compared with projections for the overall industry sector. Many measures listed above under the Energy/Industry section concern the industry sector as well.

04_IP: Introduction of taxes for highly effective GHGs

Austrian policy name: Einführung einer Besteuerung hochwirksamer Treibhausgase

Type: national policy

This PaM aims at reducing F-gases in cooling systems. Most F-gases are used in commercial and industrial cooling systems or stationary air-conditioners. It has been found that several barriers prevent the introduction of new and less effective GHG, e.g. the absence of alternative refrigerants on the market. A study found that abatements costs amount to less than € 13 per t CO_2[16] equivalent.

It is expected that the taxation of F-gases will lead to a substitution with less effective and cheaper GHGs, such as CO_2, in new cooling systems.

The implementation of this PaM is planned for 2014 by an amendment of the Austrian tax law.

Quantification/Projected GHG emissions/removals:

The quantification of the GHG reduction potential has been considered in the WAM scenario. This scenario leads to a reduction of about 45 kt CO_2 eq in 2015 and 90 kt CO_2 eq[17] in 2020 if HFCs were substituted in new cooling systems.

05_IP Benchmark for maximum leakage rate for cooling systems and thermal heat pumps (WAM)

Austrian policy name: Festlegung maximaler Leckageraten für Kälte- und Klimaanlagen sowie Wärmepumpen

Relation to EU legislation and national implementation, start/end date:

EU-legislation	National Implementation	Start
Industrial Process: F-gas regulation (Regulation 842/2006)	planned	

At present the leakage of refrigerants in cooling or heating installations is not officially documented. For the national inventory report only assumptions based on the amount of refilling are made.

As implemented in Germany, maximum leakage rates for refrigerants in cooling systems and thermal heat pumps shall be determined. Furthermore, a quantification of the refrigerant loss is envisaged.

Yet, the implementation of this PaM remains unclear. There are several propositions such as regulations by the commercial law or voluntary agreements.

Quantification/Projected GHG emissions/removals:

A quantification of the reduction potential of this measure is not available.

[16] Source: BMLFUW, 2013: Internal paper “Maßnahmentabelle Bund, Stand 18.01.2013”

[17] Source: BMLFUW, 2013: Internal paper “Maßnahmentabelle Bund, Stand 18.01.2013”

4.2.6 Solvents and other product use (CRF Source Category 3)

Policies and measures included in the scenario “with existing measures” of the sector “solvent and other product use” are listed in Annex 1. No measures have been identified for the WAM scenario.

4.2.6.1 WEM Solvent measures

01_SO Solvent Ordinance to reduce VOC emissions from paints and varnishes

Austrian policy name: Lösemittelverordnung

EU-legislation	National Implementation	Start date
Directive 2004/42/CE on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products,	Federal Law Gazette II No. 25/2013 (Amendment)	2013
	Federal Law Gazette II No. 398/2005 (Amendment)	2005
Directive 2010/79/EU on the adaptation to technical progress	Federal Law Gazette No. 872/1995	1995
	Federal Law Gazette No. 492/1991	1991

The Solvent Ordinance aims at limiting emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products. Therefore, the content of VOC is reduced in these products. Acidification and ground-level ozone shall be reduced.

Quantification/Projected GHG emissions/removals:

This PaM has not been quantified in the projections.

02_SO Limitation of VOC emissions by organic solvents in industrial installations

Austrian policy name: Begrenzung der Emissionen bei der Verwendung organischer Lösungsmittel in gewerblichen Betriebsanlagen

EU-legislation	National Implementation	Start date
Directive 2004/42/CE on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products	Federal Law Gazette II No. 42/2005 (Amendment)	2005
Commission Directive 2010/79/EU on the adaptation to technical progress	Federal Law Gazette II No. 301/2002	2002
	Federal Law Gazette II No. 77/2010	2010

This measure aims at limiting emissions of volatile organic compounds due to the use of organic solvents in the industry. The operators are obliged to comply with regulations concerning emission limits. For this reason regular measurements and reporting is necessary. An annual solvent balance has to be reported to the district administration.

Quantification/Projected GHG emissions/removals:

This PaM has not been quantified in the projections.

03_SO Limitation of VOC emissions by using organic solvents containing highly volatile halogenated hydrocarbons (VHH) in commercial enterprises

Austrian policy name: Begrenzung der Emissionen bei der Verwendung halogenierter organischer Lösungsmittel in gewerblichen Betriebsanlagen

EU-legislation	National Implementation	Start date
Directive 2004/42/CE on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products	Federal Law Gazette II No. 411/2005	2005
Commission Directive 2010/79/EU on the adaptation to technical progress		

The PaM aims at limiting emissions of volatile organic compounds due to the use of organic solvents that contain highly volatile halogenated hydrocarbons (VHH). Operators are obliged to comply with regulations concerning emission limits. For this reason regular measurements and reporting is necessary. An annual solvent balance has to be reported to the district administration.

The ordinance further includes general regulations concerning the construction and infrastructure of such commercial enterprises and extra regulations for chlorinated hydrocarbons.

Quantification/Projected GHG emissions/removals:

This PaM has not been quantified in the projections.

4.2.7 Agriculture (CRF Source Category 4)

The following policies and measures are considered to have been implemented and are listed in Annex 1. In most cases, quantification of individual policies and measures has not been possible. PAMs included in the WEM scenario are given in the following.

4.2.7.1 WEM Agricultural measures

01_AGR Common Agricultural Policy (CAP)

Austrian policy name: Gemeinsame Europäische Agrarpolitik

EU-legislation	National Implementation	Start
Common Agricultural Policy related regulations	planned	N.A.

The CAP reform 2003 decoupled the premiums for production that were directly linked to the output and implemented so called “single farm payments”. This subsidy is provided to farmers as direct payment just to maintain the land in good agronomic condition

All farmers that receive direct payments have to comply with the cross compliance obligations.

The so-called CAP "Health Check" took place in 2008. It aimed at verifying the correct implementation of the CAP reform 2003, where necessary adjustments had to be made. The health check reform included:

- Phasing out of milk quotas by 2015
- Further decoupling of premiums (some countries maintained coupled direct payments, e.g. Austria for suckling cows: see below)
- Support of sectors with difficulties
- Shift of funds to the rural development budget
- Abolition of set-aside of arable land
- Simplification of cross compliance, addition of new requirements
- Abolition of intervention mechanism for pig meat, barley and sorghum
- Abolition of energy crop premium.

In 2014, a new CAP reform will be implemented and impacts cannot be estimated at present. But it can be expected that environmental issues remain important in the new CAP framework (key word "greening").

02_AGR Fulfilling Cross compliance requirements

Austrian policy name: Erfüllung der Cross Compliance Verpflichtungen

EU-legislation	National Implementation	Start
73 Common Agricultural Policy (CAP) – CAP "Health Check" 2008 and the "Set aside" regulation (73/2009 repealing regulation 1782/2003), etc.	Federal Law Gazette I No. 492/2009 (last amendment), etc.	2010

The Cross Compliance (CC) requirements have to be fulfilled by farmers in order to profit from direct payments. They have to guarantee that e.g. the agricultural land is kept in good agricultural and environmental condition. Others refer to a range of regulations and standards related to soil protection, maintenance of soil organic matter and structure, avoiding the deterioration of habitats, and water management.

The minimum standard for a "good ecological condition" is regulated in the INVENKOS ordinance (Federal Law Gazette II No. 31/2008).

In Austria, CC requirements have to be met by:

- Recipients of direct payments from the market regulation (Marktverordnung 2005)
- Recipients of payments from the Programme for Rural Development and ÖPUL
- Others (Weinmarktordnung).

For the next CAP period 2014-2020 all direct payments have to fulfill the cross compliance.

Relevant CC measures for climate protection are:

- Protection of water bodies from nitrate pollution
- Maintenance of land in good agricultural and ecological condition
- Conservation of permanent grassland

03_AGR Programme for rural development 2007-2013 (followed by the Programme for rural development 2014-2020)

Austrian policy name: Österreichisches Programm für die Entwicklung des Ländlichen Raums 2007-2013

EU-legislation	National Implementation	Start
Council Regulation (EC) No. 1698/2005.	Österreichisches Programm für die Entwicklung des Ländlichen Raums 2007-2013	2007-2013/ 2014-2020

Although the programme expires in 2013, most of the measures included hereunder will continue to be effective in the following programming period (2014-2020) and have therefore been included in the WEM projections.

The Austrian Programme for rural development 2007-2013 was accepted by the European Commission on the 25 October, 2007. In accordance with EU Directive 1698/2005, the following major objectives were defined:

- Improving the competitiveness of agriculture and forestry by supporting restructuring, development and innovation;
- improving the environment and the countryside by supporting land management (agri-environmental measures);
- improving the quality of life in rural areas and encouraging diversification of economic activity.

Besides these issues the programme also includes the so-called LEADER approach. It includes the support of local initiative groups in the context of community responsibility that promote rural development.

The Ministry of Agriculture, Forestry, Environment and Water Management is responsible for the administration of the programme in coordination with the federal provinces.

The programme implementation is accompanied by a committee (Begleitausschuss Ländliche Entwicklung 2007-2013) that also acts as a platform for exchange of information, lessons learned and for assessment.

The agri-environmental programme includes several measures to reduce GHG emissions from the agricultural sector, e.g.:

- Renunciation of yield-increasing inputs on arable lands and grasslands
- Mulching of arable land and direct sowing
- Low-loss application of liquid manure and biogas slurry.

The following special guidelines are directly linked with the programme:

ÖPUL, Compensation Allowance for less favourable areas (Ausgleichszulage), Natura 2000 protection, Water and Forest, Leader and other measures.

04_AGR Modulation of direct payments

Austrian policy name: Reduktion der Direktzahlungen (Modulation)

Type: CCPM

EU-legislation	National Implementation	Start
Common Agricultural Policy (CAP) – CAP “Health Check“ 2008 and the “Set aside“ regulation (73/2009 repealing regulation 1782/2003), etc.	Federal Law Gazette II No. 330/2011 (last amendment)	2011

Modulation is a compulsory transfer, each year, of a percentage of funds from Pillar 1 to Pillar 2. Direct payments to larger farms (above a threshold of € 5,000) will be gradually reduced.

4.2.7.2 WAM Agricultural measures

05_AGR Promotion of grazing for cows

Austrian policy name: Weidehaltung von Kühen

Type: national policy

The grazing of cattle causes lower GHG emissions than indoor husbandry. Through counselling and financial support the share of pasture management shall be increased or at least maintained. In the suckling cow husbandry the outdoor share could be increased, while this seems hardly possible in dairy farming.

Assumptions:

Currently in suckling cow husbandry the share of manure excreted on pastures is 14.3 %, according to the Austrian GHG Inventory. It is assumed that this rate will be increased by 5 %: in 2020 19.3 per cent of the manure will be excreted on pasture by suckling cows.

Quantification/Projected GHG emissions/removals:

The reduction effect in GHG is limited, as only the summer period can be influenced thereby. The calculated reduction of GHG amounts to 1 kt CO_2 eq. in 2020.

06_AGR Decoupling of premiums for suckling cows

Austrian policy name: Entkoppelung bei der Mutterkuhhaltung

Type: EU/national policy

One of the few production-linked direct payments under the CAP is the premium for suckling cows.

A decoupling of this premium would possibly reduce the beef production, which, in turn, would lead to a decrease in the total number of cattle. A return to milk production seems only feasible for farms with both meat and milk production because of the expected investments. So, a further decline in the grassland use by cattle and a slight increase in dairy farming can be predicted.

Assumptions:

Currently there are about 260,000 suckling cows. The number of suckling cows will be reduced by 10 % (26,000 units), of which half will be converted to dairy cows.

Quantification/Projected GHG emissions/removals:

The calculated reduction of GHG emissions will be about 28 kt CO_2 equivalents. However, it should be noted that the positive effect of this measure could be compensated, if more farmers shift from suckling cow production to milk production. This measure therefore only leads to a reduction in emissions, provided it entails no further intensification of livestock.

07_AGR Adapted feeding (in phases) for pigs

Austrian policy name: N-angepasste Fütterung von Schweinen

Type: national policy

The composition of pig feed should be varied depending on the growth phases of pigs. In the juvenile phase the supply of digestible protein should be higher than in later phases. Technically phase feeding can be planned and usually includes financial benefits. The influence of phase feeding on the total N uptake and thus reduced N excretion in manure reduces GHG emissions. Advisory activities could help increase the use of phase feeding.

Assumptions:

It is assumed that phase feeding lowers the N content of pig manure by 10 %. The extent to which phase feeding is used in pig farming is unknown. It is assumed that 40 % of fattening pigs are kept without notable phase feeding. This percentage may be reduced by half by consultations and investment support.

Quantification/Projected GHG emissions/removals:

The calculations showed a GHG reduction potential of 4 kt CO_2 eq.

08_AGR Covering of slurry storages

Austrian policy name: Abdeckung der Güllelager

Type: national policy

The loss of ammonia through open slurry storage is significant. This goes along with nutrient losses and an increase in indirect GHG emissions. The promotion of technically appropriate and low-priced covering has been hardly implemented, so far. Various instruments such as investment support (slurry storage with cover) and legal requirements for new buildings are under discussion.

Assumptions:

The available data on the degree of covering is poor. It is assumed that currently about 40 % of the produced slurry is stored without adequate covering. By 2020, the proportion of open slurry storage shall be halved.

Quantification/Projected GHG emissions/removals:

The calculations resulted in a GHG reduction potential of 3 kt CO_2 eq for the year 2020.

09_AGR Fermentation of liquid manure

Austrian policy name: Güllevergärung

Type: national policy

Until now, manure is fermented only to a small extent, because compared to corn silage the energy density is low. As excretion from livestock, it arises as a resource free of costs. Anyhow, under the current conditions, fermentation plants based on liquid manure are not profitable.

Assumptions:

20 % of the manure is fermented. This measure requires high investments in manure biogas plants, because profitability could only be ensured with a feed-in tariff of about 25 cents per kWh. The manure share in the fermentation substrate should be at least 70 %.

Quantification/Projected GHG emissions/removals:

The quantified reduction of GHG emissions in the agriculture sector is 149 kt CO_2 equivalents. The additional CO_2 savings by substituting fossil fuels in power generation is not included here, but has an impact on the energy sector.

10_AGR band spreading of liquid manure

Austrian policy name: Bodennahe Gülleausbringung

Type: national policy

The application of manure in the conventional way causes considerable ammonia air emissions and economic losses for the farms, as nitrogen is lost. The promotion of band spreading techniques has already been established in the ÖPUL. However, this technique cannot be used on steep terrain.

Assumptions:

Currently, about 2.3 million m³ of liquid manure are applied by band spreading. It is assumed that by 2020 band spreading techniques can be increased by another 20 %. This measure requires investments in appropriate equipment.

Quantification/Projected GHG emissions/removals:

Due to reduced ammonia losses more nitrogen reaches the soil, where it figures in the national greenhouse gas balance as a source of direct GHG emissions. Thus, there is no significant reduction in GHG emissions, but reduced amounts of the air pollutant ammonia. Through efficient, low-loss application of manure fertilizer a smaller amount of mineral fertilizer is needed. This effect was not quantified here.

11_AGR ÖPUL measures that lead to a reduction in the use of mineral fertilizers

Austrian policy name: ÖPUL Maßnahmen, die zu einer Reduktion des Mineraldüngereinsatzes führen

Type: national policy

Existing ÖPUL measures have led to a significant reduction of mineral fertilizer application.

Assumptions:

Assuming a tightening of the provisions within ÖPUL, a 5 % reduction of the projected amount of mineral fertilizers can be assumed.

Quantification/Projected GHG emissions/removals:

The calculated GHG reduction amounts to 48 kt CO_2-eq. in 2020.

12_AGR Short-rotation areas

Austrian policy name: Kurzumtriebsflächen

Type: national policy

The expansion of areas where fast-growing plants (poplar, willow, etc.) are produced reduces the need for fuel, fertilizer and plant protection on agricultural land. As a result, GHG emissions can be saved, although reduced CO_2 emissions due to less fuel consumption affect the transport sector.

Assumptions:

Currently about 1,000 ha short-rotation areas are managed. By providing appropriate incentives, this area could be increased to 6,000 hectares.

Quantification/Projected GHG emissions/removals:

An evaluation of these additional 5,000 hectares of short rotation areas resulted in a saving of 413 tons of N-fertilizer and 0.55 million liters of diesel compared to conventionally managed farmland. The determined GHG reduction amounts to approximately 5 kt of CO_2 equivalent.

13_AGR Sustainable N management

Austrian policy name: Nachhaltiges Stickstoffmanagement (Rasche Einarbeitung der Gülle, Leguminosenanbau und Einarbeitung von Ernterückständen, Winterbegrünung, Kompostwirtschaft)

Type: national policy

This measure consists of a multitude of individual aspects, which usually do not occur independently. By giving sufficient consideration to these aspects, they should reduce the use of mineral fertilizers. This includes for example the efficiency increase in fertilizer use by customized storage for manure, the proper use of fertilizers in general, or the establishment of manure exchanges. The application of manure could be done timely through increased cooperation during application. The cultivation of legumes and the rapid incorporation of fertilizers as well as the use of compost contribute to reduced amounts of mineral fertiliser being used, provided that these aspects are taking into account when planning fertilizer use.

Assumption:

By implementing all measures mentioned above the mineral fertilizer consumption (currently in the order of 100,000t N) can be reduced by 3 % (± 2 %).

Quantification/Projected GHG emissions/removals:

A sustainable nitrogen management shows a markedly positive impact on the amount of fertilizer used and therefore on the GHG emissions. The calculated savings amount to 21 kt CO_2 equivalents.

14_AGR Organic Farming

Austrian policy name: Biologischer Landbau

Type: national policy

The efficient ÖPUL measure “organic farming” achieved through systematic closed cycle management avoids the use of mineral fertilizer. Currently, about 414,000 hectares of agricultural land are managed with organic farming practices. An increase of this area is deemed feasible.

Assumption:

The organic cropland was increased by 25,000 ha. The associated lower fertilizer consumption has a positive effect on GHG emissions.

Quantification/Projected GHG emissions/removals:

The calculations show a reduction potential of 17 kt CO_2 eq by 2020.

4.2.7.3 Other measures not specified in projections

15_AGR Reduced soil tillage – mulching and direct sowing

Austrian policy name: Schonende Bodenbearbeitung

Type: national policy

Conservation tillage systems such as mulching or direct sowing result in considerable fuel savings. This includes the equipment of tractors with multiple machines, which reduce the vehicle crossings. A possibly higher application rate of herbicides is to be considered as an offset.

Assumption:

Currently the ÖPUL measure “mulching and direct sowing” is applied to 140,000 ha. It is assumed that this proportion will increase to 280,000ha.

Quantification/Projected GHG emissions/removals:

The fuel savings through conservation tillage systems is about 10 liters of diesel per hectare, resulting in total savings of about 2.8 million liters of diesel. The estimated reduction in GHG emissions amounts to 6.7 kt of CO_2 equivalents. It has to be mentioned that this CO_2 emission reduction affects the transport sector for which reason it is not included in WEM or WAM.

16_AGR “Ecodriving” for tractors

Austrian policy name: Eco-driving

Type: national policy

The CO_2 emissions from the agricultural sector are caused by fuel use. By fuel saving training for tractor drivers, the consumption of fuel per hectare can be significantly affected. A key element, however, is the suitability of machines/vehicles for the working processes (e.g. light tractors for light work). This is not always possible because farms generally only have a limited number of machines/vehicles.

