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GHG Projections and Assessment of Policies and Measures in Austria

Reporting under Decision 280/2004/EC

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Reporting under Decision 280/2004/EC, 15th March 2011

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VORWORT

Der vorliegende Endbericht präsentiert die österreichischen Treibhausgasprojektionen für die Jahre 2010, 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 2. Februar 2010 bereits implementierten Maßnahmen inkludiert. Das WAM-Szenario baut auf den Maßnahmen in der Energiestrategie Österreich auf und 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 2010, 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 2nd February 2010. The latter is based on measures specified in the Austrian Energy Strategy and contains, in addition to the scenario WEM, 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 to 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 of 2008 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 further 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 fast die Emissionsprojetktionen 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**	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	78 171	92 916	86 641	85 237	86 096	87 333	89 098	90 847
1. Energie	55 404	72 183	64 727	64 561	64 754	65 486	66 763	68 027
2. Prozessemissionen	10 111	10 628	11 869	11 006	11 951	12 643	13 298	13 916
3. Lösemittel	512	385	388	321	343	367	386	403
4. Landwirtschaft	8 558	7 399	7 631	7 534	7 625	7 693	7 687	7 663
6. Abfall	3 586	2 322	2 024	1 815	1 423	1 144	964	838

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

	Trend der Inventur [Gg CO_2e]			Emissionen „mit zusätzlichen Maßnahmen" [Gg CO_2e]				
	1990	**2005**	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	78 171	92 916	86 641	84 594	80 447	78 911	76 552	77 395
1. Energie	55 404	72 183	64 727	63 953	59 526	58 029	55 498	56 129
2. Prozessemissionen	10 111	10 628	11 869	10 974	11 598	12 148	12 181	12 639
3. Lösemittel	512	385	388	321	343	367	386	403
4. Landwirtschaft	8 558	7 399	7 631	7 534	7 608	7 645	7 661	7 659
6. Abfall	3 586	2 322	2 024	1 815	1 423	1 144	964	838

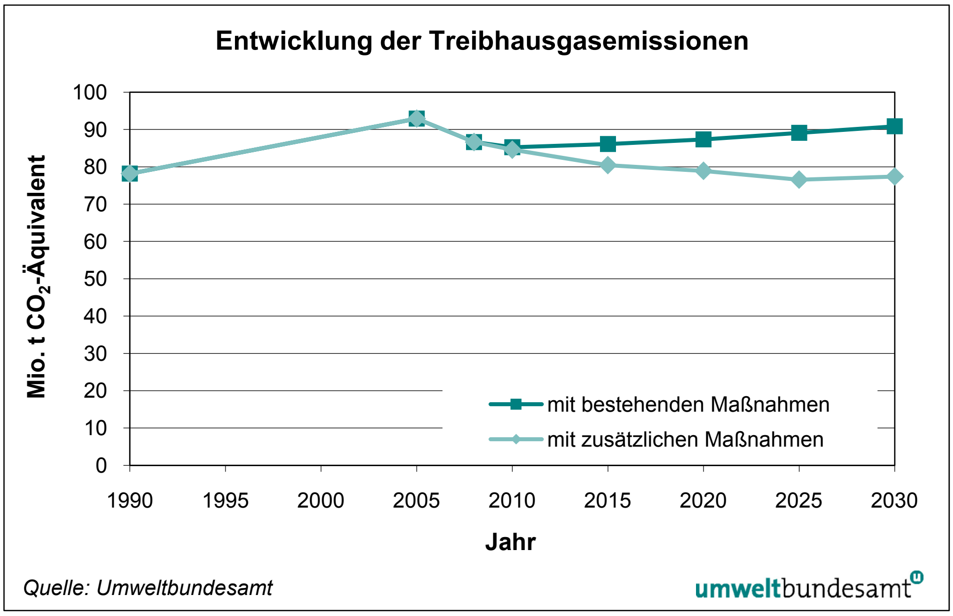


Abbildung 1: Entwicklung der THG-Emissionen (ohne LULUCF).