Assumptions:

Yearly 500 tractor drivers are trained. This measure could be integrated into the tractor license training, and refresher courses are held regularly. For calculation reason each driver cultivates about 40 hectares, starting from an average consumption of about 100 litres per hectare agricultural land per year, a saving of 5-10 % in fuel consumption can be achieved. For the evaluation fuel savings of 10l/ha were assumed, whereby annually 200,000 liters of diesel can be saved. This results in 1.6 million liters of diesel for 2020.

Quantification/Projected GHG emissions/removals:

Enforced ecodriving leads to significant fuel and CO_2 savings. The calculated reduction potential amounts to 4 kt CO_2 -eq in 2020. The effect of this measure is not attributed to the agricultural sector, but to transport. It is not displayed individually in the reporting template.

17_AGR Replacement of diesel fuel by biofuel (from oilseeds)

Austrian policy name: Ersatz des Dieselölverbrauchs in der Landwirtschaft durch Pflanzenöl-Treibstoff

Type: national policy

For land cultivation often powerful machines with high fuel consumption rates are used. It is planned to switch from fossil fuels to bio fuels, namely to increase the share of colza and sunflower oil to 3 %. Existing tractors and stationary machines shall be modified. In addition, the purchase of new machines that run on bio fuels could be promoted.

This measure will most probably be implemented by means of voluntary agreements with farmers.

Quantification/Projected GHG emissions/removals:

The emission reduction potential of this measure amounts to 20 kt CO_2 by 2020.[18] This measure affects the sector transport, not the sector agriculture. It is not displayed individually in the reporting template.

4.2.8 Land use, Land-Use Change and Forestry (CRF Source Category 5)

No specific policies and measures can be mentioned for the LULCF sector, although there are several measures listed in the sections above which are of relevance for the LULUCF sector, because they aim at increasing the share of renewable energy sources such as biomass and switching to fuels with lower (fossil) carbon content, or they are part of rural development measures. Quantification of any programmes or initiatives listed below cannot be given, due to a lack of data, and overlapping objectives.

[18] Source: BMLFUW, 2013

Description of relevant programmes/Initiatives

The **Austrian Government Programme** of the current legislative period (2008–2013) includes a strong mandate to further mobilise the domestic supply of woody biomass for energy purposes so as to increase energy security and self-sufficiency while reducing dependence on fuel imports.

The Federal Ministry for Agriculture, Forestry, Environment and Water Management initiated a multi stakeholder process in April 2003 in order to start a dialogue between all different interest groups and to improve coordination of forest related activities. Within three years, the first **Austrian Forest Dialogue Programme** (Walddialog) was developed identifying a variety of important topics, objectives and measures for the Austrian forests. With the aim of mitigating climate change, the following main goal was identified: To increase the use of wood as a renewable raw material (as material and for the generation of energy), which is the best possible substitution of fossil materials.

The following mitigation measures have been identified to support the thematic issue of the "contribution of Austrian forests to climate change mitigation":

- Organisation of information and awareness raising campaigns to support the increased demand in woody biomass (cross reference to the Biomass Action Plan);
- Mobilisation of woody biomass production by taking into account market developments and environmental circumstances
- Launching of the topic on "wood and timber for energy" ("klima:aktiv" Energieholz)
- Performing a "wood and biomass supply study", which forms the basis for establishing a reference
- Establishment of a "Task Force on Renewable Energy" to evaluate future supplies of domestic biomass (see below).

In 2006 the **Task Force "Renewable Energ**y" was established. It comprises experts and stakeholders from the forest sector. Its aim is to define the domestic supply of all sorts of renewable energy sources, including forest biomass. The final report of this task force corroborates the findings of the wood and biomass supply study which forms the basis for establishing the reference level.

In March 2009 the **Action Programme "Timber Flow" ("Aktionsprogramm Holzfluss 2008-2013")** was launched by the Federal Ministry for Agriculture, Forestry, Environment and Water Management to support a number of measures specified in the Austrian Forest Dialogue, such as the preparation of forest management plans, the construction of forest roads, the purchasing of equipment and cooperation with(in) the forest sector. The Action Programme has been endowed with 100 million €.

In the meantime several thematic programmes have been launched under **klima:aktiv**, supporting inter alia:

- the mobilisation of woody biomass for energy purposes ("klima:aktiv" Energieholz), which has increased the use of forest biomass by 2 million m³ since 2005 and
- increasing the share of woody biomass used for the production of heat in the residential sector ("klima:aktiv Erneuerbare Wärme").

Cooperative wood harvesting is an appropriate measure to mobilise wood production for energy especially on small scale forest holdings. One of the major actors is the Austrian Forest Owner Cooperative (Waldverband) a dedicated organisation within the Austrian Chamber of Agriculture, which provides a platform for 8 regional forest cooperatives to enable collective performance. The major goal of this cooperative is to increase the amount of wood harvested by combining their production and marketing activities. The results of the latest National Forest Inventory 07/09 show that wood mobilisation initiatives on small scale forest holdings increased by more than 50 % compared to the former National Forest Inventory 2000/02. These initiatives are also closely linked to measures adopted under the Austrian Forest Dialogue.

Interactions:

In the following the interaction with policies and measures from other sectors is briefly described:

- **Austrian Programme for rural development 2007-2013 (03_AGR):**
  The programme supports the following measures to improve the competitiveness of the forestry sector:
  - Cooperation of small-scale forest owners, e.g. for the acquisition of machinery through associations of forest owners or members of machinery pool associations.
  - Introduction of new technologies and innovations in the production process to improve the quality of forestry products.
  - Cooperation in the development of new products, processes and technologies including improvements of information transfer, strengthening efficiency and promoting services for forest owner associations. 2.5 million m^3 of timber harvested have already been marketed jointly by subsidised forest management communities.
  - Providing infrastructure, i.e. forest roads to improve forest management, and making provisions for the management of future extreme events resulting from climate change.
  - Product diversification in the agricultural and forestry sector and renewable energy supply in rural areas by promoting investments in bio energy installations, such as CHP, local heat supply and heat distribution grids.
- **Domestic environmental support scheme (UFI) (05_EN):**
  The main objective of this subsidy is to provide economic incentives for companies to implement measures in the field of energy efficiency, climate change mitigation and environmental protection. The following table represents the relevant biomass-related project categories for the energy supply subsector: biomass district heating systems, combined heat and power production from biomass. The focus during the period 2004–2007 was on biomass use and biomass powered combined heat and power plants (about 87 % of the supported projects) (see Table 22).
- Other interactions occur with the energy sector (e.g. Green Electricity Act) and the building sector (e.g. Change of heating systems in buildings, Efficient new buildings).

Table 22: The domestic environmental support scheme, 2004–2007: subsector “energy supply” (BMLFUW & KOMMUNAL KREDIT (2011))

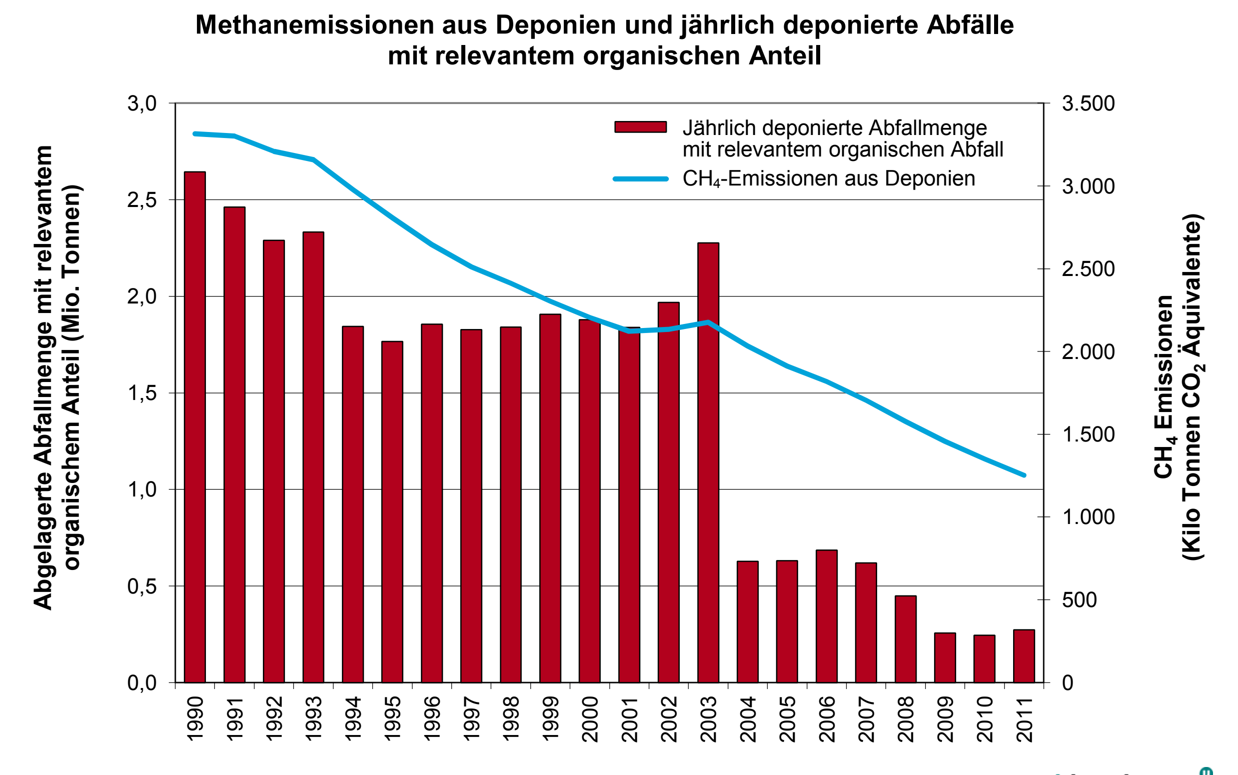
2007-2011	Number of projects	Environment related investment costs [million €]
Biomass district heating systems	284	259
Biomass – CHP	2	0,7

4.2.9 Waste (CRF Source Category 6)

The policies and measures included in the scenario “with existing measures” of the sector waste are given in Annex 1.

Important measures identified for the sector waste basically concern existing ones, for which reason no additional measures are included here. The WEM scenario for waste considers that the amount of waste and carbon content respectively being deposited has decreased strongly mainly because of the landfill ordinance, but also because waste incineration and other treatments are gaining importance. This trend is also made visible by the indicator “annually deposited waste/CH_4 emissions” (see the Figure 40 below).

Two measures listed at the end of this chapter are not specified in the scenarios, because their effect is not considered in the GHG inventory for waste either.



Source: Umweltbundesamt

Figure 40: Methane emissions from landfills and annually deposited waste with relevant organic carbon content

4.2.9.1 WEM Waste measures

In the waste sector only two measures are relevant for the WEM scenario.

01_WASTE: Landfill Ordinance (WEM)

Austrian policy name: Deponieverordnung

Type: Implementation of CCPM

EU-legislation	National Implementation	Start
Landfill Directive 1999/31/EC	Federal Law Gazette No. 164/1996, Federal Law Gazette II No. 39/2008	1997/NA

The most important measure in the waste sector is the implementation of the Austrian Landfill Ordinance (Federal Law Gazette No. 164/1996 as amended in 2004 – Federal Law Gazette No. 49/2004) according to the Austrian Waste Management Act. In 2008, this Ordinance was replaced by the Austrian Landfill Ordinance 2008 (Federal Law Gazette II No. 39/2008), which basically includes the same provisions for the treatment and disposal of wastes.

According to this Ordinance, the deposition of untreated biodegradable waste has been forbidden since 2004. However, exemptions were possible until the year 2008, and several provinces made use of them. But since then only landfilling of pre-treated wastes has been allowed. Methane emissions from landfills are thus expected to decrease continuously, due to reduced amounts and carbon content of waste being deposited. Waste incineration and the mechanical-biological treatment of waste are (pre-)treatment options that will continue playing an important role in reducing emissions from solid waste disposal.

The landfill ordinance is still the most effective policy for reducing emissions in the waste sector, this trend will also continue without the setting of further measures. Emissions are expected to decrease from 1,350 in 2010 to 670 kt CO_2 equivalents in 2020.

The implementation of the Landfill Directive is still ongoing and in the coming years will focus on (1) management of the water balance followed by aerobic in-situ stabilisation of closed landfills and (2) increasing efforts to collect produced landfill gas (e.g. through detection of leakages, examination of gas collection systems):

Quantification/Projected GHG emissions/removals:

Currently no quantified emission reduction can be attributed to this measure. But in 2013, a survey of gas collection systems will be undertaken, which will reflect the measure and serve to estimate the potential of this measure.

02_Waste: Emission reduction from mechanical biological treatment plants

Austrian policy name: Emissionsreduktion aus MBA

Type: national policy

Mechanical biological treatment of biodegradable wastes prior to landfilling reduces the gas formation potential. The Guideline for the Mechanical Biological Treatment of Wastes was prepared after expert consultations with the Environment Agency Austria in 2002. The purpose of this Guideline is to ensure consistent state-of-the-art process technology for mechanical biological treatment.

To reduce emissions from MBT plants an ordinance is being prepared in Austria to introduce binding emission limits inter alia for TOC and N_2O emissions. It has to be considered that exhaust air purification by thermal processes will contribute to increasing emissions, whereby the consumption of heating gas depends on the TOC-content in the exhaust air.

Quantification/Projected GHG emissions/removals:

It will only be possible to accurately quantify this measure once the Ordinance has finally come into force, and the final agreement on its emission limits reached. Nevertheless, the expected effect on the stock of plants and activities (waste input amounts) of mechanical-biological treatment plants have been taken into account in the projections (in the sectors Solid Waste Disposal and Other Waste).

4.2.9.2 Other relevant waste measures not specified in projections

03_WASTE: Obligatory covering of fermentation residue tanks (WEM)

Austrian policy name: Verpflichtende Abdeckung von Gärrestlagern

Type: national policy

Biogenic waste is treated in fermentation plants, whereby the covering of these tanks effectively contributes to a reduction of diffuse methane emissions and allows the collection of methane emissions, which can be used energetically.

This could be regulated in the Austrian Ordinance on Waste Treatment Obligations (Federal Law Gazette II No. 459/2004), but has not been included yet.

Quantification/Projected GHG emissions/removals:

Emissions from the storage of fermentation residues in tanks are currently not included in the GHG inventory – and hence not considered in the projection either – as it is currently not obligatory to report this source under the UNFCCC (IPCC Revised 1996 IPCC Guidelines).[19]

04_WASTE: Increased production of biogas as a product of waste treatment

➔ Note: This measure has not been included in the reporting template as it is covered in EN02.

Austrian policy name: Steigerung der Biogasproduktion aus Abfällen

Type: national policy

The amount of biogenic waste treated in biogas plants shall be increased. The profitability of refining biogas to bio methane which can e.g. be fed into the natural gas grid shall be improved. Further the feed-in tariffs for electricity produced from biogas shall be raised. This would lead to higher emissions in the waste sector as fermentation can lead to higher emissions than composting. But it would indirectly lead to lower emissions in the energy supply sector, because fossil fuel is replaced.

This measure is strongly linked to the energy supply sector and is therefore covered in measure EN02.

[19] The IPCC 2006 Guidelines includes emissions from anaerobic digestion of organic waste, but is only obligatory for GHG reporting from 2015 on.

5 SCENARIO DEFINITION

5.1 Definition of the Scenarios by Summing up Relevant Policies & Measures

Both scenarios – the "with existing measures" (WEM) and the "with additional measures" (WAM) – contain a combination of all measures combined. The effects of single measures or groups of measures are presented in Annex 1 (reporting template).

The scenario "with existing measures" includes measures implemented before 8 March 2012. The scenario definition table lists all measures described above.

The scenario "with additional measures" additionally takes into account planned policies and measures with a realistic chance of being adopted and implemented in time to influence the emissions.

The selection process for measures to be considered for both scenarios has been carried out by sectoral experts in consultation with the Federal Ministry of Agriculture, Forestry, Environment and Water Management and in cooperation with the respective modelling teams.

Some measures are not specified in projections due to various reasons (already implemented and regarded as WOM, emission reductions not allocated in the specific sector, outdated measures, measure with unknown effect, etc.)

- 06_EN Combined Heat and Power Act (CHP)
- 09_EN Research Initiative for Industrial Processes and Pilot Plants
- 18_TRA CO_2 Labeling for passenger cars
- 19_TRA Promotion of the purchase of clean and energy-efficient cars
- 20_TRA Implementation of EURO 5 and EURO 6 standards
- 21_TRA ACEA voluntary agreement
- 15_AGR Reduced soil tillage – mulching and direct sowing
- 16_AGR "Ecodriving" for tractors
- 17_AGR Replacement of diesel fuel by vegetable oil (from oilseeds)
- 03_WASTE Obligatory covering of fermentation residue tanks.

5.2 Scenario "with existing measures"

Table 23: PAMs included in the scenario "with existing measures"

CRF	Policies & Measures
1.A.1 Energy industries and 1.A.2 Manufacturing Industries and Construction	Energy related measures are defined in the energy projections. The following measures and regulations which are relevant for the sector energy industries have been considered: 01_EN Emission Trading Scheme 02_EN Green Electricity Act 03_EN Consequences of the EU Water Framework Directive 04_Implementation of the National Energy Efficiency Action Plan 2011 05_EN Domestic Environmental Support Scheme (UFI)

CRF	Policies & Measures
1.A.3 Transport	01_TRA Promotion of Biofuels – Implementation of Directive 2006/38/EC 02_TRA Fuel tax increase 2011 (“Klimabeitrag”) 03_ klima:aktiv mobility programme 04_TRA Greening the truck toll 05_TRA Greening the consumption tax (NoVA) 06_TRA Promotion of corporate rail connections 07_ Fuel saving initiative 08_TRA Telematics and existing speed limits of IG-L 09_TRA Implementation plan for electric mobility 10_TRA Economic incentive: fuel tax increase in 2015 and 2019 11_TRA Further greening of the consumption tax (NOVA) 12_TRA Nationwide speed limits 13_TRA Mobility management including Master Plan Bicycle and Master Plan Pedestrians 14_TRA Trend electro-mobility – promoting electric vehicles according to the Austrian Energy Strategy 15_TRA Commuter tax reform (job ticket) 16_TRA Implementation of the new infrastructure costs directive 17_TRA implementation of the National Action Plan Danube Navigation (NAP)
1.A.4 & 1.A.5 Other Sectors (Residential, Commercial, Agriculture and Other)	01_B Efficient new buildings 02_B Thermal insulation of existing buildings 03_B change of heating systems 04_B Eco-design requirements for energy using products 05_B End-use efficiency and energy services 06_B Recast directive of energy performance of buildings 07_B Energy labelling of household appliances
1.B Fugitive Emissions from fuels	No policies and measures.
2 Industrial Processes	01_IP Implementation of the EU F-gas regulation 02_IP Prohibition and restriction of the use of (partly fluorinated hydrocarbons and SF6 03_IP Reducing HFC emissions from air conditioning in motor vehicles
3 Solvent and Other Product Use	01_SO Solvent Ordinance to reduce VOC emission from paints and varnishes 02_SO Limitation of VOC emissions by organic solvents in industrial installations 03_SO Limitation of VOC emissions by using organic solvents containing highly volatile halogenated hydrocarbons (VHH) in industrial installations
4 Agriculture	01_AGR Common Agricultural Policy (CAP) 2003 02_AGR Fulfilling cross compliance 03_AGR Programme for rural development 04_AGR Modulation of direct payments
6 Waste	01_WASTE Landfill Ordinance 02_WASTE Emission reduction from mechanical biological treatment plants

5.3 Scenario "with additional measures"

Table 24: PAMs included in the scenario "with additional measures".

CRF	Measures
1.A.1 Energy Industries and 1.A.2 Manufacturing Industries and Construction	07_EN Energy Efficiency Act draft 2012 08_EN Green Electricity Act – beyond 2020
1.A.3 Transport	10_TRA Fuel tax increase in 2014 and 2019 11_TRA Further greening of consumption tax 12_Nation wide speed limits 13_TRA Master plan bicycle and pedestrian master plan 14_TRA Promoting electric vehicles according to the Austrian Energy Strategy 15_TRA Commuter tax reform (job ticket) 16_TRA Implementation of the new Infrastructure Cost Directive 2011/76/EG 17_TRA Implementation of National Action Plan Danube Navigation (NAP)
1.A.4 & 1.A.5 Other Sectors (Residential, Commercial, Agriculture and Other)	08_B Enforced thermal insulation 09_B Promote efficient and climate friendly heating systems
1.B Fugitive Emissions from Fuels	There are no additional sector-specific measures
2 Industrial Processes	04_IP Introduction of taxes for highly effective GHGs 05_IP Benchmark for maximum leakage rate for cooling systems and thermal heat pumps
3 Solvent and Other Product Use	There are no sector-specific additional measures
4 Agriculture	05_AGR Promotion of grazing for cows and suckling cows 06_AGR Decoupling of premiums for suckling cows 07_AGR Adapted feeding (in phases) for pigs 08_AGR Coverage of slurry storages 09_AGR Fermentation of liquid manure 10_AGR Band spreading of liquid manure 11_AGR ÖPUL measures that lead to a reduction in the use of mineral fertilizers 12_AGR Short rotation areas 13_AGR Sustainable N management 14_AGR Organic Farming
6 Waste	A discussion with experts about additional measures in the sector waste has come to the conclusion that no additional measures in the field of waste management are foreseen until 2020. State-of–the-art technology of the landfill facilities and mechanical biological plants available is fully developed and the separate collection and recycling of biodegradable waste has reached a high level.

6 CHANGES WITH RESPECT TO THE SUBMISSION OF 2011

Changes compared to the last GHG emission projections of 2011 are presented in this chapter. In general, there are three main factors influencing these changes:

1. Recalculations in the GHG inventory triggered by methodological changes. This has led to recalculations of the emission projections, as the methods have to be applied consistently for the calculation of historical and forecast emissions.
2. Assumptions for activity forecasts have changed. These changes can be triggered by revised economic or technical scenarios, additional policies and measures considered, and revisions of policies or measures due to amendments to legal texts.
3. Changes of the models used for activity or emission scenarios.

The following table shows a comparison of the historical and forecast national emission totals.

Table 25: Comparison of projections 2009, 2011 and 2013 – national Totals (in Gg CO_2e).

Total – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2009	79 037	92 832	93 873	95 473	98 112		
Projections 2011	78 171	92 916	85 237	86 096	87 333	89 098	90 847
Projections 2013	78 162	92 880	84 594	82 441	81 636	82 759	84 034
Difference 2013/11	– 9	– 36	– 643	– 3 655	– 5 697	– 6 339	– 6 813
Total – WAM							
Projections 2009	79 037	92 832	92 871	91 582	89 605		
Projections 2011	78 171	92 916	84 594	80 447	78 911	76 552	77 395
Projections 2013	78 162	92 880	84 594	80 103	77 502	77 617	78 064
Difference 2013/11	– 9	– 36	0	– 344	– 1 409	1 065	668

The following tables present the changes of historical and forecast emissions by sector.

6.1.1 Energy Industries (1.A.1)

Table 26: Comparison of projections 2009, 2011 and 2013 – Energy Industries (in Gg CO_2e).

1.A.1 – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2009	13 844	16 167	17 518	17 193	18 554		
Projections 2011	13 842	16 184	12 605	10 671	10 910	12 005	12 842
Projections 2013	13 842	16 359	14 293	12 301	11 416	12 155	12 815
Difference 2013/11	0	175	1 688	1 630	506	150	– 27
1.A.1 – WAM							
Projections 2009	13 844	16 167	16 763	15 230	13 988		
Projections 2011	13 842	16 184	11 998	10 072	9 439	10 026	11 233
Projections 2013	13 842	16 359	14 293	12 238	11 137	11 367	11 826
Difference 2013/11	0	175	2 295	2 166	1 698	1 342	593

Revisions are mainly due to updates of the national energy balance, which has also been published in more detail since 2010. Furthermore the adjustment with the input data of the models has been facilitated.

6.1.2 Manufacturing Industries and Construction (1.A.2)

Table 27: Comparison of projections 2009, 2011 and 2013 – Manufacturing Industries and Construction (in Gg CO_2e).

1.A.2 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2009	12 773	15 832	15 767	17 011	18 045		
Projections 2011	12 772	16 143	16 110	17 616	19 030	20 504	22 217
Projections 2013	12 774	16 526	15 618	15 595	16 268	17 215	18 350
Difference 2013/11	1	383	– 492	– 2 021	– 2 761	– 3 289	– 3 867
1.A.2 – WAM							
Projections 2009	12 773	15 832	15 767	17 011	18 045		
Projections 2011	12 772	16 143	16 132	17 584	18 975	20 412	22 110
Projections 2013	12 774	16 526	15 618	15 372	15 774	16 419	17 171
Difference 2013/11	1	383	– 514	– 2 211	– 3 201	– 3 993	– 4 939

As the national energy balance has been published in more detail since 2010, the adjustment with the input data of the models has been facilitated.

For the projections in 2011 an average GDP growth of 2 % p.a. was used. For the projections in 2013 the average GDP growth was estimated at 1.5 % p.a. Hence, energy demand and thus emissions are significantly lower in the current projections.

6.1.3 Transport (CRF Source Category 1.A.3)

Table 28: Comparison of projections 2009, 2011 and 2013 – Transport (in Gg CO_2e).

1.A.3 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2009	14 023	25 340	24 043	25 460	26 329		
Projections 2011	14 010	24 981	23 308	24 850	24 872	24 684	24 513
Projections 2013	14 030	25 040	22 452	23 695	23 800	23 931	23 965
Difference 2013/11	20	59	– 856	– 1 155	– 1 071	– 753	– 548
1.A.3 – WAM							
Projections 2009	14 023	25 340	23 883	24 194	24 224		
Projections 2011	14 010	24 981	23 316	20 684	19 927	16 976	16 101
Projections 2013	14 030	25 040	22 452	21 914	21 111	21 244	21 247
Difference 2013/11	20	59	– 864	1 230	1 184	4 268	5 146

It can be seen that GHG emissions of both scenarios (WEM and WAM) of the 2013 submission are lower compared to the 2011 submission. The two main reasons for this are:

- in the 2013 submission a lower annual GDP increase was assumed (1.5 % vs. 2 %) resulting in less transport (UMWELTBUNDESAMT 2013b)

- new assumptions in the 2013 submissions about the common practices of Austrian hauliers registering trucks and/or hiring driver personnel abroad (especially in Eastern European countries) (SCHRAMM 2009) resulting in a shift of fuel export abroad leading to a lower amount of fuel export and lower GHG emissions (HAUSBERGER & SCHWINGSHACKL 2012).

Especially the WAM scenario in the 2013 submission is not as optimistic as the 2011 submission, which is mainly due to a different set of measures considered and minor fuel tax increases between 2012 and 2020 compared to the 2011 projections, resulting in a lower level of GHG reduction.

6.1.4 Other Sectors (CRF Source Category 1.A.4 & 1.A.5)

Table 29: Comparison of projections 2009, 2011 and 2013 – Other Energy Sectors (in Gg CO_2e).

1.A.4 & 1.A.5 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2009	14 468	13 690	14 455	13 649	12 789		
Projections 2011	14 468	14 435	12 089	11 173	10 244	9 161	8 067
Projections 2013	14 441	13 748	11 448	10 646	9 705	8 673	7 700
Difference 2013/11	– 27	– 688	– 641	– 528	– 538	– 488	– 366
1.A.4 & 1.A.5 – WAM							
Projections 2009	14 468	13 690	14 436	13 022	10 991		
Projections 2011	14 468	14 435	12 059	10 742	9 257	7 676	6 297
Projections 2013	14 441	13 748	11 448	10 575	9 466	8 263	7 119
Difference 2013/11	– 27	– 688	– 611	– 167	210	587	822

The difference to the last projections (2011) is due to a different economic situation (taking into consideration the last economic crisis with consequences until now) and corresponding price-based assumptions. Furthermore, activity data (energy consumption) for the last inventory years, which form the basis for the projections (and the model calibration), are remarkably lower than for the last submission.

6.1.5 Fugitive Emissions from Fuels (1.B)

Table 30: Comparison of projections 2009, 2011 and 2013 – Fugitive emissions (in Gg CO_2e).

1.B – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2009	487	876	959	977	975		
Projections 2011	312	440	448	444	431	409	388
Projections 2013	311	441	516	539	570	582	594
Difference 2013/11	– 1	1	68	95	138	173	206
1.B – WAM							
Projections 2009	487	876	959	977	975		
Projections 2011	312	440	448	444	431	409	388
Projections 2013	311	441	516	539	570	582	594
Difference 2013/11	– 1	1	68	95	138	173	206

The differences can be seen in the historical and forecast data; the larger changes since the Projections of 2009 are due to methodological improvements in the inventory, especially with regard to the use of country specific emission factors. In the Projections of 2011 a decrease in natural gas exploration was assumed while in the current projections an increase is forecasted.

6.1.6 Industrial Processes (2)

Table 31: Comparison of projections 2009, 2011 and 2013 – Industrial Processes (in Gg CO_2e).

2 – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2009	10 111	10 306	11 006	11 458	11 864		
– of which F-gases	1 605	1 320	1 431	1 413	1 607		
Projections 2011	10 111	10 628	11 006	11 951	12 643	13 298	13 916
– of which F-gases	*1 600*	*1 628*	*1 713*	*1 734*	*1 738*	*1 785*	*1 804*
Projections 2013	10 108	10 623	10 680	10 277	10 675	11 193	11 741
– of which F-gases	*1 600*	*1 628*	*1 575*	*1 501*	*1 494*	*1 514*	*1 533*
Difference 2013/11	– 3	– 4	– 325	– 1 673	– 1 968	– 2 105	– 2 175
– of which F-gases	*0*	*0*	*– 138*	*– 233*	*– 244*	*– 272*	*– 271*
2 – WAM							
Projections 2009	10 111	10 306	11 006	11 458	11 864		
Projections 2011	10 111	10 628	10 971	11 546	11 726	12 043	12 367
– of which F-gases	*1 600*	*1 628*	*1 664*	*1 451*	*963*	*727*	*394*
Projections 2013	10 108	10 623	10 680	10 194	10 491	10 972	11 469
– of which F-gases	*1 600*	*1 628*	*1 575*	*1 456*	*1 404*	*1 424*	*1 443*
Difference 2013/11	– 3	– 4	– 290	– 1 353	– 1 235	– 1 071	– 897
– of which F-gases	*0*	*0*	*– 88*	*5*	*441*	*697*	*1 049*

The differences in process emissions are mainly due to different assumptions for the economic growth. Additionally the data set for last projections was based on the year 2008. Therefore the year 2009 with the economic recession and the following years were only taken into account as projections. As the new projection was based on 2010, also the year after the recession is included in the basis for the projections, resulting in more robust data, in particular for first years.

The differences in F-gas emissions are due to updates of chapter 2.F of the National Inventory on Greenhouse Gases (see UMWELTBUNDESAMT 2012a for further explanations).

6.1.7 Solvents and other product use (3)

Table 32: Comparison of projections 2009, 2011 and 2013 – Solvents and other product use in Gg CO_2 eq.

3 – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2009	512	394	412	419	426		
Projections 2011	512	385	321	343	367	386	403
Projections 2013	512	387	327	342	340	338	336
Difference 2013/11	0	2	6	– 1	– 27	– 48	– 67
3 – WAM							
Projections 2009	512	394	412	419	426		
Projections 2011	512	385	321	343	367	386	403
Projections 2013	512	387	327	342	340	338	336
Difference 2013/11	0	2	6	– 1	– 27	– 48	– 67

The model revision included an update of activity data by using the structural business statistics from 2000 onwards and updating the activity data on non-solvent use and the solvent content of products. Furthermore, emission factors were updated with information from surveys of companies and associations which were extrapolated using structural business statistics provided by Statistik Austria.

Whereas the emission forecast 2009 & 2011 is based on the assumption that the growth rate of CO_2 emissions for the period 2008–2030 correlates with the population growth rate, the emission forecast 2013 is calculated by multiplying emissions of the latest inventory year (2010; submission 2012) by the extrapolation of the trend (2000–2010) of the activity data in each subsector.

6.1.8 Agriculture (4)

Table 33: Comparison of projections 2009, 2011 and 2013 – Agriculture (in Gg CO_2e).

4 – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2009	9 171	7 848	7 797	7 811	7 893		
Projections 2011	8 558	7 399	7 534	7 625	7 693	7 687	7 663
Projections 2013	8 558	7 412	7 453	7 654	7 733	7 711	7 687
Difference 2013/11	0	13	– 82	29	40	23	23
4 – WAM							
Projections 2009	9 171	7 848	7 729	7 775	7 855		
Projections 2011	8 558	7 399	7 534	7 608	7 645	7 661	7 659
Projections 2013	8 558	7 412	7 453	7 526	7 461	7 447	7 430
Difference 2013/11	0	13	– 82	– 82	– 183	– 214	– 229

Projections 2009 and 2011

The differences can be seen in historical and forecast data; they are due to

- methodological improvements in the inventory, especially the inclusion of new animal waste management system distribution data and the application of new country specific methane conversion factors (MCF) for liquid systems;
- updated activity data generated by the PASMA model (SINABELL et al. 2011a). In contrast to the data used in the previous projections (SINABELL & SCHMID 2005), results obtained with the new model indicate that the declining trend in cattle (cow) numbers will come to an end and that the number of dairy cows will stabilise at a higher level.

Projections 2011 and 2013

The differences can be seen in historical and forecast data; they are due to

- the consideration of CH_4 losses from anaerobic digesters in the inventory;
- the inclusion of new policy measures in the WAM scenario.

6.1.9 LULUCF (CRF Source Category 5)

Table 34: Comparison of GHG projections 2011 and 2013 – LULUCF (in Gg CO_2e).

5 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2011	– 13 139	– 17 332	– 4 773	– 3 493	– 1 823	– 1 823	– 1 823
Projections 2013	– 10 023	– 7 395	– 3 611	3 533	5 031	5 031	5 031
Difference 2013/11	3 117	9 936	1 162	7 026	6 854	6 854	6 854

The revisions with respect to the projections 2011 are due to:

CRF 5.A.1

The results of the new NFI 2007/09 were available for the first time. The previously reported biomass increment and drain rates, dead wood stock changes, forest land areas for the historical years after 2002 were based on the means of the NFI 2000/02 results. These were updated by the values of the new NFI results.

There was an inconsistency in the 2011 projections with regard to historic data because the projected figures of the sector 5.A.1 to 2020 only covered emissions resulting from the harvest of “useable” trees, whereas the NFI and subsequently the historic values cover all biomass drain, including biomass losses due to mortality, which were around 10 % of the total biomass drain in the forests in yield according to the latest NFI. The latter now includes losses due to mortality which represents an increase in annual emissions of around 2 200 Gg CO_2 for the projected future values up to 2020, compared to the last projection report in 2011.

Furthermore, single forest biomass functions were improved and the whole time series was estimated with these improved functions. As a consequence, the expansion ratios from stem wood to total tree biomass changed. The expansion ratios for increment decreased by around 8 %, those for harvest by around 2 %. As a result of these new expansion ratios the net removals of the historic time series decreased significantly in comparison to previous submissions. And, this adjustment also leads to an average decrease in the projected annual removals of around 2 400 Gg CO_2 compared to the figures of the 2011projection.

A slight change in the interpolation procedure of historic data in the forest land category was carried out.

An error in the calculation of the weighted average stem wood increment was corrected. In addition, results of the new NFI 2007/09 were taken up in the calculation of the weighted average. This correction results in a change of the projected annual stem wood increment from 29.9 to 30.1 Mio. m^3 o.b.; this change represents an increase in annual removals of around 200 Gg CO_2 compared to the projected values of the 2011 report.

The gains in the dead wood pool were recalculated on the basis of the new NFI results. The annual removals in this pool changed from approx. 600 to 800 Gg CO_2 in the recent years. These more recent figures were used for the projection up to 2020, which represents an increase in annual removals of around 200 Gg CO_2 up to 2020.

The litter and soil C stock changes for subcategory 5.A.1 were estimated for the first time and also included in the projections. The new estimates for the 5.A.1 litter and soil C pool changes represent an increase in annual emissions of about 2 600 Gg CO_2 per year compared to the time series of projection 2011.

The sum of all the technical corrections result in an average difference of 6 760 Gg CO_2 p.a. between the 5.A.1 projection figures of report 2011 and those of this report.

Other CRF 5 subcategories

The following recalculations of the historic emissions/removals were carried out for other subcategories of sector 5:

The more recent land-use-change areas to and from forests were updated on the basis of NFI 2007/09. For area consistency reasons also the LUC areas from other categories to wetlands, settlements and other land were changed. As a consequence, the related emissions/removals had to be revised.A more stratified estimate of the soil C stocks and the related soil C stock changes at land-use-change lands to and from forests according to five forest growth regions was carried out.

The method to estimate C-stock changes from the litter pool at LUC areas from forest land to other land uses was changed to annual discounting.

Therefore, compared to the projection report 2011, the time series of these sector 5 subcategories (where historic values are reported for future years) was also changed.

6.1.10 Waste (CRF Source Category 6)

Table 35: Comparison of projections 2009, 2011 and 2013 – Waste (in Gg CO_2e).

6 – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2009	3 649	2 378	1 915	1 495	1 237		
Projections 2011	3 586	2 322	1 815	1 423	1 144	964	838
Projections 2013	3 587	2 345	1 806	1 392	1 128	961	847
Difference 2013/11	1	22	– 9	– 31	– 16	– 3	9
6 – WAM							
Projections 2009	3 649	2 378	1 915	1 495	1 237		
Projections 2011	3 586	2 322	1 815	1 423	1 144	964	838
Projections 2013	3 587	2 345	1 806	1 392	1 128	961	847
Difference 2013/11	1	22	– 9	– 31	– 16	– 3	9

Recalculations in the subsectors 6.A and 6.D are mainly due to changed assumptions on the development of the amount of waste subjected to mechanical-biological treatment[20]. The former assumption that MBT plants will increasingly close down to the extent that by 2030 no waste will be treated there (due to the entering into force of the Ordinance on the mechanical-biological treatment) had to be revised. The Ordinance is not yet in force and its impact on the stock of existing plants not expected to be as strong as originally assumed.