Das WEM-Szenario ohne LULUCF zeigt einen Anstieg um 11,7 % zwischen 1990 und 2020 und 16,2 % im Zeitraum von 1990 bis 2030, d. h. von 78,2 Mio. t CO_2-Äquivalent (1990) auf 87,3 Mio. t CO_2-Äquivalent 2020 und 90,8 Mio. t CO_2-Äquivalent 2030. Das WAM-Szenario zeigt einen Anstieg von 0,9 % zwischen 1990 und 2020 und eine Abnahme von 1,0 % bis 2030, d. h. von 78,2 Mio. t CO_2-Äquivalent (1990) auf 78,9 Mio. t CO_2-Äquivalent 2020 und 77,4 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**	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
CO_2	62 068	79 773	73 630	72 792	73 997	75 505	77 432	79 316
CH_4	8 306	6 086	5 717	5 487	5 154	4 928	4 770	4 669
N_2O	6.197	5.430	5.681	5.245	5.211	5.161	5.111	5.057
HFKW	26	986	1 058	1 091	1 152	1 153	1 194	1 209
FKW (PFC)	1 079	134	174	285	300	315	330	345
SF_6	494	507	381	337	282	270	262	251
Gesamt	**78 171**	**92 916**	**86 641**	**85 237**	**86 096**	**87 333**	**89 098**	**90 847**

Im WEM-Szenario werden für die Gesamt THG-Emissionen zwischen 2005 und 2020 eine Abnahme von 6,0 % oder 5,6 Tg CO_2-Äquivalent vorausgesagt. Diese Veränderung ist hauptsächlich auf die Projektion zurückzuführen, dass die Emissionen im Energiesektor um 9,3 % oder 6,7 Tg CO_2-Äquivalent sinken werden. Der erwartete Anstieg der Emissionen im Sektor Industrieprozesse wird mit 19 % oder 2,0 Tg CO_2-Äquivalent vorausgesagt. Für die Emissionen des Sektors Lösemittel wird eine Abnahme um 4,5 % oder 17 Gg CO_2-Äquivalent erwartet. Für die Emissionen des Sektors Landwirtschaft wird eine Erhöhung von 4,0 % oder 0,29 Tg CO_2-Äquivalent erwartet. Für die Emissionen des Sektors Abfall wird im WEM-Szenario eine Abnahme um 50,7 % oder 1,2 Tg CO_2-Äquivalent angenommen. Im Energie-Sektor des Sektors 1.A.1 Energieversorgung wird eine Abnahme der Emissionen um 33 % oder 5,3 Tg CO_2-Äquivalent angenommen und im Sektor 1.A.2 Industrie wird ein Anstieg um 18 % oder 2,9 Tg CO_2-Äquivalent angenommen. Für die Emissionen vom Sektor 1.A.3 Transport wird eine Abnahme um 0,4 % oder 0,11 Tg 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 % oder 4,2 Tg CO_2-Äquivalent erwartet.

Gemäß der WEM-Projektion wird CO_2 weiterhin das wichtigste THG in Österreich sein, sein Anteil an den Gesamtemissionen wird sich von 85,9 % im Jahr 2005 auf 86,5 % im Jahr 2020 und 87,3 % im Jahr 2030 erhöhen. Zwischen 2005 und 2020 wird der Anteil am CO_2-Äquivalent für CH_4 und N_2O um 19 % und 5,0 % sinken, während für die Fluorierten Gase (HFKW, FKW und SF_6) ein Anstieg um 6,8 % von 2005 bis 2020 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**	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
CO_2	62 068	79 773	73 630	72 200	68 684	67 926	66 002	67 323
CH_4	8 306	6 086	5 717	5 487	5 117	4 860	4 718	4 630
N_2O	6 197	5 430	5 681	5 243	5 196	5 162	5 106	5 048
HFKW	26	986	1 058	1 055	1 003	582	444	171
FKW (PFC)	1 079	134	174	272	180	126	47	0
SF_6	494	507	381	337	267	255	237	222
Gesamt	**78 171**	**92 916**	**86 641**	**84 594**	**80 447**	**78 911**	**76 552**	**77 395**