Further revisions are due to updates in the course of the continuous inventory improvement. Thus e.g. new data on (historically) deposited and mechanical-biological waste amounts became available and updated values on denitrification and the rate of connection to public sewage treatment plants (affecting 6.B) have been incorporated in the inventory.

Minor changes in the sector 6.C are due to recalculations in the inventory.

[20] This fraction affects both categories: 6.D. because of the allocation of mechanical-biological treatment to 'other waste treatment' and 6.A. because residues from the mechanical-biological treatment are partly disposed of on landfills.

7 ABBREVIATIONS

AEA ....Austrian Energy Agency

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

CHP....................Combined Heat and Power

CRF ....Common Reporting Format

EEG....................Energy Economics Group

GDP....................Gross Domestic Product

Gg.......................Gigagramme

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)

GWh ....gigawatt hours

LEAP ....Long-range Energy Alternatives Planning System

NIR ....National Inventory Report

PAM....................Policies and Measures

SVO....................Straight Vegetable Oil

Tg ....Terragramme

UFI......................Umweltförderung im Inland (domestic environmental support scheme)

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

WAM...................scenario “with additional measures”

WIFO ....Österreichisches Wirtschaftsforschungsinstitut (Austrian Institute of Economic Research)

WEM...................scenario “with existing measures”

Greenhouse gases

CH_4.....................methane

CO_2.....................carbon dioxide

N_2O.....................nitrous oxide

HFC ....hydrofluorocarbons

PFC ....perfluorocarbons

SF_6 ....sulphur hexafluoride

8 REFERENCES

AEA – AUSTRIAN ENERGY AGENCY (2012): Begleitung des politischen Entscheidungsprozesses zur Ermittlung von Sektorzielen gemäß dem Klimaschutzgesetz, Evaluierung der Maßnahmen der Verhandlungsgruppe „Gebäude" (unpublished).

AEA – Austrian Energy Agency (2013): Baumann, M. & Lang, B.: Entwicklung energiewirtschaftlicher Inputdaten und Szenarien für das Klimaschutzgesetz und zur Erfüllung der österreichischen Berichtspflichten des EU Monitoring Mechanismus 2013. AEA, Wien.

BMLFUW – Federal Ministry of Agriculture and Forestry, Environment and Water Management (2007): Klimastrategie 2007. Anpassung der Klimastrategie Österreichs zur Erreichung des Kyoto-Ziels 2008–2012. Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, 21.03.2007. Vienna. http://www.klimastrategie.at.

BMLFUW – Federal Ministry of Agriculture and Forestry, Environment and Water Management (2002): Strategie Österreichs zur Erreichung des Kyoto-Ziels. Klimastrategie 2008/20012. Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, 17.07.2002. Vienna.

BMLFUW & WIKO (2010): 10 Punkte Aktionsprogramm zur Markteinführung von Elektromobilität mit erneuerbaren Energien, in Österreich. 20.01.2012. http://doku.cac.at/aktionsprogramm_elektromobilitaet.pdf.

BMLFUW & KOMMUNAL KREDIT (2011): Umweltförderungen des Bundes 2011.

BMWFJ & BMLFUW – Federal Ministry of Economy, Family and Yout & Federal Ministry of Agriculture and Forestry, Environment and Water Management (2010): Eckpunkte der Energiestrategie Österreich. Wien, 20.03.2010. http://www.energiestrategie.at/.

BMWFJ (2013): Treibstoffpreismonitor; unter http://www.bmwfj.gv.at/EnergieUndBerg-bau/Energiepreise/Seiten/MonitorTreibstoff.aspx?Report=3 (23.2.2013).

DIPPOLD, M., REXEIS, M., HAUSBERGER, S. (2012): NEMO – A Universal and Flexible Model for Assessment of Emissions on Road Networks. 19th International Conference "Transport and Air Pollution", 26. – 27.11.2012, Thessaloniki.

EC – European Commission (2011): Health Check of the Common Agricultural Policy, http://ec.europa.eu/agriculture/healthcheck/index_en.htm (accessed 28 Feb 2011).

EEG – Energy Economics Group (2007): Haas, R.; Biermayr, P.; Kranzl, L.; Müller, A. & Schriefl, E.: Wärme und Kälte aus Erneuerbaren 2030. Studie für den Dachverband Energie-Klima, Maschinen und Metallwaren Industrie und die Wirtschaftskammer Österreich, Abteilung Umwelt- und Energiepolitik, Wien.

GSCHREY, B. (2010): Projections of Emissions of Fluorinated Greenhouse Gases in Austria 2008–2020, Study on behalf of the Umweltbundesamt GmbH, Wien, Öko-Recherche GmbH, Frankfurt/Main. Unpublished study.

HAUSBERGER, S. (1998): GLOBEMI – Globale Modellbildung für Emissions- und Verbrauchsszenarien im Verkehrssektor; Institute for Internal Combustion and Thermodynamics. University of Technology Graz; Volume 71; Graz.

HAUSBERGER, S. & SCHWINGSHACKL, M. (2012): Straßenverkehrsemissionen und Emissionen sonstiger mobiler Quellen Österreichs für die Jahre 1990 bis 2011. FVT – Forschungsgesellschaft für Verbrennungskraftmaschinen und Thermodynamik mbH. Erstellt im Auftrag der Umweltbundesamt GmbH. Graz 2012.

ICCT – The International Council on Clean Transportation (2012): Assessment for 2001-2011 European passenger cars. Paper number 2012-2.

LEDERMANN, T. (2002): Ein Einwuchsmodell aus den Daten der Österreichischen Waldinventur 1981-1996. Centralblatt für das gesamte Forstwesen 119(1): 40–77.

LEDERMANN, T. (2006): Description of PrognAus for Windows 2.2. In: Hasenauer H. (ed.): Sustainable Forest Management – Growth Models for Europe. Springer-Verlag, Berlin, Heidelberg, New York. pp. 71–78.

LEDERMANN, T. & STERBA, H. (2006): Evaluating management regimes and their impact on commercial timber supply using an individual-tree growth model and scenario analysis. In: Hasenauer H. (ed.): Sustainable Forest Management – Growth Models for Europe. Springer-Verlag, Berlin, Heidelberg, New York. pp. 195–209.

MCCOLLUM, D. et al. (2009): Greenhouse gas emissions from aviation and marine transportation: mitigation potential and policies. University of California and Oak Ridge National Laboratory.

MOLITOR, R.; HAUSBERGER, S. et. al (2004): Abschätzung der Auswirkungen des Tanktourismus auf den Kraftstoffverbrauch und die Entwicklung der CO_2-Emissionen in Österreich, Bericht im Auftrag von Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Trafico, Wien 2004.

MOLITOR, R.; HAUSBERGER, S. et. al (2009): Abschätzung der Auswirkungen des Export im Kraftstofftank auf den Kraftstoffabsatz und die Entwicklung der CO_2 und Luftschadstoffemissionen in Österreich – Aktualisierung 2007 und Prognose 2030; im Auftrag des Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft; Bundesministerium für Verkehr, Innovation und Technologie; Graz-Wien; 2009 (not published).

MONSERUD, R.A. & STERBA, H. (1996): A basal area increment model for individual trees growing in even- and uneven-aged forest stands in Austria. Forest Ecology and Management 80: 57–80.

MONSERUD, R.A. & STERBA, H. (1999): Modeling individual tree mortality for Austrian forest species. Forest Ecology and Management 113: 109–123.

NACHTMANN, G. (2006): Height increment models for individual trees in Austria depending on site and competition. Austrian Journal of Forest Science 123(4): 199–222.

OECD-FAO (2010): Agricultural Outlook 2010. OECD & Food and Agriculture Organization of the United Nations.

ÖROK (2010): HANIKA, A.: Kleinräumige Bevölkerungsprognose für Österreich 2010-2030 mit Ausblick bis 2050 („ÖROK-Prognosen“). Teil 1: Endbericht zur Bevölkerungsprognose. Österreichische Raumordnungskonferenz (ÖROK). Wien. http://www.oerok.gv.at/raum-region/daten-und-grundlagen/oerok-prognosen/oerok-prognosen-2010.html

PISCHINGER, R. (2000): Emissionen des Off-Road-Verkehrs im Bundesgebiet Österreich für die Bezugsjahre 1990 bis 1999. Institut für Verbrennungskraftmaschinen und Thermodynamik TU Graz, Graz.

PÖYRY – Wasserkraftpotenzialstudie Österreich (Endbericht) (2008): Pöyry (im Auftrag des Verbandes der Elektrizitätsunternehmen Österreichs). Wien. http://www.veoe.at/8266.html#.

SCHRAMM, H.-J. (2009): Deregulation of European Road Transport and its Impacts on International Transport Operations. ERS Conference, 23/04/2012, Frankfurt-on-Main.

SINABELL, F. & SCHMID, E. (2005): Austrian Agriculture 2005–2020. Consequences of Measures to Mitigate Greenhouse Gas Emission. Österreichisches Institut für Wirtschaftsforschung (WIFO), Wien.

SINABELL, F.; SCHÖNHART, M. & SCHMID E. (2011a): Austrian Agriculture 2005–2030. Consequences of Measures to Mitigate Greenhouse Gas Emission. Österreichisches Institut für Wirtschaftsforschung (WIFO) und BOKU Wien.

SINABELL, F.; BOCK-SCHAPPELWEIN, J.; MAYER, CH.; KNIEPERT, M.; SCHMID, E.; SCHÖNHART, M. & STREICHER, G. (2011b): Indikatoren für die Auswirkungen des Programms der Ländlichen Entwicklung 2007/2013 in Österreich. Studie des Österreichischen Instituts für Wirtschaftsforschung im Auftrag des Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Wien.

STATISTIK AUSTRIA (2010): Bevölkerungsvorausschätzung 2010–2050 sowie Modellrechnung bis 2075 für Österreich (Hauptszenario). Wien.

STERBA, H. & MONSERUD, R.A. (1997): Applicability of the forest stand growth simulator Prognaus for the Austrian part of the Bohemian Massif. Ecological Modelling 98(1): 23–34.

STERBA, H.; BLAB, A. & KATZENSTEINER, K. (2002): Adapting an individual tree growth model for Norway spruce (Picea abies L. Karst.) in pure and mixed species stands. Forest Ecology and Management 159: 101–110.

TU WIEN – TECHNICAL UNIVERSITY OF VIENNA (2013): Kranzl, L.; Müller, A..: Energieszenarien bis 2030: Wärmebedarf der Kleinverbraucher. Endbericht. Energy Economics Group (EEG). Technische Universität Wien, Wien.

TU GRAZ – TECHNICAL UNIVERSITY OF GRAZ (2013): Hausberger, S. & Schwingshackl, M.: Monitoring Mechanism 2013 – Verkehr. Institut für Verbrennungskraftmaschinen und Thermodynamik (IVT), Graz.

UMWELTBUNDESAMT (2009a): Anderl, M.; Böhmer, S.; Gössl, M.; Köther, T.; Krutzler, T.; Lenz, K.; Muik, B.; Pazdernik, K.; Poupa, S.; Schachermayer, E.; Schodl, B.; Sporer, M.; Storch, A.; Wiesenberger, H.; Zechmeister, A. & Zethner, G.: GHG Projections and Assessment of Policies and Measures in Austria. Reporting under Decision 280/2004/EC. Reports, Bd. REP-0227. Umweltbundesamt, Wien.

UMWELTBUNDESAMT (2010): Pötscher, F.; Winter, R.; Lichtblau, G.: Elektromobilität in Österreich – Szenario 2020 und 2050. Reports, Bd. REP-0257. Umweltbundesamt, Wien 2010.

UMWELTBUNDESAMT (2012a): Pazdernik, K.; Anderl, M.; Freudenschuß, A.; Friedrich, A.; Haider, S.; Jobstmann, H.; Köther, T.; Kriech, M.; Kuschel, V.; Lampert, C.; Poupa, S.; Purzner, M.; Sporer, M.; Schodl, B.; Stranner, G.; Schwaiger, E.; Seuss, K.; Weiss, P.; Wieser, M.; Zechmeister, A. & Zethner, G.: Austria's National Inventory Report 2012. Reports, Bd. REP-0381. Umweltbundesamt, Wien.

UMWELTBUNDESAMT (2012): Winter, R.: Biokraftstoffe im Verkehrssektor 2010 – Zusammenfassung der Daten der Republik Österreich gemäß Art.4, Abs.1 der Richtlinie 2003/30/EG für das Berichtsjahr 20098, im Auftrag des BMFLUW, Wien.

UMWELTBUNDESAMT (2013a): Pazdernik, K.; Anderl, M.; Freudenschuß, A.; Friedrich, A.; Haider, S.; Jobstmann, H.; Köther, T.; Kriech, M.; Lampert, C.; Poupa, S.; Schindlbacher, S.; Stranner, G.; Schwaiger, E.; Seuss, K.; Weiss, P.; Wieser, M.; Zechmeister, A. & Zethner, G.: Austria's National Inventory Report 2013. Reports, Bd. REP-0416. Umweltbundesamt, Wien.

UMWELTBUNDESAMT (2013b): Krutzler, T.; Gallauner, T.; Gössl, M.; Heller, C.; Lichtblau, G.; Schindler, I.; Stoiber, H.; Storch, A.; Stranner, G.; Wiesenberger, H. & Zechmeister, A.: Energiewirtschaftliche Inputdaten und Szenarien als Grundlage für den Monitoring Mechanisms 2013 und das Klimaschutzgesetz. Reports, Bd. REP-0415. Umweltbundesamt, Wien.

WIFO (2013): Kratena, K.; Meyer, I. & Sommer, M.: Energy Scenarios 2030. Model projections of energy demand as a basis to quantify Austria's GHG emissions. WIFO, Wien.

WIFO, WEGENER CENTER & UMWELTBUNDESAMT (2012): Begleitung des politischen Entscheidungsprozesses zur Ermittlung von Sektorzielen gemäß dem Klimaschutzgesetz, Vorläufiger Endbericht Stand 10.10.2012 (unpublished).

WINDSPERGER, S. & SCHMIDT-STEJSKAL, H. (2008): Revision der Lösemittelemissionsdaten der Österreichischen Luftschadstoffinventur (OLI). Wien.

WINDSPERGER, S.; STEINLECHNER, H.; SCHMIDT-STEJSKAL, H.; DRAXLER, S.; FISTER, G., SCHÖNSTEIN, R. & SCHÖRNER, G. (2002a): Gegenüberstellung und Abgleich der Daten von Top-down zu Bottom-up für Lösungsmittel im Jahr 2000. Institut für Industrielle Ökologie (IIÖ) und Forschungsinstitut für Energie und Umweltplanung, Wirtschaft- und Marktanalysen GmbH (FIEU). Studie im Auftrag des Lebensministeriums und Bundesministeriums für Wirtschaft und Arbeit. Wien.

WINDSPERGER, S.; STEINLECHNER, H.; SCHMIDT-STEJSKAL, H.; DRAXLER, S.; FISTER, G., SCHÖNSTEIN, R. & SCHÖRNER, G. (2002b): Verbesserung von Emissionsdaten (Inventur und Projektion bis 2010 für den Bereich Lösungsmittel in Österreich. Institut für Industrielle Ökologie (IIÖ) und Forschungsinstitut für Energie und Umweltplanung, Wirtschaft- und Marktanalysen GmbH (FIEU). Studie im Auftrag des Lebensministeriums und Bundesministeriums für Wirtschaft und Arbeit. Wien.

WINDSPERGER, S.; STEINLECHNER, H.; SCHMIDT-STEJSKAL, H.; DRAXLER, S.; FISTER, G., SCHÖNSTEIN, R. & SCHÖRNER, G. (2004): Studie zur Anpassung der Zeitreihe der Lösungsmittelemissionen der österreichischen Luftschadstoffinventur (OLI) 1980–2002. Institut für Industrielle Ökologie (IIÖ) und Forschungsinstitut für Energie und Umweltplanung, Wirtschaft- und Marktanalysen GmbH (FIEU). Studie im Auftrag des Umweltbundesamt. Wien.

Legislation

204/ME (XXIII.GP) Bundesklimaschutzgesetz: Bundesverfassungsgesetz, mit dem das Bundesverfassungsgesetz vom 27. November 1984 über den umfassenden Umweltschutz geändert wird, Bundesverfassungsgesetz, mit dem das Bundes-Verfassungsgesetz geändert wird, und Bundesgesetz, mit dem Bund und den Ländern Klimaschutzverpflichtungen zugeordnet werden.

Abwasseremissionsverordnung (BGBl Nr. 186/1996): Verordnung des Bundesministers für Land- und Forstwirtschaft über die allgemeine Begrenzung von Abwasseremissionen in Fließgewässer und öffentliche Kanalisationen (AAEV).

Council Regulation No. 1782/2003 of 29 September 2003 establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers.

Decision 2005/166 of 10 February 2005 laying down rules implementing Decision No 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol (notified under document number C(2005) 247).

Decision 93/389 of 24 June 1993 for a monitoring mechanism of Community CO_2 and other greenhouse gas emissions.

Decision 99/296/EC amending Council Decision 93/389/EEC for a Monitoring Mechanism of Community CO_2 and other Greenhouse Gas Emissions.

Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing framework for Community action in the field of water policy (Water framework directive).

Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport.

Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.

Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directive 96/57/EC and 2000/55/EC of the European Parliament and of the council (Eco Design Directive).

Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services.

Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air-conditioning systems in motor vehicles and amending Council Directive 70/156/EEC.

Federal Law Gazette I No. 109/2002 Bundesstraßen-Mautgesetz 2002 – BStMG: Bundesgesetz über die Mauteinhebung auf Bundesstraßen.

Federal Law Gazette I No. 149/2002 i.d.F. BGBl. I Nr 105/2006 Ökostromgesetz: Bundesgesetz, mit dem Neuregelungen auf dem Gebiet der Elektrizitätserzeugung aus erneuerbaren Energieträgern und auf dem Gebiet der Kraft-Wärme-Kopplung erlassen werden (Ökostromgesetz) sowie das Elektrizitätswirtschafts- und -organisationsgesetz (ElWOG) und das Energieförderungsgesetz 1979 (EnFG) geändert werden. Zuletzt geändert durch BGBl. I Nr. 114/2008.

Federal Law Gazette I No. 40/2007 Klima- und Energiefondsgesetz KLI:EN-FondsG: Bundesgesetz über die Errichtung des Klima- und Energiefonds.

Federal Law Gazette I No. 44/2008 Ökostromgesetz – ÖSG: Bundesgesetz, mit dem Neuregelungen auf dem Gebiet der Elektrizitätserzeugung aus erneuerbaren Energieträgern und auf dem Gebiet der Kraft-Wärme-Kopplung erlassen werden.

Federal Law Gazette II No. 139/2007. Änderung der Verordnung über Verbote und Beschränkungen teilfluorierter und vollfluorierter Kohlenwasserstoffe sowie von Schwefelhexafluorid (HFKW-FKW-SF6-V), Vienna, 2007.

Federal Law Gazette II No. 301/2002 VOC-Anlagen-Verordnung – VAV: Verordnung des Bundesministers für Wirtschaft und Arbeit zur Umsetzung der Richtlinie 1999/13/EG über die Begrenzung der Emissionen bei der Verwendung organischer Lösungsmittel in gewerblichen Betriebsanlagen, Änderung der VOC-Anlagen-Verordnung – VAV, BGBl. II Nr. 42/2005.

Federal Law Gazette II No. 411/2005 HKW-Anlagen-Verordnung – HAV: Verordnung des Bundesministers für Wirtschaft und Arbeit über die Begrenzung der Emissionen bei der Verwendung halogenierter organischer Lösungsmittel in gewerblichen Betriebsanlagen.

Federal Law Gazette II No. 418/1999 i.d.F. BGBl. II Nr. 417/2004 Kraftstoffverordnung 1999: Verordnung des Bundesministers für Umwelt, Jugend und Familie über die Festlegung der Qualität von Kraftstoffen (Kraftstoffverordnung 1999) (CELEX-Nr.: 398L0070).

Federal Law Gazette II No. 447/2002. Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über Verbote und Beschränkungen teilfluorierter und vollfluorierter Kohlenwasserstoffe sowie von Schwefelhexafluorid (HFKW-FKW-SF6-V); Vienna, 2002.

Federal Law Gazette II No. 492/1991 i.d.F. Nr. 398/2005 Lösemittelverordnung 2005 – LMV (implementation of Council Directive 2004/42/CE): Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Begrenzung der Emissionen flüchtiger organischer Verbindungen durch Beschränkung des Inverkehrsetzens und der Verwendung organischer Lösungsmittel in bestimmten Farben und Lacken.

Federal Law Gazette II Nr. 39/2008: 39. Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über Deponien (Deponieverordnung 2008).

Federal Law Gazette No. 164/1996 i.d.F. BGBl. II Nr. 49/2004 Deponieverordnung: Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über Deponien.

Federal Law Gazette No. 185/1993 i.d.F. 34/2008 Umweltförderungsgesetz UFG: Bundesgesetz über die Förderung von Maßnahmen in den Bereichen der Wasserwirtschaft, der Umwelt, der Altlastensanierung, zum Schutz der Umwelt im Ausland und über das österreichische JI/CDM-Programm für den Klimaschutz.

Federal Law Gazette No. 210/1992 i.d.F. 309/1994 Ozongesetz: Bundesgesetz über Maßnahmen zur Abwehr der Ozonbelastung und die Information der Bevölkerung über hohe Ozonbelastungen, mit dem das Smogalarmgesetz, BGBl. No. 38/1989, geändert wird.

Federal Law Gazette No. 299/1989 i.d.F. Nr. 142/2000 und Nr. 136/2004 Altlastensanierungsgesetz: Bundesgesetz vom 7. Juni 1989 zur Finanzierung und Durchführung der Altlastensanierung, mit dem das Umwelt- und Wasserwirtschaftsfondsgesetz, BGBl. Nr. 79/1987, das Wasserbautenförderungsgesetz, BGBl. Nr. 148/1985, das Umweltfondsgesetz, BGBl. Nr. 567/1983, und das Bundesgesetz vom 20. März 1985 über die Umweltkontrolle, BGBl. Nr. 127/1985, geändert werden.

Federal Law Gazette Nr. 865/1994 CKW-Anlagen-Verordnung 1994: Verordnung des Bundesministers für wirtschaftliche Angelegenheiten über die Begrenzung der Emission von chlorierten organischen Lösemitteln aus CKW-Anlagen in gewerblichen Betriebsanlagen.

Regulation (EC) No. 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases.

ANNEX 1: INFORMATION EXTRACTED FROM THE REPORTING TEMPLATE

Emission Projections – scenario “with existing measures“

Table 36: CO_2 emissions in 2010 and projections 2015–2030, scenario “with existing measures”.

CO_2 [Gg]	2010	2015	2020	2025	2030
Total excluding LULUCF	**72 290**	**70 545**	**69 982**	**71 310**	**72 722**
Total including LULUCF	**68 630**	**74 029**	**74 963**	**76 291**	**77 704**
1. Energy	**63 088**	**61 645**	**60 683**	**61 517**	**62 406**
A. Fuel Combustion Activities	62 851	61 402	60 434	61 261	62 145
1. Energy Industries	14 174	12 176	11 291	12 036	12 708
a. Public Electricity and Heat production	10 730	8 718	7 772	8 454	9 057
b. Petroleum Refining	2 724	2 780	2 780	2 780	2 780
c. Manufacture of Solid Fuels and Other Energy Industries	719	678	738	802	871
2. Manufacturing Industries and Construction	15 456	15 445	16 120	17 059	18 183
a. Iron and Steel	5 835	6 036	6 312	6 643	6 956
b. Non-Ferrous Metals	243	250	252	258	278
c. Chemicals	1 360	1 396	1 530	1 717	1 970
d. Pulp, Paper and Print	2 229	2 330	2 503	2 734	3 030
e. Food Processing, Beverages and Tobacco	1 021	880	830	772	707
f. Other	4 768	4 552	4 693	4 935	5 242
3. Transport	22 205	23 508	23 662	23 816	23 861
a. Civil Aviation	64	72	83	95	107
b. Road Transportation	21 662	22 761	22 893	23 021	23 038
c. Railways	149	155	157	162	168
d. Navigation	11	11	11	10	10
e. Other Transportation	320	509	518	528	538
4. Other Sectors	10 970	10 221	9 302	8 282	7 316
a. Commercial/Institutional	2 303	2 727	2 487	2 170	1 852
b. Residential	7 813	6 600	5 919	5 200	4 537
c. Agriculture/Forestry/Fisheries	854	894	895	912	927
5. Other	46	53	60	68	77
a. Stationary	NO				
b. Mobile	46	53	60	68	77
B. Fugitive Emissions from Fuels	237	243	249	255	262
1. Solid Fuels	0	0	0	0	0
2. Oil and Natural Gas	237	243	249	255	262
2. Industrial Processes	**9 023**	**8 710**	**9 114**	**9 613**	**10 141**
A. Mineral Products	2 936	2 876	3 021	3 209	3 443
B. Chemical Industry	608	570	570	570	570
C. Metal Production	5 480	5 264	5 523	5 834	6 128
3. Solvent and Other Product Use	**177**	**188**	**183**	**178**	**173**
5. Land Use, Land-Use Change and Forestry	**-3 661**	**3 483**	**4 981**	**4 981**	**4 981**
6. Waste	**2**	**2**	**2**	**2**	**2**
C. Waste Incineration	2	2	2	2	2

Table 37: CH_4 emissions in 2010 and projections 2015–2030, scenario "with existing measures".

CH_4 [Gg]	2010	2015	2020	2025	2030
Total excluding LULUCF	**265.45**	**248.28**	**238.85**	**232.33**	**228.45**
Total including LULUCF	**265.46**	**248.28**	**238.86**	**232.34**	**228.45**
1. Energy	**25.12**	**24.29**	**24.72**	**24.33**	**24.10**
A. Fuel Combustion Activities	11.84	10.18	9.45	8.77	8.25
1. Energy Industries	0.37	0.47	0.48	0.47	0.45
2. Manufacturing Industries and Construction	0.68	0.69	0.72	0.76	0.81
3. Transport	0.72	0.51	0.42	0.36	0.35
4. Other Sectors	10.07	8.51	7.84	7.18	6.63
B. Fugitive Emissions from Fuels	13.29	14.11	15.27	15.55	15.84
1. Solid Fuels	NO	0.00	0.00	0.00	0.00
2. Oil and Natural Gas	13.29	14.11	15.27	15.55	15.84
2. Industrial Processes	**0.87**	**0.86**	**0.86**	**0.86**	**0.86**
B. Chemical Industry	0.87	0.86	0.86	0.86	0.86
4. Agriculture	**171.33**	**174.88**	**177.81**	**179.85**	**181.83**
A. Enteric Fermentation	155.07	158.70	161.51	163.63	165.72
1. Cattle	145.00	149.43	152.30	154.58	156.82
3. Sheep	2.87	2.45	2.41	2.38	2.35
4. Goats	0.36	0.29	0.29	0.29	0.29
6. Horses	1.57	1.55	1.55	1.54	1.53
7. Mules and Asses	IE	IE	IE	IE	IE
8. Swine	4.70	4.42	4.39	4.29	4.18
9. Poultry	0.25	0.24	0.24	0.23	0.23
10. Other	0.33	0.33	0.33	0.32	0.32
B. Manure Management	15.75	15.78	15.92	15.88	15.79
1. Cattle	10.90	11.17	11.35	11.42	11.44
3. Sheep	0.07	0.06	0.06	0.06	0.06
4. Goats	0.01	0.01	0.01	0.01	0.01
6. Horses	0.11	0.11	0.11	0.11	0.11
7. Mules and Asses	IE	IE	IE	IE	IE
8. Swine	3.68	3.50	3.47	3.38	3.29
9. Poultry	0.97	0.93	0.92	0.90	0.87
D. Agricultural Soils	0.46	0.35	0.34	0.31	0.28
F. Field Burning of Agricultural Residues	0.04	0.04	0.04	0.04	0.04
6. Waste	**68.13**	**48.25**	**35.46**	**27.30**	**21.66**
A. Solid Waste Disposal on Land	64.29	44.63	32.03	23.85	18.21
B. Waste Water Handling	1.30	1.11	0.94	0.96	0.98
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00
D. Other	2.54	2.51	2.49	2.49	2.48

Table 38: N_2O emissions in 2010 and projections 2015–2030, scenario "with existing measures".

N_2O [Gg]	**2010**	**2010**	**2015**	**2020**	**2025**
Total excluding LULUCF	**16.92**	**16.62**	**16.71**	**16.59**	**16.31**
Total including LULUCF	**17.07**	**16.79**	**16.87**	**16.75**	**16.47**
1. Energy	**2.16**	**2.30**	**2.00**	**1.80**	**1.71**
A. Fuel Combustion Activities	2.16	2.30	2.00	1.80	1.71
1. Energy Industries	0.29	0.36	0.37	0.37	0.35
2. Manufacturing Industries and Construction	0.47	0.48	0.44	0.43	0.45
3. Transport	0.70	0.75	0.57	0.42	0.35
4. Other Sectors	0.70	0.71	0.62	0.57	0.55
B. Fugitive Emissions from Fuels	0.00	IE	0.00	0.00	0.00
2. Industrial Processes	**0.27**	**0.20**	**0.16**	**0.16**	**0.16**
B. Chemical Industry	0.27	0.20	0.16	0.16	0.16
3. Solvent and Other Product Use	**0.52**	**0.48**	**0.50**	**0.51**	**0.52**
4. Agriculture	**12.75**	**12.43**	**12.84**	**12.90**	**12.69**
A. Enteric Fermentation	0.00	NA	0.00	0.00	0.00
B. Manure Management	2.98	2.99	3.04	3.09	3.12
D. Agricultural Soils	9.78	9.45	9.80	9.81	9.57
1. Direct Soil Emissions	5.79	5.61	5.80	5.82	5.67
2. Pasture, Range and Paddock Manure (3)	0.30	0.31	0.30	0.30	0.30
3. Indirect Emissions	3.69	3.53	3.70	3.70	3.60
6. Waste	**1.21**	**1.20**	**1.22**	**1.23**	**1.24**
A. Solid Waste Disposal on Land	0.00	NA	0.00	0.00	0.00
B. Waste Water Handling	0.84	0.85	0.87	0.89	0.91
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00
D. Other	0.36	0.35	0.34	0.34	0.34

Table 39: HFC, PFC and SF_6 emissions in 2010 and projections 2015–2030, scenario "with existing measures".

	2010	**2015**	**2020**	**2025**	**2030**
HFC [Gg CO_2e]					
Total (without LULUCF)	**1 161**	**1 152**	**1 153**	**1 181**	**1 209**
2. Industrial Processes	**1 161**	**1 152**	**1 153**	**1 181**	**1 209**
F. Consumption of Halocarbons and SF_6	1 161	1 152	1 153	1 181	1 209
PFC [Gg CO_2e]					
Total (without LULUCF)	**70**	**70**	**67**	**71**	**73**
2. Industrial Processes	**70**	**70**	**67**	**71**	**73**
F. Consumption of Halocarbons and SF_6	70	70	67	71	73
SF_6 [Gg CO_2e]					
Total (without LULUCF)	**345**	**282**	**270**	**260**	**250**
2. Industrial Processes	**345**	**282**	**270**	**260**	**250**
F. Consumption of Halocarbons and SF_6	345	282	270	260	250

Emission Projections – scenario "with additional measures"

Table 40: CO_2 emissions in 2010 and projections 2015–2030, scenario "with additional measures".

CO_2 [Gg]	**2010**	**2015**	**2020**	**2025**	**2030**
Total excluding LULUCF	**72.290**	**68.391**	**66.222**	**66.534**	**67.120**
Total including LULUCF	**68.630**	**71.874**	**71.203**	**71.515**	**72.101**
1. Energy	**63.088**	**59.529**	**57.016**	**56.871**	**56.985**
A. Fuel Combustion Activities	62.851	59.286	56.767	56.616	56.723
1. Energy Industries	14.174	12.114	11.007	11.237	11.708
a. Public Electricity and Heat production	10.730	8.644	7.483	7.651	8.058
b. Petroleum Refining	2.724	2.780	2.780	2.780	2.780
c. Manufacture of Solid Fuels and Other Energy Industries	719	690	744	806	871
2. Manufacturing Industries and Construction	15.456	15.230	15.642	16.284	17.030
a. Iron and Steel	5.835	5.995	6.213	6.504	6.763
b. Non-Ferrous Metals	243	249	250	255	274
c. Chemicals	1.360	1.375	1.499	1.673	1.913
d. Pulp, Paper and Print	2.229	2.280	2.382	2.524	2.703
e. Food Processing, Beverages and Tobacco	1.021	858	789	711	626
f. Other	4.768	4.472	4.509	4.617	4.751
3. Transport	22.205	21.731	20.978	21.135	21.150
a. Civil Aviation	64	72	83	95	107
b. Road Transportation	21.662	20.984	20.208	20.339	20.326
c. Railways	149	155	158	163	168
d. Navigation	11	11	11	11	11
e. Other Transportation	320	509	518	528	538
4. Other Sectors	10.970	10.159	9.080	7.892	6.759
a. Commercial/Institutional	2.303	2.703	2.395	2.019	1.651
b. Residential	7.813	6.562	5.790	4.961	4.179
c. Agriculture/Forestry/Fisheries	854	894	895	912	929
5. Other	46	53	60	68	77
a. Stationary	NO				
b. Mobile	46	53	60	68	77
B. Fugitive Emissions from Fuels	237	243	249	255	262
1. Solid Fuels	NA	0	0	0	0
2. Oil and Natural Gas	237	243	249	255	262
2. Industrial Processes	**9 023**	**8 671**	**9 021**	**9 482**	**9 960**
A. Mineral Products	2 936	2 876	3 021	3 209	3 443
B. Chemical Industry	608	570	570	570	570
C. Metal Production	5 480	5 225	5 430	5 703	5 947
3. Solvent and Other Product Use	**177**	**188**	**183**	**178**	**173**
5. Land Use, Land-Use Change and Forestry	**-3 661**	**3 483**	**4 981**	**4 981**	**4 981**
6. Waste	**2**	**2**	**2**	**2**	**2**
C. Waste Incineration	2	2	2	2	2

Table 41: CH_4 emissions in 2010 and projections 2015–2030, scenario "with additional measures".

CH_4 [Gg]	2010	2015	2020	2025	2030
Total excluding LULUCF	**265.45**	**247.20**	**236.51**	**229.97**	**226.01**
Total including LULUCF	**265.46**	**247.21**	**236.52**	**229.97**	**226.02**
1. Energy	**25.12**	**24.16**	**24.47**	**23.99**	**23.63**
A. Fuel Combustion Activities	11.84	10.05	9.20	8.44	7.79
1. Energy Industries	0.37	0.47	0.48	0.49	0.47
2. Manufacturing Industries and Construction	0.68	0.68	0.69	0.71	0.74
3. Transport	0.72	0.50	0.40	0.34	0.33
4. Other Sectors	10.07	8.41	7.62	6.90	6.25
B. Fugitive Emissions from Fuels	13.29	14.11	15.27	15.55	15.84
1. Solid Fuels	NO	0.00	0.00	0.00	0.00
2. Oil and Natural Gas	13.29	14.11	15.27	15.55	15.84
2. Industrial Processes	**0.87**	**0.86**	**0.86**	**0.86**	**0.86**
B. Chemical Industry	0.87	0.86	0.86	0.86	0.86
4. Agriculture	**171.33**	**173.93**	**175.72**	**177.82**	**179.85**
A. Enteric Fermentation	155.07	158.26	160.67	162.85	164.99
1. Cattle	145.00	148.99	151.47	153.80	156.09
3. Sheep	2.87	2.45	2.41	2.38	2.35
4. Goats	0.36	0.29	0.29	0.29	0.29
6. Horses	1.57	1.55	1.55	1.54	1.53
7. Mules and Asses	IE	IE	IE	IE	IE
8. Swine	4.70	4.42	4.39	4.29	4.18
9. Poultry	0.25	0.24	0.24	0.23	0.23
10. Other	0.33	0.33	0.33	0.32	0.32
B. Manure Management	15.75	15.28	14.67	14.62	14.54
1. Cattle	10.90	10.78	10.40	10.46	10.48
3. Sheep	0.07	0.06	0.06	0.06	0.06
4. Goats	0.01	0.01	0.01	0.01	0.01
6. Horses	0.11	0.11	0.10	0.10	0.10
7. Mules and Asses	IE	IE	IE	IE	IE
8. Swine	3.68	3.45	3.33	3.24	3.16
9. Poultry	0.97	0.88	0.78	0.75	0.73
D. Agricultural Soils	0.46	0.35	0.34	0.31	0.28
F. Field Burning of Agricultural Residues	0.04	0.04	0.04	0.04	0.04
6. Waste	**68.13**	**48.25**	**35.46**	**27.30**	**21.66**
A. Solid Waste Disposal on Land	64.29	44.63	32.03	23.85	18.21
B. Waste Water Handling	1.30	1.11	0.94	0.96	0.98
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00
D. Other	2.54	2.51	2.49	2.49	2.48

Table 42: N_2O emissions in 2010 and projections 2015–2030, scenario "with additional measures".

N_2O [Gg]	**2010**	**2015**	**2020**	**2025**	**2030**
Total excluding LULUCF	**16.62**	**16.34**	**15.84**	**15.58**	**15.34**
Total including LULUCF	**16.79**	**16.50**	**16.00**	**15.74**	**15.50**
1. Energy	**2.30**	**1.98**	**1.78**	**1.69**	**1.61**
A. Fuel Combustion Activities	2.30	1.98	1.78	1.69	1.61
1. Energy Industries	0.36	0.37	0.39	0.39	0.35
2. Manufacturing Industries and Construction	0.48	0.43	0.42	0.43	0.45
3. Transport	0.75	0.55	0.40	0.33	0.29
4. Other Sectors	0.71	0.61	0.56	0.54	0.52
B. Fugitive Emissions from Fuels	IE	0.00	0.00	0.00	0.00
2. Industrial Processes	**0.20**	**0.16**	**0.16**	**0.16**	**0.16**
B. Chemical Industry	0.20	0.16	0.16	0.16	0.16
3. Solvent and Other Product Use	**0.48**	**0.50**	**0.51**	**0.52**	**0.53**
4. Agriculture	**12.43**	**12.49**	**12.17**	**11.98**	**11.78**
A. Enteric Fermentation	NA	0.00	0.00	0.00	0.00
B. Manure Management	2.99	2.85	2.66	2.69	2.72
D. Agricultural Soils	9.45	9.65	9.50	9.28	9.07
1. Direct Soil Emissions	5.61	5.71	5.64	5.50	5.37
2. Pasture, Range and Paddock Manure (3)	0.31	0.30	0.30	0.30	0.30
3. Indirect Emissions	3.53	3.63	3.56	3.48	3.40
6. Waste	**1.20**	**1.22**	**1.23**	**1.24**	**1.26**
A. Solid Waste Disposal on Land	NA	0.00	0.00	0.00	0.00
B. Waste Water Handling	0.85	0.87	0.89	0.91	0.92
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00
D. Other	0.35	0.34	0.34	0.34	0.34

Table 43: HFC, PFC and SF_6 emissions in 2010 and projections 2015–2030, scenario "with additional measures".