Im WAM-Szenario wird für die THG-Emissionen eine Abnahme zwischen 2005 und 2020 von 15 % oder 14 Tg CO_2-Äquivalent erwartet. Diese Abnahme ergibt sich hauptsächlich durch die erwartete Abnahme der Emissionen des Energie-Sektors um 20 % oder 14 Tg CO_2-Äquivalent. Für die Emissionen des Abfall-Sektors wird eine Abnahme um 51 % oder 1,2 Tg CO_2-Äquivalent angenommen. Im Gegensatz dazu wird bei den Emissionen des Sektors Industrieprozesse ein Anstieg um 14 % oder 1,5 Tg CO_2-Äquivalent erwartet und für die Emissionen der Lösemittel wird eine Abnahme um 4,5 % oder 17 Gg CO_2-Äquivalent erwartet. Im Energie-Sektor wird für die Sektoren 1.A.4 Kleinverbrauch und 1.A.5 Sonstige (Militär) eine Abnahme um 36 % oder 5,2 Tg CO_2-Äquivalent angenommen. Für die Emissionen des Sektors 1.A.1 Energieversorgung wird eine Abnahme um 42 % oder 6,7 Tg CO_2-Äquivalent und im Sektor 1.A.3 Transport um 20 % oder 5,1 Tg CO_2-Äquivalent angenommen. Für die Emissionen im Sektor 1.B Diffuse Emissionen wird eine Abnahme um 1,8 % oder 8,1 Gg CO_2-Äquivalent erwartet. Im Gegensatz dazu wird für die Emissionen des Sektors 1.A.2 Fertigungsindustrie und Konstruktion eine Abnahme um 18 % oder 2,8 Tg CO_2-Äquivalent angenommen.

Gemäß der WAM-Projektion wird CO_2 weiterhin das wichtigste THG in Österreich sein, sein Anteil an den Gesamtemissionen erhöht sich von 85,9 % im Jahr 2005 auf 86,1 % im Jahr 2020 und 87,0 % im Jahr 2030. Zwischen 2005 und 2020 wird der Anteil am CO_2-Äquivalent für CH_4 und N_2O um 20 % und 4,9 % sinken. Für die Fluorierten Gase (HFKW, FKW und SF_6) wird eine Abnahme von 2005 bis 2020 um 41 % erwartet.

Eine Auswertung der Projektion für einzelne Sektoren gibt 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.

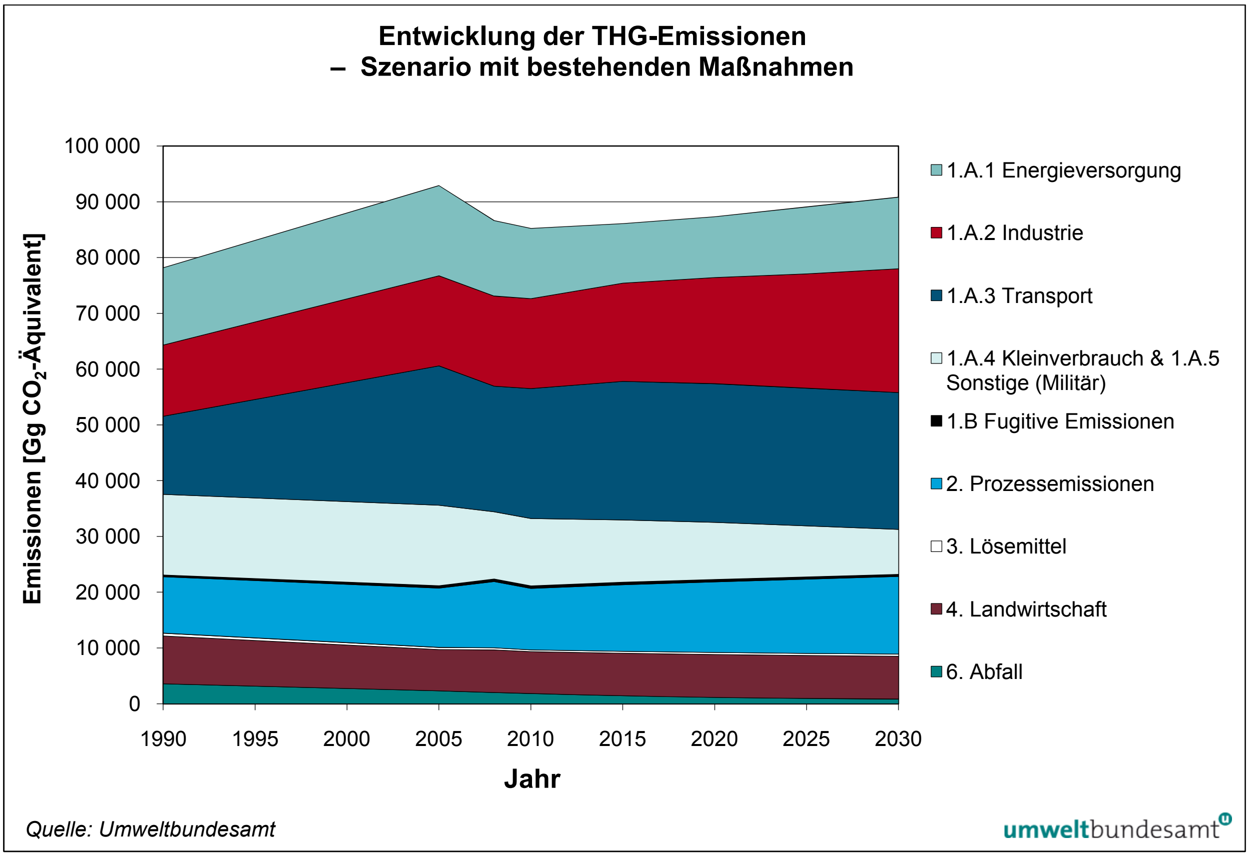


Abbildung 2: Entwicklung der THG-Emissionen nach Sektoren, Szenario mit bestehenden Maßnahmen.

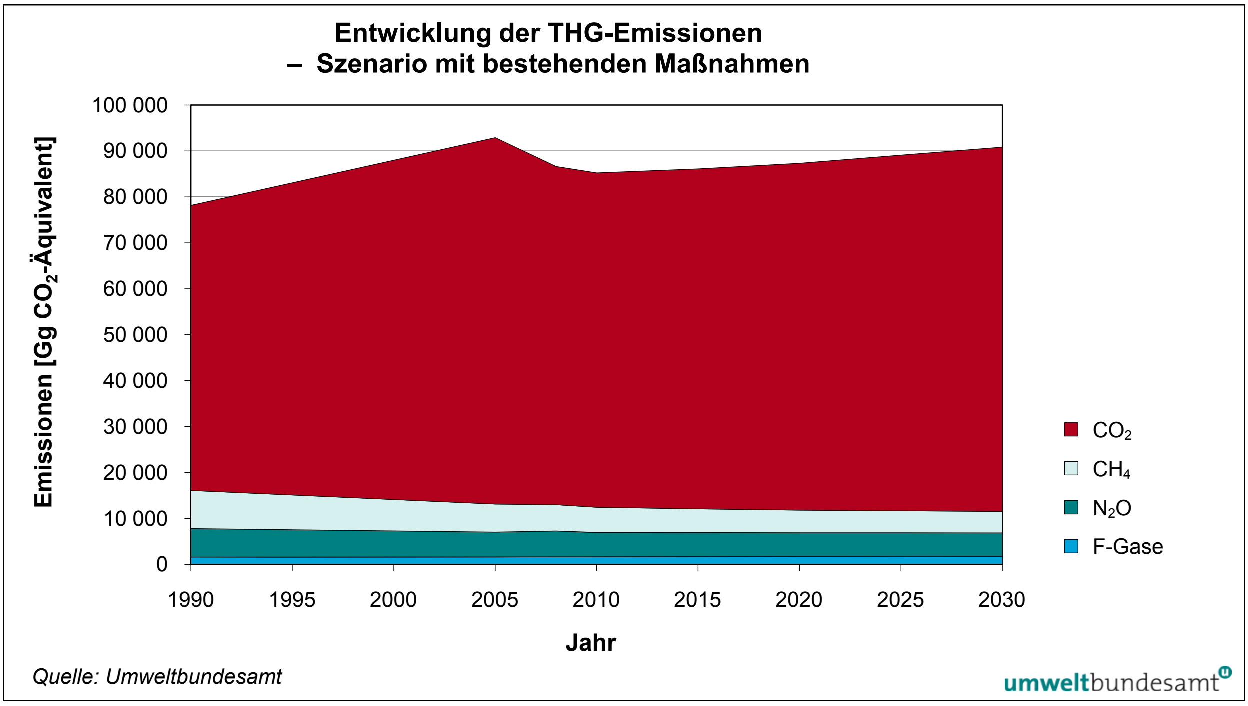


Abbildung 3: Entwicklung der THG-Emissionen nach THG, Szenario mit bestehenden Maßnahmen.