HFC, PFC & SF_6 [Gg CO_2e]	**2010**	**2015**	**2020**	**2025**	**2030**
HFC					
Total (without LULUCF)	**1 161**	**1 107**	**1 063**	**1 091**	**1 119**
2. Industrial Processes	**1 161**	**1 107**	**1 063**	**1 091**	**1 119**
F. Consumption of Halocarbons and SF_6	1 161	1 161	1 107	1 063	1 091
PFC					
Total (without LULUCF)	**70**	**67**	**71**	**73**	**74**
2. Industrial Processes	**70**	**67**	**71**	**73**	**74**
F. Consumption of Halocarbons and SF_6	70	67	71	73	74
SF_6					
Total (without LULUCF)	**345**	**282**	**270**	**260**	**250**
2. Industrial Processes	**345**	**282**	**270**	**260**	**250**
F. Consumption of Halocarbons and SF_6	345	282	270	260	250

Indicators for projections to monitor and evaluate progress

(according to Annex III of Commission Decision 2005/166/EC)

Table 44: Indicators for projections to monitor and evaluate progress – scenario "with existing measures".

Indicator/numerator/denominator	2010	2015	2020	2025	2030
MACRO **Total CO_2 intensity of GDP [t/million €]**	**252**	**226**	**206**	**206**	**206**
Total CO_2 emissions [kt]	72 290	70 545	69 982	71 310	72 722
GDP [million €] (EC 2010)	286 397	311 917	339 840	345 935	352 171
TRANSPORT C0 **Passenger Car CO_2 [Gg/Mvkm]**	**0.13**	**0.12**	**0.11**	**0.10**	**0.09**
CO_2 emissions from passenger cars [kt]	12 046	10 959	10 483	9 887	9 155
Number of kilometres by passenger cars,[Mkm]	90 377	89 678	94 467	99 967	105 960
TRANSPORT D0 **Freight Transport CO_2 [Gg/Mtkm]**	**0.08**	**0.06**	**0.06**	**0.06**	**0.06**
CO_2 emissions from freight transport (all modes) [kt]	9 183	9 629	10 356	11 150	11 947
Freight transport (all modes) [Mtkm]	113 218	151 222	170 455	191 375	210 222
INDUSTRY A1 **Energy related CO_2 intensity of industry [t/million €]**	**259**	**238**	**228**	**220**	**213**
CO_2 emissions from fossil fuel combustion in industry [kt]	15 456	15 445	16 120	17 059	18 183
Gross value-added total industry [billion €] (EC 2000)	60	65	71	78	85
HOUSEHOLDS A.1 **Specific CO_2 emissions of households [t/dwelling]**	**2.15**	**1.73**	**1.50**	**1.28**	**1.09**
CO_2 emissions from fossil fuel consumption households [kt]	7 813	6 600	5 919	5 200	4 537
Stock of permanently occupied dwellings [1 000]	3 638	3 820	3 957	4 070	4 166
SERVICES A0 **CO_2 intensity of the Service Sector [t/million €]**	**14.25**	**15.71**	**13.33**	**10.80**	**8.53**
CO_2 emissions from fossil fuel consumption in services [kt]	2 303	2 727	2 487	2 170	1 852
Gross value-added services [billion €] (EC 2010)	162	174	187	201	217
TRANSFORMATION B0 **Specific CO_2 emissions from public and autoproducer power plants [t/TJ]**	**43.87**	**34.72**	**28.82**	**29.82**	**30.93**
CO_2 emissions from public and autoproducer thermal power stations (without heat-only plants) [kt]	10 730	8 718	7 772	8 454	9 057
All products – output of public and autoproducer thermal power stations [PJ]	245	251	270	283	293
AGRICULTURE **Specific N_2O emissions from fertiliser and manure use [kg/kg]**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**
N_2O emissions from synthetic fertiliser and manure use [kt]	9.45	9.80	9.81	9.57	9.33
Use of synthetic fertiliser and manure [kt nitrogen]	197	205	199	193	186
AGRICULTURE **Specific CH_4 emissions from cattle production, [kg/head]**	72.0	73.8	74.8	76.1	77.5
CH_4 emissions from cattle [kt]	145	149	152	155	157
Cattle population [1 000 head]	2 013	2 025	2 037	2 030	2 024
WASTE **Specific CH_4 emissions from landfills [kt/kt]**	**0.26**	**0.22**	**0.19**	**0.17**	**0.15**
CH_4 emissions from landfills [kt]	64.29	44.63	32.03	23.85	18.21
Municipal solid waste going to landfills [kt]*	245	202	168	144	121

** MSW no longer landfilled in Austria, only sorting residues; NA=not applicable*

Table 45: Indicators for projections to monitor and evaluate progress –scenario "with additional measures".

Indicator/Numerator/denominator	2010	2015	2020	2025	2030
MACRO **Total CO_2 intensity of GDP [t/million €]**	**252**	**219**	**195**	**192**	**191**
Total CO_2 emissions [kt]	72 290	68 391	66 222	66 534	67 120
GDP [million €] (EC 2010)	286 397	311 917	339 840	345 935	352 171
TRANSPORT C0 **Passenger Car CO_2 [Gg/Mvkm])**	**0.13**	**0.12**	**0.10**	**0.09**	**0.08**
CO_2 emissions from passenger cars [kt]	12 046	10 455	9 673	8 942	8 029
Number of kilometres by passenger cars [Mkm]	90 377	88 572	92 465	98 506	105 464
TRANSPORT D0 **Freight Transport CO_2 [Gg/Mtkm]**	**0.08**	**0.06**	**0.06**	**0.06**	**0.06**
CO_2 emissions from freight transport (all modes) [kt]	9 183	8 412	8 552	9 479	10 424
Freight transport (all modes) [Mtkm]	113 218	130 867	139 005	160 845	181 561
INDUSTRY A1 **Energy related CO_2 intensity of industry [t/million €]**	**259**	**234**	**221**	**210**	**199**
CO_2 emissions from fossil fuel combustion in industry [kt]	15 456	15 230	15 642	16 284	17 030
Gross value-added total industry [billion €] (EC 2000)	60	65	71	78	85
HOUSEHOLDS A.1 **Specific CO_2 emissions from households [t/dwelling]**	**2.15**	**1.72**	**1.46**	**1.22**	**1.00**
CO_2 emissions from fossil fuel consumption households [kt]	7 813.29	6 562.22	5 789.50	4 960.59	4 179.38
Stock of permanently occupied dwellings [1 000]	3 638.26	3 819.92	3 956.79	4 069.53	4 166.47
SERVICES A0 **CO_2 intensity of the Service Sector [t/million €]**	**14.25**	**15.57**	**12.83**	**10.05**	**7.61**
CO_2 emissions from fossil fuel consumption in services [kt]	2 303	2 703	2 395	2 019	1 651
Gross value-added services [billion €] (EC 2010)	162	174	187	201	217
TRANSFORMATION B0 **Specific CO_2 emissions from public and autoproducer power plants [t/TJ]**	**43.87**	**34.52**	**27.82**	**26.41**	**26.27**
CO_2 emissions from public and autoproducer thermal power stations (without heat only plants) [kt]	10 730	8 644	7 483	7 651	8 058
All products – output of public and autoproducer thermal power stations [PJ]	245	250	269	290	307
AGRICULTURE **Specific N_2O emissions from fertiliser and manure use [kg/kg]**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**
N_2O emissions from synthetic fertiliser and manure use [kt]	9.45	9.65	9.50	9.28	9.07
Use of synthetic fertiliser and manure, [kt nitrogen]	197	205	199	193	186
AGRICULTURE **Specific CH_4 emissions from cattle production [kg/head]**	72.0	73.8	74.8	76.2	77.6
CH_4 emissions from cattle [kt]	145	149	151	154	156
Cattle population [1 000 head]	2 013	2 018	2 024	2 017	2 011
WASTE **Specific CH_4 emissions from landfills [kt/kt]**	**0.26**	**0.22**	**0.19**	**0.17**	**0.15**
CH_4 emissions from landfills [kt]	64.29	44.63	32.03	23.85	18.21
Municipal solid waste going to landfills [kt]*	245	202	168	144	121

** MSW no longer landfilled in Austria, only sorting residues; NA=not applicable*

List of parameters for projections

(according to Annex IV of Commission Decision 2005/166/EC)

Table 46: General parameters for projections – scenarios "with existing measures" and "with additional measures".

		2010	2015	2020	2025	2030
Assumption for general economic parameters						
1a. Gross Domestic Product	Value [billion €]	286.40	311.92	339.84	345.94	352.17
1b. Gross Domestic Product growth rate	Annual growth rate [%]	3.7 %	1.5 %	1.5 %	1.5 %	1.5 %
2a. Population	[1 000 people]	8 382	8 555	8 733	8 889	9 034
2b. Population growth rate and base year value	Annual growth rate [%]	0.3 %	0.4 %	0.4 %	0.4 %	0.3 %
3. International coal prices	[€ (2010)/boe]	15.21	16.37	17.06	17.66	18.14
4. International oil prices	[€ (2010)/boe]	58.85	81.77	90.85	97.92	103.46
5. International gas prices	[€ (2010)/boe]	31.38	41.00	46.02	49.79	52.72
Carbon price	[€ (2010 price)/t CO_2]	13	15	20	25	30
Assumptions for weather parameters						
18a. Heating Degree Days	Annual HDD	3 241	3 147	3 100	3 053	3 006
Assumptions for the Industry Sector						
19. Gross value-added total industry, billion € (EC 2000)	Value [€]	59.66	64.98	70.79	77.52	85.43
22. The production index for Industrial Sector	Annual growth rate [%]					
Iron and Steel		2.8 %	2.5 %	2.4 %	2.3 %	2.3 %
Chemical Industry		5.6 %	5.3 %	5.3 %	5.3 %	5.3 %
Food Industry		-0.2 %	0.7 %	0.7 %	0.8 %	0.7 %
Pulp and Paper		2.0 %	1.9 %	1.9 %	2.0 %	1.9 %
Wood		1.9 %	1.8 %	1.8 %	1.8 %	1.8 %
Other						
Assumptions for Buildings						
26. Gross value-added – services, Bio Euro(EC95)	Value (EUR billion)	162	174	187	201	217
31a. Number of dwellings	(1 000)	3 638	3 820	3 957	4 070	4 166

Table 47: Parameters for projections – Energy sector: inland consumption, electricity generation, scenario "with existing measures".

	2010	2015	2020	2025	2030
6. Total gross inland consumption [PJ]	**1 458**	**1 463**	**1 507**	**1 560**	**1 622**
6a. Oil (fossil)	549	561	562	566	570
6b. Gas (fossil)	141	136	131	136	141
6c. Solid fuels	347	309	316	338	360
6d. Renewables	384	404	444	454	458
6e. Nuclear (IEA definition for energy calc.)	0	0	0	0	0
6f. Net Electricity import (–/+)	8	9	9	19	42
6g. Other[1)]	27	44	45	48	51
Total gross electricity generation by fuel type [GWhe]	**67 937**	**69 747**	**74 914**	**78 737**	**81 339**
7. Oil (fossil)	1 274	1 089	1 021	1 022	1 074
8. Gas (fossil)	6 703	6 442	5 469	5 566	5 740
9. Solid fuels	14 348	10 786	11 474	13 727	15 747
10. Renewable	45 132	49 994	55 584	57 132	57 564
11. Nuclear (IEA definition for energy calc.)	0	0	0	0	0
12. Other[2)]	480	1 436	1 366	1 290	1 214

Table 48: Parameters for projections – Energy sector: inland consumption, electricity generation, scenario "with additional measures".

6. Total gross inland consumption [PJ]	**2010**	**2015**	**2020**	**2025**	**2030**
6. Total gross inland consumption	1 458	1 426	1 444	1 484	1 528
6a. Oil (fossil)	549	532	518	520	522
6b. Gas (fossil)	141	137	131	135	139
6c. Solid fuels	347	305	303	311	323
6d. Renewables	384	401	441	465	476
6e. Nuclear (IEA definition for energy calc.)	0	0	0	0	0
6f. Net Electricity import (–/+)	8	8	5	7	19
6g. Other[1)]	27	43	45	47	49
Total gross electricity generation by fuel type [GWhe]	**67 937**	**69 552**	**74 722**	**80 471**	**85 211**
7. Oil (fossil)	1 274	1 089	1 021	1 022	1 074
8. Gas (fossil)	6 703	6 409	5 469	5 607	5 747
9. Solid fuels	14 348	10 622	10 964	12 099	13 831
10. Renewable	45 132	49 996	55 903	60 454	63 346
11. Nuclear (IEA definition for energy calc.)	0	0	0	0	0
12. Other[2)]	480	1 436	1 366	1 290	1 214

[1)] *waste (total), heat (total), hydrogen*

[2)] *waste (total) and unspecified autoproducers*

Table 49: Parameters for projections – energy demand by sector, scenario "with existing measures".

	2010	2015	2020	2025	2030
Total Energy Demand [PJ]	**1 179**	**1 203**	**1 239**	**1 278**	**1 329**
13. Energy Industries	84	92	99	108	117
13a. Oil (fossil)	20	24	26	27	29
13b. Gas (fossil)	22	22	24	26	27
13c. Solid fuels	19	20	21	22	24
13d. Renewables (see 13e)	-	-	-	-	-
13e. Nuclear	0	0	0	0	0
13e. Other[1)]	23	25	28	33	38
14. Industry	318	313	340	374	416
14a. Oil (fossil)	28	13	13	13	14
14b. Gas (fossil)	18	19	20	21	22
14c. Solid fuels	102	99	103	109	117
14d. Renewables	46	45	49	55	62
14e. Electricity	96	106	121	139	159
14f. Heat (from CHP)	11	11	12	13	15
14g. Other	17	21	23	25	28
15. Commercial (Tertiary)	122	254	244	234	224
15a. Oil (fossil)	12	46	38	31	24
15b. Gas (fossil)	0	2	1	1	0
15c. Solid fuels	26	52	51	49	46
15d. Renewables	6	61	58	56	53
15e. Electricity	44	57	56	54	54
15f. Heat	33	37	40	43	47
15g. Other[1)]	0	0	0	0	0
16. Residential	287	124	122	119	118
16a. Oil (fossil)	58	15	12	9	7
16b. Gas (fossil)	2	0	0	0	0
16c. Solid fuels	57	27	27	25	23
16d. Renewables	80	7	8	10	11
16e. Electricity	61	43	42	42	44
16f. Heat	29	32	32	33	33
16g. Other[1)]	0	0	0	0	0
17. Transport	369	419	433	443	453
7a. Gasoline of which biofuels	77 3	71 5	68 5	64 5	59 4
17b. Diesel of which biofuels	239 14	291 18	301 23	308 23	313 22
17c. Jet Kerosine	30	34	39	44	50
17d. Other liquid fuels	2	1	1	1	0
17e. Gas (fossil)	6	9	10	10	10
17f. Electricity	12	13	14	16	20
17g. Renewables	3	0	0	0	0
17h. Other[2)]	0	0	0	0	0

[1)] *waste (total) + electricity demand of sector + transportation losses;* [2)] *electricity, coal and hydrogen*

Table 50: Parameters for projections – energy demand by sector, scenario "with additional measures".

	2010	2015	2020	2025	2030
Total Energy Demand [PJ]	**1 179**	**1 168**	**1 179**	**1 205**	**1 240**
13. Energy Industries	84	90	97	105	113
13a. Oil (fossil)	20	21	23	24	25
13b. Gas (fossil)	22	24	25	27	28
13c. Solid fuels	19	20	21	22	24
13d. Renewables (see 13e)	-	-	-	-	-
13e. Nuclear	0	0	0	0	0
13e. Other[1)]	23	25	28	32	37
14. Industry	318	308	327	351	379
14a. Oil (fossil)	28	13	13	12	12
14b. Gas (fossil)	18	18	19	20	21
14c. Solid fuels	102	97	99	102	106
14d. Renewables	46	44	46	49	53
14e. Electricity	96	105	117	132	148
14f. Heat (from CHP)	11	11	11	12	14
14g. Other	17	21	22	24	26
15. Commercial (Tertiary)	122	253	241	228	217
15a. Oil (fossil)	12	45	37	29	22
15b. Gas (fossil)	0	2	1	1	0
15c. Solid fuels	26	52	50	47	43
15d. Renewables	6	60	57	53	50
15e. Electricity	44	57	56	54	53
15f. Heat	33	36	40	44	48
15g. Other[1)]	0	0	0	0	0
16. Residential	287	123	120	116	113
16a. Oil (fossil)	58	15	12	9	6
16b. Gas (fossil)	2	0	0	0	0
16c. Solid fuels	57	27	25	23	20
16d. Renewables	80	7	8	10	11
16e. Electricity	61	43	41	42	44
16f. Heat	29	32	32	32	32
16g. Other[1)]	0	0	0	0	0
17. Transport	369	394	394	405	416
7a. Gasoline	77	68	63	58	52
of which biofuels	3	5	5	4	4
17b. Diesel	239	268	267	274	280
of which biofuels	14	16	21	20	20
17c. Jet Kerosine	30	34	39	44	50
17d. Other liquid fuels	2	1	1	1	0
17e. Gas (fossil)	6	9	10	10	10
17f. Electricity	12	13	15	18	24
17g. Renewables	3	0	0	0	0
17h. Other[2)]	0	0	0	0	0

[1)] waste (total) + electricity demand of sector + transportation losses; [2)] electricity, coal and hydrogen

Table 51: Parameters for projections – Other, scenario "with existing measures".

		2010	2015	2020	2025	2030
Assumptions for the transport sector						
24a. Growth of passenger person kilometres	Mkm	119 713	119 806	125 686	132 184	139 319
24b. Total kilometres driven by passenger cars	Mkm	90 377	89 678	94 467	99 967	105 960
25a. Growth of freight tonne kilometres	Mtkm	131 501	171 311	192 449	215 314	236 212
25b. Freight transport (all modes)	Mtkm	113 218	151 222	170 455	191 375	210 222
Assumptions in the agriculture sector						
33. Total cattle	1 000 heads	2 013.3	2 025.0	2 036.7	2 030.2	2 023.8
33a. Dairy cattle	1 000 heads	532.7	541.2	549.7	546.8	544.0
33b. Non-dairy cattle	1 000 heads	1 480.5	1 483.8	1 487.0	1 483.4	1 479.8
34. Sheep	1 000 heads	358.4	306.0	301.4	297.7	293.9
35. Swine	1 000 heads	3 134.2	2 944.8	2 924.9	2 857.3	2 789.8
36. Poultry	1 000 heads	14 644.4	12 456.3	12 361.1	12 028.1	11 695.1
37. Other (goats, horses, …)	1 000 heads	358.4	358.4	358.4	358.4	358.4
39. Fertiliser Used (Synthetic & Manure)	kt Nitrogen	196.7	209.4	208.2	193.4	196.7

Table 52: Parameters for projections – Other, scenario "with additional measures".