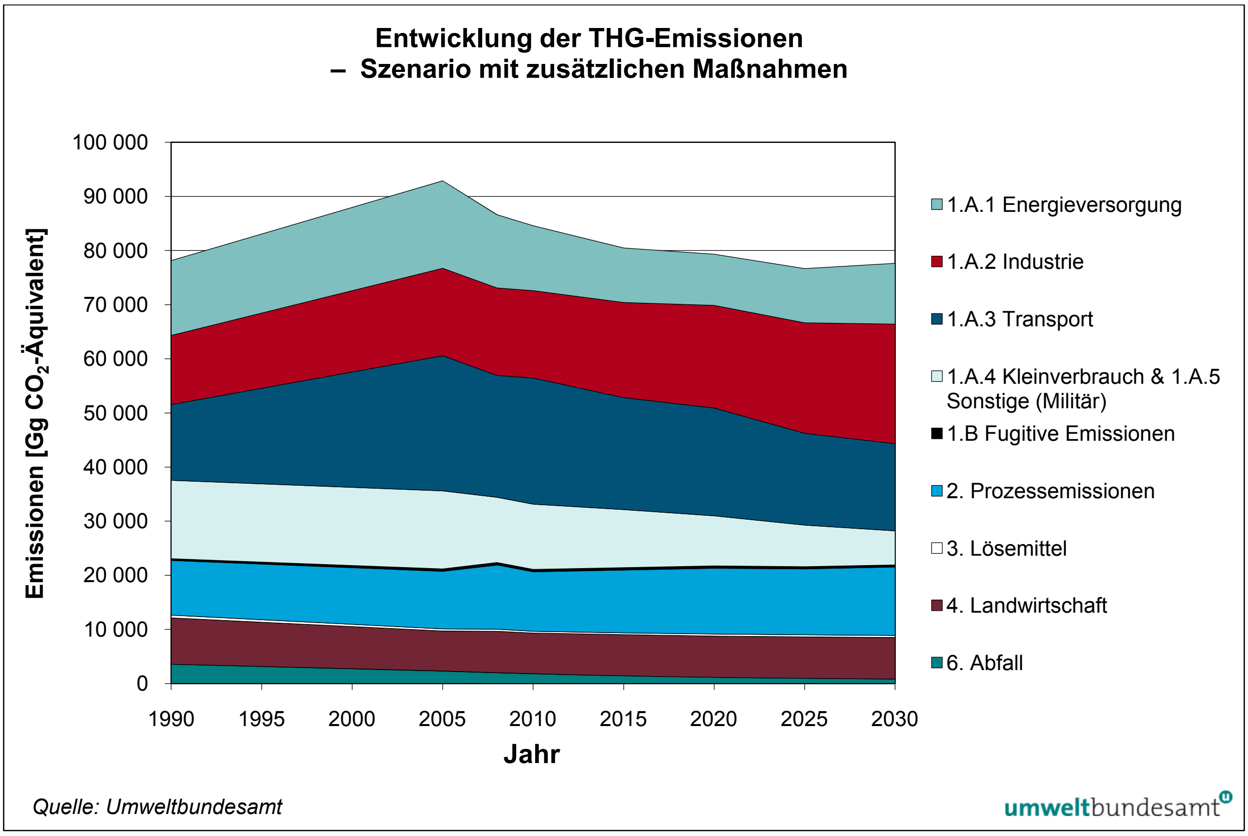


Abbildung 4: Entwicklung der THG-Emissionen nach Sektoren, Szenario mit zusätzlichen Maßnahmen.

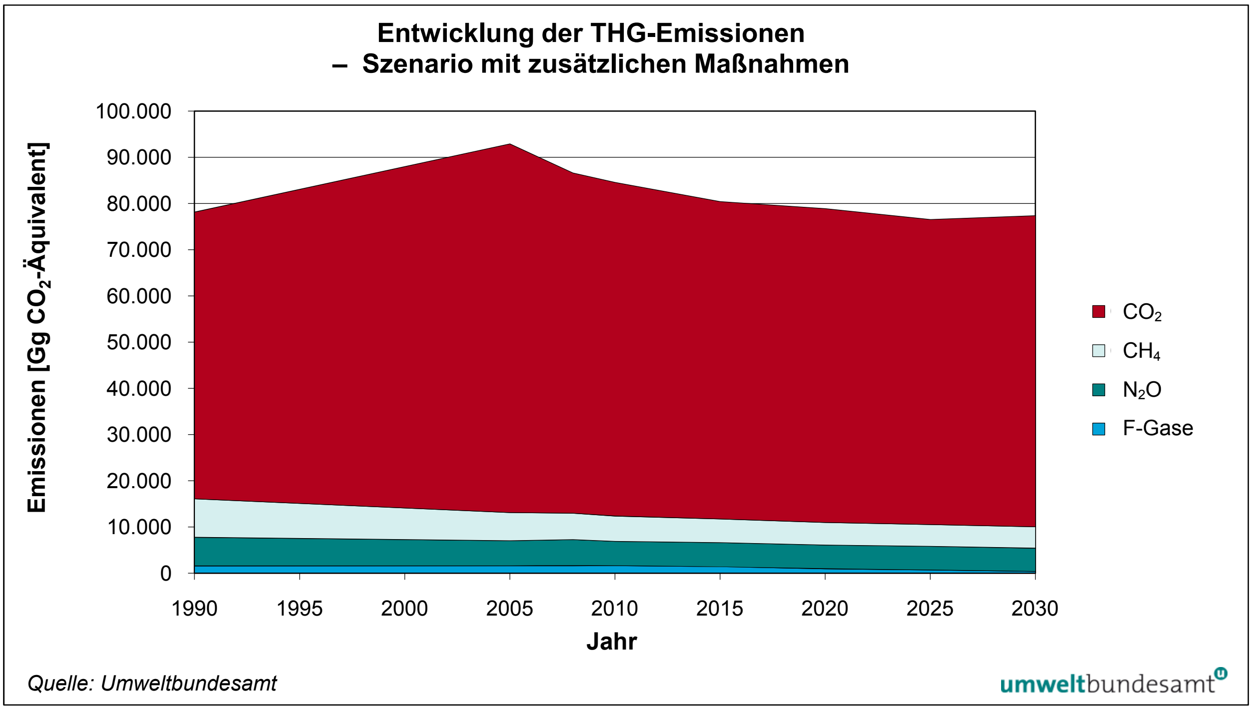


Abbildung 5: Entwicklung der THG-Emissionen nach THG, Szenario mit zusätzlichen Maßnahmen.

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. 17 % und der Sektor Prozessemissionen mit einem Wachstum von rd. 29 % im Zeitraum von 2008 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	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	32.004	30.071	31.563	33.447	36.058	38.604
1. Energie	22.711	21.394	21.430	22.628	24.633	26.581
2. Prozessemissionen	9.293	8.677	10.133	10.819	11.425	12.023
non-ETS THG-Emissionen	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	54.637	55.166	54.533	53.886	53.040	52.243
1. Energie	42.016	43.167	43.323	42.858	42.130	41.447
2. Prozessemissionen	2.576	2.328	1.818	1.824	1.873	1.893

Der Anstieg im WAM-Szenario wird aufgrund zusätzlicher Maßnahmen (mit rd. 15 %) etwas niedriger als im WEM-Szenario (rd. 29 %) im Zeitraum vom 2008 bis 2030 erwartet. Genauer betrachtet wird eine Zunahme der EU ETS Emissionen im Sektor Energie um rd. 10 % und im Sektor Prozessemissionen um rd. 28 % projiziert. Die gesamten Emissionen, welche nicht dem Emissionshandel unterliege (non-ETS) wird eine Reduktion von rd. 26 % 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	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	32.004	29.479	30.979	32.041	34.132	36.929
1. Energie	22.711	20.789	20.966	21.364	22.902	25.044
2. Prozessemissionen	9.293	8.690	10.012	10.678	11.230	11.885
non-ETS THG-Emissionen	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Gesamt (ohne LULUCF)	54.637	55.115	49.469	46.870	42.421	40.466
1. Energie	42.016	43.164	38.560	36.665	32.596	31.085
2. Prozessemissionen	2.576	2.280	1.534	1.048	814	482

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 the single gases are presented in CO_2 equivalents. Trend graphs of the GHG totals as well as GHG totals by category and by gas are included.

Total GHG emissions

Table 1: Trend and forecast (2010–2030) of total emissions – scenario "with existing measures".