		2010	2015	2020	2025	2030
Assumptions for the transport sector						
24a. Growth of Passenger person kilometres	Mkm	119 713	119 004	123 982	131 017	139 110
24b. Total kilometres driven by passenger cars	Mkm	90 377	88 572	92 465	98 506	105 464
25a. Growth of freight tonne kilometres	Mtkm	131 501	153 316	163 854	187 668	210 442
25b. Freight transport (all modes)	Mtkm	113 218	130 867	139 005	160 845	181 561
Assumptions in the agriculture sector						
33. Total cattle	1 000 heads	12 013.3	2 018.5	2 023.8	2 017.2	2 010.6
33a. Dairy cattle	1 000 heads	532.7	547.7	562.6	559.9	557.2
33b. Non-dairy cattle	1 000 heads	11 480.5	1 470.8	1 461.1	1 457.3	1 453.4
34. Sheep	1 000 heads	358.4	306.0	301.4	297.7	293.9
35. Swine	1 000 heads	3 134.2	2 944.8	2 924.9	2 857.3	2 789.8
36. Poultry	1 000 heads	14 644.4	12 456.3	12 361.1	12 028.1	11 695.1
37. Other (goats, horses, …)	1 000 heads	358.4	358.4	358.4	358.4	358.4
39. Fertiliser Used (Synthetic & Manure)	kt Nitrogen	196.7	205.1	199.2	192.5	185.8

Policies and Measures

Table 53: Policies & Measures I.

PAM-No	Status of policy, measure or group	Scenario	Name of policy or measure (or group)	Common and coordinated policy and measure (CCPM)
01_EN	implemented	WEM	Emission Trading Scheme	Cross-cutting: EU ETS Directive 2003/87/EC as amended by Directive 2008/101/EC and Directive 2009/29/EC
02_EN	implemented	WEM	Green Electricity Act	Energy supply: RES Directive 2009/28/EC (repealing RES-E Directive 2001/77/EC and Biofuel Directive 2003/30/EC)
03_EN	implemented	WEM	Consequences of the EU Water Framework Directive	Agriculture: Water Framework Directive 2000/60/EC
04_EN	implemented	WEM	Implementation of the National Energy Efficiency Action Plan 2011	Energy consumption: End-use efficiency and energy services 2006/32/EC repealing SAVE Directive (Directive 93/76/EEC)
05_EN	implemented	WEM	Domestic Environmental Support Scheme (UFI)	Non CCPM National Policy
06_EN	expired	Not in projections	Combined heat and power Act (CHP)	Energy supply: Combined Heat and Power (CHP) Directive Promotion of cogeneration 2004/8/EC
07_EN	planned	WAM only	Energy efficiency Act draft 2012	Energy supply: RES Directive 2009/28/EC (repealing RES-E Directive 2001/77/EC and Biofuel Directive 2003/30/EC)
08_EN	planned	WAM only	Green Electricity Act – beyond 2020	Energy supply: RES Directive 2009/28/EC (repealing RES-E Directive 2001/77/EC and Biofuel Directive 2003/30/EC)
09_EN	planned	Not in projections	Research Initiative for industrial processes and pilot plants	Non CCPM National Policy
01_TRA	implemented	WEM	Promotion of biofuels – Implementation of Directive 2003/30/EC on Biofuels Regulation	Transport: Biofuels Directive (Directive 2003/30/EC)
02_TRA	implemented	WEM	Economic incentives – fuel tax increase in 2011 ("Klimabeitrag")	Energy supply: Taxation of energy products 2003/96/EC
03_TRA	implemented	WEM	Mobility management and awareness: klima:aktiv mobility programme	Non CCPM National Policy
04_TRA	implemented	WEM	Economic incentives – Greening the truck toll (Directive 2006/38/EC)	Transport: Infrastructure charging for heavy goods (revised Eurovignette) 2006/38/EC
05_TRA	implemented	WEM	Economic incentives – Greening of consumption tax (NoVA)	Transport: Regulation on CO_2 from cars 2009/443/EC
06_TRA	implemented	WEM	Promotion of corporate rail connections	Non CCPM National Policy
07_TRA	implemented	WEM	Mobility management and awareness raising: fuel saving intitiative	Non CCPM National Policy
08_TRA	implemented	WEM	More efficient car use/telematics – existing speed limits of IG-L	Non CCPM National Policy
09_TRA	implemented	WEM	Trend electromobility – Implementation Plan for electric mobility	Non CCPM National Policy
10_TRA	planned	WAM only	Economic incentive: fuel tax increase in 2015 and 2019	Transport: Regulation on CO_2 from cars 2009/443/EC
11_TRA	planned	WAM only	Economic incentives – Further greening of consumption tax (NoVA)	Transport: Regulation on CO_2 from cars 2009/443/EC
12_TRA	planned	WAM only	More efficient car use – nation wide speed limits	Non CCPM National Policy
13_TRA	planned	WAM only	Mobility Management and awareness – Promoting mobility management including Master Plan Bicycle & Pedestrian Master Plan	Non CCPM National Policy
14_TRA	planned	WAM only	Trend electromobility – Promoting electric vehicles according to the Austrian Energy Strategy	Non CCPM National Policy

PAM-No	Status of policy, measure or group	Scenario	Name of policy or measure (or group)	Common and coordinated policy and measure (CCPM)
15_TRA	planned	WAM only	Economic incentives – commuter tax reform (job ticket)	Non CCPM National Policy
16_TRA	planned	WAM only	Economic incentives – implementation of the new Infrastructure Costs Directive 2011/76/EC in Austria	Transport: Infrastructure charging for heavy goods (revised Eurovignette) 2006/38/EC
17_TRA	planned	WAM only	Improvements in freight transport – Implementation of National Action Plan Danube Navigation (NAP)	Non CCPM National Policy
18_TRA	implemented	Not in projections	CO_2 Labelling for passenger cars	Transport: New Passenger Car Labelling on fuel economy rating 1999/94/EC
19_TRA	implemented	Not in projections	Promoting the purchase of clean and energy-efficient cars	Transport: Clean and Energy efficient road transport Directive 2009/33/EC
20_TRA	implemented	Not in projections	Implementation of EURO 5 and EURO 6 standards	Non CCPM National Policy
21_TRA	expired	Not in projections	ACEA – voluntary agreement	Transport: Voluntary agreement with car manufacturers to reduce specific CO_2 emissions (ACEA, KAMA, JAMA)
01_B	implemented	WEM	Efficient new buildings	Non CCPM National Policy
02_B	implemented	WEM	Thermal insulation of existing buildings	Energy consumption: End-use efficiency and energy services 2006/32/EC repealing SAVE Directive (Directive 93/76/EEC)
03_B	implemented	WEM	Change of heating systems (Heizsystemerneuerung)	Non CCPM National Policy
04_B	implemented	WEM	Ecodesign requirements for energy using products	Energy consumption: Ecodesign Directive 2009/125/EC (amending 2005/32/EC)
05_B	implemented	WEM	End-use efficiency and energy services (Directive 2006/32/EC)	Energy consumption: End-use efficiency and energy services 2006/32/EC repealing SAVE Directive (Directive 93/76/EEC)
06_B	implemented	WEM	Recast Directive of energy performance of buildings	Energy consumption: Recast of the Energy performance of buildings (Directive 2010/31/EC) amending 2002/91/EC
07_B	implemented	WEM	Energy labelling of household appliances	Energy consumption: Directives on energy labelling of household appliances
08_B	planned	WAM only	Promote thermal insulation (Sanierung)	Energy consumption: Recast of the Energy Performance of Buildings Directive (2010/31/EC) amending 2002/91/EC
09_B	planned	WAM only	Promote efficient and climate friendly heating systems	Energy consumption: Recast of the Energy Performance of Buildings Directive (2010/31/EC) amending 2002/91/EC
01_IP	implemented	WEM	Implementation of the EU F-gas Regulation	Industrial Process: F-gas Regulation (842/2006)
02_IP	implemented	WEM	Prohibition and restriction of the use of (partly) fluorinated hydrocarbons and SF6	Industrial Process: F-gas regulation (Regulation 842/2006)
03_IP	implemented	WEM	Reducing HFC emissions from air conditioning in motor vehicles	Industrial Process: HFCs in mobile air conditioning Directive 2006/40/EC
04_IP	planned	WAM only	Introduction of taxes for highly effective GHGs	Non CCPM National Policy
05_IP	planned	WAM only	Benchmark for maximum leakage rate for cooling systems and thermal heat pumps	Industrial Process: F-gas regulation (Regulation 842/2006)
01_SO	implemented	WEM	Solvent Ordinance to reduce VOC emissions from paints and varnishes	Other: Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations amended by 2004/42/EC
02_SO	implemented	WEM	Limitation of VOC emissions by organic solvents in industrial installations	Other: Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations amended by 2004/42/EC

PAM-No	Status of policy, measure or group	Scenario	Name of policy or measure (or group)	Common and coordinated policy and measure (CCPM)
03_SO	implemented	WEM	Limitation of VOC emissions by using organic solvents containing highly volatile halogenated hydrocarbons (VHH) in industrial installations	Other: Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations amended by 2004/42/EC
01_AGR	implemented	WEM	Common Agricultural Policy (CAP)	Agriculture: Common Agricultural Policy (CAP) related regulations
02_AGR	implemented	WEM	Fulfilling Cross Compliance	Agriculture: Common Agricultural Policy (CAP) – establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers (Regulation 1782/2003)
03_AGR	implemented	WEM	Programme for rural development	Agriculture: Common Agricultural Policy (CAP) – on support for rural development by the European Agricultural Fund for Rural Development (2603/1999, 1698/2005 and 1290/2005)
04_AGR	implemented	WEM	Modulation of direct payments	Agriculture: Common Agricultural Policy (CAP) – establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers (Regulation 1782/2003)
05_AGR	planned	WAM only	Promotion of grazing for cows and suckling cows	Non CCPM National Policy
06_AGR	planned	WAM only	Decoupling of premiums for suckling cows	Agriculture: Common Agricultural Policy (CAP) related regulations
07_AGR	planned	WAM only	Adapted feeding (in phases) for pigs in order to reduce N2O/NH3-emissions	Non CCPM National Policy
08_AGR	planned	WAM only	Covering of slurry storages	Non CCPM National Policy
09_AGR	planned	WAM only	Fermentation of liquid manure	Non CCPM National Policy
10_AGR	planned	WAM only	Band spreading of liquid manure	Non CCPM National Policy
11_AGR	planned	WAM only	ÖPUL measures that lead to a reduction in the use of mineral fertilizers	Non CCPM National Policy
12_AGR	planned	WAM only	Short-rotation areas	Non CCPM National Policy
13_AGR	planned	WAM only	Sustainable N management	Agriculture: Common Agricultural Policy (CAP) related regulations
14_AGR	planned	WAM only	Organic farming	Agriculture: Common Agricultural Policy (CAP) related regulations
15_AGR	planned	Not in projections	Reduced soil tillage – mulching and direct sowing	Non CCPM National Policy
16_AGR	planned	Not in projections	“Ecodriving” for tractors	Non CCPM National Policy
17_AGR	planned	Not in projections	Replacement of diesel fuel by vegetable oil (from oilseeds)	Non CCPM National Policy
01_Waste	implemented	WEM	Landfill Ordinance	Waste: Landfill directive 1999/31/EC
02_Waste	planned	WEM	Emission reduction from mechanical biological treatment plants	Non CCPM National Policy
03_Waste	implemented	Not in projections	Obligatory covering of fermentation residue tanks	Waste: Waste Framework Directive (2008/98/EC) amending Directive on waste 2006/12/EE

IP = Industrial processes, EN = EnergySupply, IND = Industry, TRA = Transport, RES = Residential, AGR = Agriculture

Table 54: Policies & Measures II.

P&M-No	Objective of measure(s)	Type of instruments
01_EN	The objective is to limit the CO_2 emissions of large power plants and industrial plants through a trading mechanism for emission certificates.	Reg, Ec
02_EN	The expansion targets for 2020 for renewables are +2400 MW, the share of renewables in electricity consumption from the public grid shall rise to 15 % by 2015	Ec, Reg
03_EN	The implementation of the EU Water Framework Directive has led to a reduction of electricity production of small hydropower plants and run-off river power plants since 2011.	Reg
04_EN	Definition of target regarding the reduction of energy consumption	P, Reg
05_EN	GHG relevant projects are funded to increase energy efficiency and the use of renewables	Ec
06_EN	The main purpose of this Act is to increase energy efficiency and improve the security of supply. Therefore, a framework for the promotion and development of high efficiency cogeneration of heat and power has been created. New CHP plants are subsidized.	Ec, Reg
07_EN	Efficiency of energy use in businesses and in the federal government shall be increased in a cost-effective way and contribute to energy savings in order to achieve the objectives defined in 2020 in Austria	Reg, Vo
08_EN	supporting green electricity also beyond 2020, especially wind power and photovoltaic installations	Ec, Reg
09_EN	funding projects which aim at increasing technological progress in terms of moving towards a low-carbon economy	Res, Ec
01_TRA	promotion of the use of biofuels or other renewable fuels for transport	Reg
02_TRA	reduction of individual motorised transport and a shift towards public transport	Fi
03_TRA	consultation of various stakeholders regarding emission reductions through fuel efficiency	Inf, Ed, VO, Ec
04_TRA	charge the use of heavy goods on federal roads and highways	Fi, Reg, Ec
05_TRA	promotion of clean and efficient vehicles	Fi, Reg
06_TRA	improvement of intermodal freight transport logistics	Ec, Inf
07_TRA	initiative to promote fuel saving	Inf, Ed, VO, Ec
08_TRA	immission control caused by road transport	Reg, Inf
09_TRA	Development and use of clean, and at least partly electrified vehicles for private, public and commercial traffic, as well as the intelligent integration of innovative mobility offers and services	P, Ec, Res
10_TRA	reduction of individual motorised transport and a shift towards public transport	FI
11_TRA	promotion of clean and efficient vehicles	FI, Reg
12_TRA	reduction of speed limits leading to less emissions	Reg, Inf
13_TRA	promoting bicycle use and other vehicles for pedestrians	Inf, Ed, VO, Ec
14_TRA	Development and use of clean, and at least partly electrified vehicles for private, public and commercial traffic	P, Ec, Res
15_TRA	promote the use of public transport for	Ec, Inf
16_TRA	charging for external effects (eg. noise, air pollution) together with tolls	Fi, Reg, Ec
17_TRA	increase freight transport on the Danube	P, Vo
18_TRA	help customers choose climate-friendly cars	Reg, Inf
19_TRA	promoting and stimulating the market for clean and energy-efficient vehicles	Reg, Inf
20_TRA	limiting air pollution caused by road transport	Reg
21_TRA	Raising the market share of advanced engine technologies with low fuel consumption	Vo
01_B	This group of measures targets the energy efficiency of new buildings by reducing the energy consumption. The group of measures includes: toughening the standards of construction 2010 and financial support for new buildings.	Reg, Ec
02_B	This group of measures analyses the effects of the enforced thermal renovation of buildings. A WOM scenario was taken as a fictitious reference scenario where thermal renovation had no effects.	Ec, Reg, Inf, Vo
03_B	This group of measures includes measures that affect the impacts of the change of heating systems in the WEM scenario. The WEM scenario was compared to a fictitious WOM scenario where heating systems were not replaced or subsidised.	Ec, Reg
04_B	Consists of defining minimum ecodesign requirements for specific energy-using products. These products have to be certified with the CE label and have to meet the minimum requirements defined in the EU directive.	Reg
05_B	This directive aims at making the end use of energy more economical and efficient. Member States must adopt and achieve an indicative energy saving target of 9 % by 2016 in the framework of a national energy efficiency action plan (NEEAP). Furthermore, energy saving targets for the public sector have to be set and harmonised indicators and benchmarks for energy efficiency have to be established.	Reg, Inf

P&M-No	Objective of measure(s)	Type of instruments
06_B	The recast of the Directive on the energy performance of buildings (2010/31/EC) was released in order to improve the efficiency of the previous building regulation and to counteract deficiencies in national implementations. The mechanisms remained the same: Definition of calculation methods for the total energy efficiency and minimum requirements, Specifications for the creation, submission and notice of the energy performance certificate, Inspections of heating and cooling systems.	Reg, Inf
07_B	The regulation specifies different energy classes, starting from A+++ (the best class) to D (the poorest class). As in the amendment of the Eco-design directive, the scope was expanded to a larger group of energy consuming products. The energy label helps consumers to compare products in terms of their energy consumption.	Reg, Inf
08_B	increasing energy efficiency	Ec
09_B	promote highly efficient heating systems	Reg
01_IP	reduction of F-gas emissions mainly from stationary applications through application- specific requirements covering all stages of the life-cycle of F-gases	Reg
02_IP	The use of HFCs, PFCs and SF6 for all sectors covered in the National Inventory are banned or restricted. In case of exception a strict reporting and documentation is required	Reg
03_IP	Refrigerants in motor vehicles with a high GWP shall be banned successively.	Reg
04_IP	to substitute high effective GHG in cooling systems	Fi
05_IP	Maximum leakage rates for refrigerants in cooling systems and thermal heat pumps shall be determined and quantifications for the refrigerant loss shall be documented	Vo, Reg
01_SO	The PaM aims at limiting emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products. Therefore, the VOC content of these products is reduced in. Acidification and ground-level ozone shall be reduced.	Reg
02_SO	The PaM aims at limiting emissions of volatile organic compounds due to the use of organic solvents. The operators are obliged to comply with regulations concerning emission limits. For this reason regular measurements and reporting is necessary. An annual solvent balance has to be reported to the district administration.	Reg
03_SO	The PaM aims at limiting emissions of volatile organic compounds due to the use of organic solvents that contain highly volatile halogenated hydrocarbons (VHH). The operators are obliged to comply with regulations concerning emission limits. For this reason regular measurements and reporting is necessary. An annual solvent balance has to be reported to the district administration.	Reg
01_AGR	Reduction of environmental pollution from agricultural activity	Reg, Ec
02_AGR	keep the agricultural land and environment in a good condition	Reg, Ec
03_AGR	support of regions in agricultural development, considering environmental aspects	Reg, Ec
04_AGR	direct payments for big farms are gradually reduced	Ec
05_AGR	Compared to indoor husbandry the grazing of cattle causes lower GHG emissions. Through counselling and financial support the share of outdoor husbandry shall be increased or at least maintained.	Inf, Ec
06_AGR	A decoupling of this premium would possibly reduce beef production – so the total number of cattle decreases	Ec
07_AGR	The composition of the pig feeding should be varied depending on the growth phases. The influence of the total N uptake and thus reduced N excretion in manure reduces the GHG emissions	Inf, Ec
08_AGR	reduce emissions from slurry storages	Reg, Ec
09_AGR	The reduction of greenhouse gases (methane, nitrous oxide) through fermentation.	Ec
10_AGR	reduce considerable ammonia air emissions	Ec
11_AGR	reduce the use of mineral fertilizers	Ec
12_AGR	The expansion of areas where fast-growing plants (poplar, willow, ...) are produced, reduces the need for fuel, fertilizer and plant protection on agricultural land	Ec
13_AGR	efficiency increase in fertilizer use by customized storage for manure, the proper use of fertilizers in general, or the establishment of manure exchanges	Inf, Ec
14_AGR	The efficient ÖPUL measure “organic farming” is achieved through systematic closed cycle management and avoids the use of mineral fertilizer	Ec
15_AGR	Reduced soil tillage (mulching or direct sowing) leads to considerable fuel savings	Ec, Inf
16_AGR	reduce tractor fuel consumption per hectare	Ed, Inf
17_AGR	switch from fossil fuels to bio fuels, namely to increase the share of colza and sunflower oil to 3 %.	Vo
01_Waste	reduction of methane emissions through decomposition of waste (reduce organic carbon content in waste, collect landfill gas, etc)	Reg
02_Waste	setting emission limits i.a. for TOC and N_2O	Reg
03_Waste	reduction of diffuse methane emissions	Reg

Ec = Economic, Fi = Fiscal, Vo = Voluntary, Reg =regulatory, Inf = Information, Ed = Education, Res = Research, P = Planning, O = Other

Table 55: Policies & Measures III.