	Inventory Trend [Gg CO_2e]			Emissions "with existing measures" [Gg CO_2e]				
	1990	**2005**	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	78 171	92 916	86 641	85 237	86 096	87 333	89 098	90 847
1. Energy	55 404	72 183	64 727	64 561	64 754	65 486	66 763	68 027
2. Industrial Processes	10 111	10 628	11 869	11 006	11 951	12 643	13 298	13 916
3. Solvents	512	385	388	321	343	367	386	403
4. Agriculture	8 558	7 399	7 631	7 534	7 625	7 693	7 687	7 663
6. Waste	3 586	2 322	2 024	1 815	1 423	1 144	964	838

Table 2: Trend and forecast (2010–2030) of total emissions – scenario "with additional measures".

	Inventory Trend [Gg CO_2e]			Emissions "with additional measures" [Gg CO_2e]				
	1990	**2005**	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	78 171	92 916	86 641	84 594	80 447	78 911	76 552	77 395
1. Energy	55 404	72 183	64 727	63 953	59 526	58 029	55 498	56 129
2. Industrial Processes	10 111	10 628	11 869	10 974	11 598	12 148	12 181	12 639
3. Solvents	512	385	388	321	343	367	386	403
4. Agriculture	8 558	7 399	7 631	7 534	7 608	7 645	7 661	7 659
6. Waste	3 586	2 322	2 024	1 815	1 423	1 144	964	838

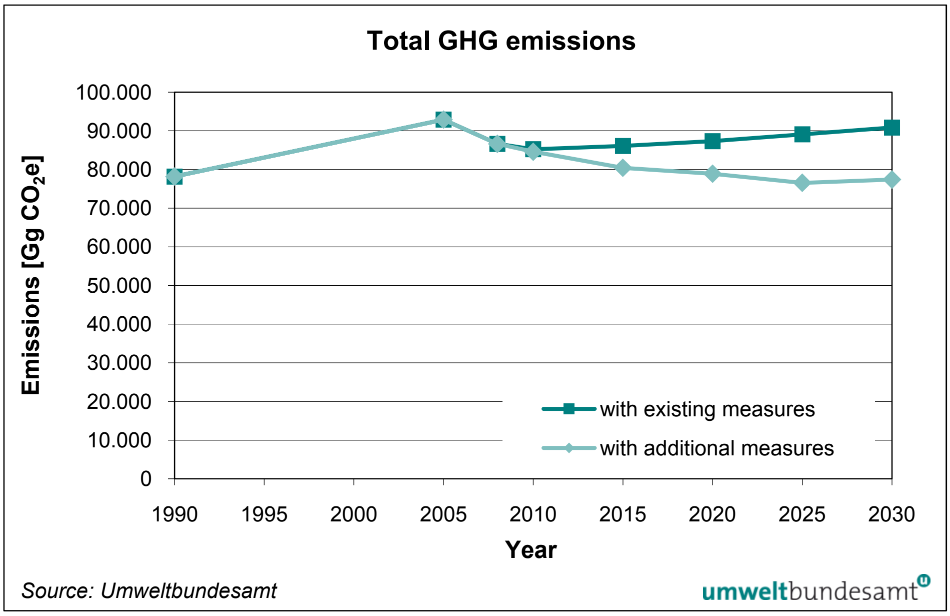


Figure 1: Trend and forecast (2010–2030) of total GHG emissions (without LULUCF).

The scenario WEM without LULUCF shows an increase of 11.7% from 1990 to 2020 and 16.2% from 1990 to 2030, i.e. from 78.2 1990 to 87.3 Mt CO_2 equivalents 2020 and 90.8 Mt CO_2 equivalents 2030. The scenario WAM shows an increase of 0.9% from 1990 up to 2020 and a decrease of 1.0% until 2030, i.e. from 78.2 Mt CO_2 equivalents in 1990 to 78.9 Mt CO_2 equivalents in 2020 and 77.4 Mt CO_2 equivalents in 2030. Total greenhouse gas emissions in this chapter exclude Land Use Change and Forestry for methodological reasons.