P&M-No	GHG affected	Ex-ante (Projected) Estimate of GHG emission reduction in Gg CO_2e		Policy Interactions
		2015	2020	
01_EN	CO_2	NE	NE	interaction with all targeted sectors, e.g. industry, transport (aviation), and the whole energy sector
02_EN	CO_2	412	421	combined heat power Act, UFI fund, agricultural sector (biogas production)
03_EN	CO_2	-28	-28	
04_EN	CO_2	NE	NE	influences also the building sector, and domestic energy consumption, the agricultural sector, transport sector, spatial planning
05_EN	CO_2	300	250	important funding for the sectors: buildings, energy production, transport
06_EN	CO_2	NE	NE	green electricity act, feed-in tariffs regulations, financial support from UFI, but also industrial processes
07_EN	CO_2	NE	150	CHP act, district heating, energy efficiency action plan
08_EN	CO_2	NE	NE	combined heat and power Act, UFI fund, agricultural sector (biogas production)
09_EN	CO_2	0	0	industrial processes
01_TRA	CO_2	NE	2.100	sector agriculture, cultivation of energy plants
02_TRA	CO_2	NE	1.200	more fuel efficient driving, switch to public transportation
03_TRA	CO_2	NE	500	
04_TRA	CO_2	NE	400	switch to other means of transports, e.g. railways or shipping
05_TRA	CO_2	NE	100	more fuel efficient driving, switch to public transportation
06_TRA	CO_2	NE	70	
07_TRA	CO_2	NE	60	
08_TRA	CO_2	NE	30	more fuel efficient driving
09_TRA	CO_2	NE	20	increased electricity demand, effect on energy production
10_TRA	CO_2	NE	2.100	more fuel efficient driving, switch to public transportation
11_TRA	CO_2	NE	300	more fuel efficient driving, switch to public transportation
12_TRA	CO_2	NE	200	more fuel efficient driving
13_TRA	CO_2	NE	200	switch to public transport as well
14_TRA	CO_2	NE	90	increased electricity demand
15_TRA	CO_2	NE	70	switch to public transport
16_TRA	CO_2	NE	4	switch to railway transport
17_TRA	CO_2	NE	0.2	
18_TRA	CO_2	NE	NE	19_tra
19_TRA	CO_2	NE	NE	18_tra
20_TRA	CO_2	NE	NE	switch to other means of transports, e.g. railways or shipping
21_TRA	CO_2	NE	NE	18_tra, 19_tra
01_B	CO_2	27	77	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
02_B	CO_2	268	426	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
03_B	CO_2	311	707	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
04_B	CO_2	NE	NE	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
05_B	CO_2	NE	NE	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
06_B	CO_2	NE	NE	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
07_B	CO_2	NE	NE	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
08_B	CO_2	NE	205	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
09_B	F-gases	NE	75	linkage with other measures in the building sector, as they all target the increase of energy efficiency in households
01_IP	F-gases	NE	NE	interaction with other F-gas measures

P&M-No	GHG affected	Ex-ante (Projected) Estimate of GHG emission reduction in Gg CO_2e		Policy Interactions
		2015	2020	
02_IP	F-gases	NE	NE	It is part of the implementation of the EU F-gas regulation together with PaM 01_IP. -Furthermore, measures in public procurement (abandonment of products containing F-gases) and public funding (criteria for federal financial support to housing construction) were implemented in the agreement 15a B-VG (between the federal government and the federal provinces).
03_IP	F-gases	NE	NE	interaction with other F-gas measures
04_IP	F-gases	45	90	interaction with other F-gas measures
05_IP	F-gases	NE	NE	interaction with other F-gas measures
01_SO	CO_2	NE	NE	
02_SO	CO_2	NE	NE	
03_SO	CO_2	NE	NE	02_IP includes regulations concerning this PaM
01_AGR	CO_2, CH_4, N_2O	NE	NE	the implementation of the CAP interferes with other policies listed in this sector
02_AGR	CO_2, CH_4, N_2O	NE	NE	interaction with other agricultural measures focusing on fertiliser use, and management of fields/pastures
03_AGR	CO_2, CH_4, N_2O	NE	NE	interaction with other agricultural measures focusing on fertiliser use, and management of fields/pastures
04_AGR	CO_2, CH_4, N_2O	NE	NE	direct payments influence farmer's decision and are therefore linked to all other agricultural measures taken
05_AGR	CH_4, N_2O CO_2	NE	1	interferes with other agricultural measures targeting cattle husbandry
06_AGR	CH_4, N_2O CO_2	NE	-2	interferes with other agricultural measures targeting cattle husbandry, especially Agr_05
07_AGR	N_2O	NE	4	
08_AGR	CH_4, N_2O CO_2	NE	3	linkage with PAM 09_AGR as all target manure treatment
09_AGR	CH_4, N_2O CO_2	NE	149	linkage with PAM 08_AGR as all target manure treatment, Green electricity Act (Feed-in tariffs)
10_AGR	CH_4, N_2O CO_2	NE	0	reduction of N loss (economic savings)
11_AGR	N_2O, CH_4, CO_2	NE	48	linkage with all other agricultural measures targeting fertiliser use
12_AGR	CO_2, N_2O	NE	5	linkage to energy sector, as plants can serve as renewable energy source
13_AGR	N_2O	NE	21	interferes with other agricultural measures targeting fertiliser use (e.g. 12_AGR)
14_AGR	CO_2, CH_4, N_2O	NE	17	interaction with all other agricultural measures as environmental and climate-friendly farming practises are supported
15_AGR	CO_2	NE	6	linkage with transport measures, as fuel is saved
16_AGR	CO_2	NE	4	linkage with transport measures, as fuel is saved
17_AGR	CO_2	NE	20	linkage with transport measures, as fuel is saved
01_Waste	CH_4	NE	NE	Waste incineration as a energy source is gaining importance in Austria, therefore less waste is deposited
02_Waste	CH_4, N_2O	NE	NE	if waste is pretreated in an MBA, less waste with less organic content is going to be deposited, which leads to reduced emissions from solid waste disposal
03_Waste	CH_4	NE	NE	interacts with energy supply sector, as it represents a renewable energy source, which can replace fossil fuels

NE = not estimated; IP = Industrial processes, EN = EnergySupply, IND = Industry, TRA = Transport, RES = Residential, AGR = Agriculture

ANNEX 2: ADDITIONAL KEY PARAMETERS FOR SECTORAL FORECASTS

Energy Industries

Scenario “with existing measures“

Table 56: Projected fuel input into power and heat plants – scenario “with existing measures”.

Energy [TJ]	2010	2015	2020	2025	2030
Bituminous Coal and Anthracite	60 834	52 843	44 234	44 280	44 895
Residual Fuel Oil	18 530	14 177	12 802	12 435	12 778
Natural gas	117 045	83 586	86 218	103 193	118 450
Waste	13 672	20 144	19 571	18 995	18 419
Biomass	76 383	90 356	96 090	90 691	80 626
Hydropower	136 243	145 447	153 810	156 204	156 097
Wind power	7 484	13 057	21 198	24 956	29 107
Photovoltaics	387	2 263	4 783	5 233	5 683
Geothermal	740	1 422	2 113	2 137	2 165

Scenario “with additional measures”

Table 57: Projected fuel input into power and heat plants – scenario “with additional measures”.

Energy [TJ]	2010	2015	2020	2025	2030
Bituminous Coal and Anthracite	60 834	52 636	44 248	44 572	44 973
Residual Fuel Oil	18 530	14 177	12 802	12 435	12 777
Natural gas	117 025	81 713	80 015	87 718	99 509
Waste	13 672	20 144	19 571	18 995	18 419
Biomass	76 383	90 365	100 672	102 521	92 453
Hydropower	136 243	145 447	153 810	156 204	156 097
Wind power	7 484	13 057	21 198	32 156	43 507
Photovoltaics	387	2 263	4 783	6 943	9 213
Geothermal	740	1 422	2 327	2 504	2 685

Manufacturing Industries and Construction

Scenario “with existing measures“

Table 58: Final energy demand of industry – scenario “with existing measures”.

Energy [TJ]	2010	2015	2020	2025	2030
Coal without coke	6 266	5 757	6 101	6 590	7 215
Coke	6 949	7 753	8 013	8 347	8 758
Light Fuel Oil	2 863	2 926	3 171	3 435	3 717
Heavy Fuel Oil	7 930	6 388	6 053	5 872	5 811
Other petr. Products	4 426	3 953	3 982	4 023	4 056
Natural gas	102 162	98 956	102 639	108 692	117 127
Derived gas	4 393	5 135	5 452	5 835	6 291
Waste	19 625	20 754	22 603	24 926	27 783
Biomass	45 905	44 688	49 095	54 648	61 544
Electricity	96 399	106 411	121 237	138 624	158 695
Heat	10 652	10 750	11 911	13 440	15 418

Scenario “with additional measures”

Table 59: Final energy demand of industry – scenario “with additional measures”.

Energy [TJ]	2010	2015	2020	2025	2030
Coal without coke	6 266	5 620	5 773	6 026	6 354
Coke	6 949	7 727	7 955	8 253	8 623
Light Fuel Oil	2 863	2 844	2 975	3 084	3 160
Heavy Fuel Oil	7 930	6 264	5 777	5 427	5 174
Other Petr. Products	4 426	3 873	3 795	3 709	3 591
Natural gas	102 162	97 238	98 520	101 533	106 060
Derived gas	4 393	5 124	5 429	5 798	6 238
Waste	19 625	20 551	22 065	23 928	26 167
Biomass	45 905	43 554	46 252	49 399	52 830
Electricity	96 399	104 674	117 160	131 570	147 751
Heat	10 652	10 525	11 326	12 330	13 528

Transport

Scenario "with existing measures"

Table 60: Energy consumption of mobile sources by fuel – scenario "with existing measures".

Energy [TJ]	2010	2015	2020	2025	2030
gasoline fossil	73 974	65 459	63 320	59 180	54 841
diesel fossil	247 832	272 971	277 715	285 040	291 088
bioethanol	1 620	1 810	1 733	1 619	1 501
biodiesel	18 512	17 564	23 415	22 810	22 334
vegetable oil	612	306	0	0	0
BIO ETBE	1 650	3 276	3 171	2 964	2 746
LPG	1 562	1 437	1 045	627	203
natural gas	152	180	274	364	445
biogas	0	0	0	0	0
H_2	0	0	0	0	0
coal	5	4	3	3	3
electricity rail	7 339	7 965	8 645	9 327	10 072
electricity passenger cars	4	23	322	1 842	4 831
aviation jet fuel	29 627	33 781	38 857	44 105	49 828

Scenario "with additional measures"

Table 61: Energy consumption of mobile sources by fuel – scenario "with additional measures".

Energy [TJ]	2010	2015	2020	2025	2030
gasoline fossil	73 974	62 656	58 787	53 955	48 659
diesel fossil	247 832	251 623	245 779	253 852	260 457
bioethanol	1 620	1 733	1 609	1 476	1 332
biodiesel	18 512	16 284	20 722	20 058	19 547
vegetable oil	612	306	0	0	0
BIO ETBE	1 650	3 136	2 944	2 702	2 437
LPG	1 562	1 437	1 045	627	203
natural gas	152	180	274	364	445
biogas	0	0	0	0	0
H2	0	0	0	0	0
coal	5	4	3	3	3
electricity rail	7 339	8 020	8 699	9 380	10 124
electricity passenger cars	4	122	1 048	3 791	8 453
aviation jet fuel	29 627	33 780	38 853	44 099	49 818

Residential, Commercial & Other Sectors

Table 62: Assumptions for energy prices – scenarios WEM & WAM.

price, real [€/MWh]	2010	2015	2020	2025	2030
natural gas	68.2	73.8	75.7	76.8	77.6
heating and other gas oil	75.2	89.8	94.9	98.7	101.5
coal	32.0	35.8	35.6	35.4	35.2
wood log and wood briquettes	35.6	40.5	42.2	43.4	44.2
wood chips	30.8	35.0	36.5	37.5	38.2
wood pellets	39.9	45.4	47.2	48.5	49.4
distr. heat	47.6	54.1	56.4	57.9	59.0

*Table 63: Assumptions on subsidy rates – scenario WEM & WAM**

subsidy rates [%]	2010	2015	2020	2025	2030
wood log and wood briquettes	20	20	20	20	20
wood chips	20	20	20	20	20
wood pellets	23	23	23	23	23
distr. heat Vienna	15	15	15	15	15
distr. heat Other	15	15	15	15	15
distr. heat biomass	23	23	23	23	23
solar heat	20–25	20–25	20–25	20–25	20–25

* *Forced usage of condensing boiler in the WAM scenario for gas and gas oil fuels.*

Table 64: Assumptions for the number and size of buildings, and the number of permanently occupied dwellings – scenarios WEM & WAM.

Number of buildings		**2010**	**2020**	**2030**
residential buildings with one or two apartments	number	1 586 037	1 719 441	1 804 816
residential buildings with more than two apartments	number	183 442	199 950	211 015
commercial buildings	number	151 033	173 927	185 706
Size of buildings		**2010**	**2020**	**2030**
residential buildings with one or two apartments	million m² gross floor area	278	301	318
residential buildings with more than two apartments	million m² gross floor area	162	179	191
commercial buildings	million m³ gross floor volume	146	169	180
Number of dwellings		**2010**	**2020**	**2030**
residential buildings with one or two apartments	number in 1 000	1 830	1 984	2 082
residential buildings with more than two apartments	number in 1 000	1 808	1 973	2 085

Table 65: Heating demand, renovation rates and boiler exchange rates – scenario "with existing measures".

Heating demand (average)*		**2010**	**2020**	**2030**
residential buildings with one or two apartments	[kWh/m².a]	161	130	108
residential buildings with more than two apartments	[kWh/m².a]	110	91	79
commercial buildings	kWh/m².a	174	141	119
renovation rate	**[%]**			
residential buildings with one or two apartments		0.77	0.72	0.40
residential buildings with more than two apartments		0.75	0.73	0.47
commercial buildings		0.70	0.75	0.67
boiler exchange rate in residential buildings		1.78	2.46	2.54

* *m² gross floor space*

Table 66: Heating demand, renovation rates and boiler exchange rates – scenario "with additional measures".

Heating demand (average)*		**2010**	**2020**	**2030**
residential buildings with one or two apartments	[kWh/m².a]	161	127	104
residential buildings with more than two apartments	[kWh/m².a]	110	90	76
commercial buildings	kWh/m².a	174	138	112
renovation rate	**[%]**			
residential buildings with one or two apartments		1.01	1.20	0.93
residential buildings with more than two apartments		0.96	1.17	1.04
commercial buildings		0.87	0.99	1.03
boiler exchange rate in residential buildings		1.76	2.44	2.57

* *m² gross floor space*

Fugitive Emissions from Fuels

Table 67: Historical and forecast activities (2011–2030) for calculation of fugitive emissions.

	2010	**2015**	**2020**	**2025**	**2030**
Gas pipeline length [km]	6 798	7 419	8 055	8 055	8 055
Gas distribution network [km]	28 733	31 049	33 366	35 683	37 999
Natural gas production [million m³]	1 731	1 775	1 820	1 866	1 913
Natural gas final consumption [PJ]	192	175	175	183	194
Refinery crude oil input [PJ]	336	325	329	332	337
Natural gas storage capacities [million m³]	3 070	4 655	5 700	5 700	5 700

Agriculture

Table 68: Livestock population cattle 2010 and forecast 2015–2030

	Population size [heads]			
Year	**Dairy (WEM)**	**Non-Dairy (WEM)**	**Dairy (WAM)**	**Non-Dairy (WAM)**
2010	532 735	1 480 546	532 735	1 480 546
2015	541 219	1 483 751	547 708	1 470 773
2020	549 702	1 486 963	562 615	1 461 138
2025	546 841	1 483 390	559 893	1 457 285
2030	543 979	1 479 818	557 171	1 453 433

Table 69: Livestock population other animals 2010 and forecast 2015–2030

	Population size [heads]					
Year	**Swine**	**Sheep**	**Goats**	**Poultry**	**Horses**	**Other**
2010	3 134 156	358 415	71 768	14 644 413	81 637	47 575
2015	2 944 776	305 954	58 270	12 456 275	86 267	40 931
2020	2 924 866	301 416	57 566	12 361 130	86 133	40 888
2025	2 857 332	297 661	57 732	12 028 123	85 664	40 342
2030	2 789 799	293 906	57 898	11 695 116	85 194	39 797

Table 70: Milk production 2010 and forecast (2015–2030)

	Ø milk yield per dairy cow				
year	**2010**	**2015**	**2020**	**2025**	**2030**
kg/yr	6 100	6 820	7 209	7 685	8 161

Table 71: Mineral fertiliser use 2010 and forecast (2015–2030)

	Mineral fertiliser use (t/year)				
	2010	**2015**	**2020**	**2025**	**2030**
WEM	88 465	101 143	98 192	89 675	81 157
WAM	88 465	96 074	88 405	80 556	72 707

PERSPEKTIVEN FÜR UMWELT & GESELLSCHAFT umweltbundesamt

Umweltbundesamt GmbH
Spittelauer Lände 5
1090 Wien/Österreich

Tel.: +43-(0)1-313 04
Fax: +43-(0)1-313 04/5400

office@umweltbundesamt.at
www.umweltbundesamt.at

This report presents information on projections, policies and measures according to reporting obligations as defined in Decision 280/2004/EC. It includes greenhouse gas projections for the years 2015, 2020, 2025 and 2030 and describes policies and measures to reduce emissions by source.

The results include two different scenarios: the scenario "with existing measures" takes into account climate change mitigation measures implemented under the Austrian Climate Strategies 2002 and 2007 before 8 March 2012. It shows a 4 percent increase in greenhouse gases from 1990 to 2020 and a 7.5 percent increase from 1990 to 2030. The scenario "with additional measures" also includes planned policies and measures. Here a 0.8 percent decrease is projected for the period from 1990 to 2020 and a 0.1 percent decrease for the period up to 2030.

EMAS
Geprüftes Umweltmanagement
REG.NO. AT- 000484

ISBN 978-3-99004-216-8