Table 3: Trend and forecast (2010–2030) of 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**	**2010**	**2015**	**2020**	**2025**	**2030**
CO_2	62 068	79 773	73 630	72 792	73 997	75 505	77 432	79 316
CH_4	8 306	6 086	5 717	5 487	5 154	4 928	4 770	4 669
N_2O	6 197	5 430	5 681	5 245	5 211	5 161	5 111	5 057
HFC	26	986	1 058	1 091	1 152	1 153	1 194	1 209
PFC	1 079	134	174	285	300	315	330	345
SF_6	494	507	381	337	282	270	262	251
Total	**78 171**	**92 916**	**86 641**	**85 237**	**86 096**	**87 333**	**89 098**	**90 847**

In the scenario "with existing measures" total GHG emissions are forecast to decrease between 2005 and 2020 by 6.0% or 5.6 Tg CO_2 equivalents. This change is mainly driven by the forecast decrease of emissions from the Energy sector by 9.3% or 6.7 Tg CO_2 equivalents. The forecast increase of emissions from the Industrial Processes sector is expected to be 19% or 2 Tg CO_2 equivalents. Emissions from the sector Solvents are forecast to decrease by 4.5% or 17 Gg CO_2 equivalents. Emissions from the sector Agriculture are forecast to increase 4.0% or 0.29 Tg CO_2 equivalents. Emissions in the Waste sector in the scenario "with existing measures" are forecast to decrease by 50.7% or 1.2 Tg CO_2 equivalents. In the Energy sector emissions from the sub-sectors 1.A.1 Energy industries are forecast to decrease by 33% or 5.3 Tg CO_2 equivalents and in the 1.A.2 Manufacturing industries and construction are forecast to increase by 18% or 2.9 Tg CO_2 equivalents. Emissions from the sub-sector 1.A.3 Transport are forecast to decrease by 0.4% or 0.11 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% or 4.2 Tg CO_2 equivalents.

According to the WEM forecast the most important GHG in Austria will still be CO_2, increasing its share of total emissions from 85.9% in 2005 to 86.5% in 2020 and 87.3% in 2030. Between 2005 and 2020 CO_2 equivalent CH_4 emissions and N_2O emissions are both forecast to decrease by 19% and 5%, whereas emissions of fluorinated gases (HFC, PFC and SF_6) are forecast to increase by 6.8% from 2005 to 2020.

Table 4: Trend and forecast (2010–2030) of 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**	**2010**	**2015**	**2020**	**2025**	**2030**
CO_2	62 068	79 773	73 630	72 200	68 684	67 926	66 002	67 323
CH_4	8 306	6 086	5 717	5 487	5 117	4 860	4 718	4 630
N_2O	6 197	5 430	5 681	5 243	5 196	5 162	5 106	5 048
HFC	26	986	1 058	1 055	1 003	582	444	171
PFC	1 079	134	174	272	180	126	47	0
SF_6	494	507	381	337	267	255	237	222
Total	**78 171**	**92 916**	**86 641**	**84 594**	**80 447**	**78 911**	**76 552**	**77 395**

In the scenario "with additional measures" total GHG emissions are forecast to decrease between 2005 and 2020 by 15% or 14 Tg CO_2 equivalents. This decrease is mainly driven by the forecast decrease of emissions from the Energy sector by 20% or 14 Tg CO_2 equivalents. Emissions are forecast to decrease in the Waste sector by 51% or 1.2 Tg CO_2 equivalents. By contrast, emissions from the sector Industrial Processes are forecast to increase by 14% or 1.5 Tg CO_2 equivalents and emissions from Solvents are decrease 4.5% or 17 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 36% or 5.2 Tg CO_2 equivalents. Emissions are also forecast to decrease in the subsector 1.A.1 Energy industries by 42% or 6.7 Tg CO_2 equivalents and in the subsector 1.A.3 Transport by 20% or 5.1 Tg CO_2 equivalents. Emissions in the sub-sector 1.B 'Fugitive' are forecast to decrease by 1.8% or 8.1 Gg CO_2 equivalents. By contrast, emissions from the sub-sector 1.A.2 Manufacturing industries and construction are forecast to increase by 18% or 2.8 Tg CO_2 equivalents.

According to the WAM forecast, the most important GHG in 2020 in Austria will still be CO_2, increasing its share of total emissions from 85.9% in 2005 to 86.1% in 2020 and 87% in 2030. Between 2005 and 2020 CH_4 emissions and N_2O emissions are both forecast to decrease by 20% and 4.9%. Emissions of fluorinated gases (HFC, PFC and SF_6) are forecast to decrease from 2005 to 2020 by 41%.

An analysis of the trend forecast by sector is presented in chapter 2 Sectoral Scenario Results. Tables with detailed emissions by sub-sectors 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 figures show sectoral developments and total emissions by gas.

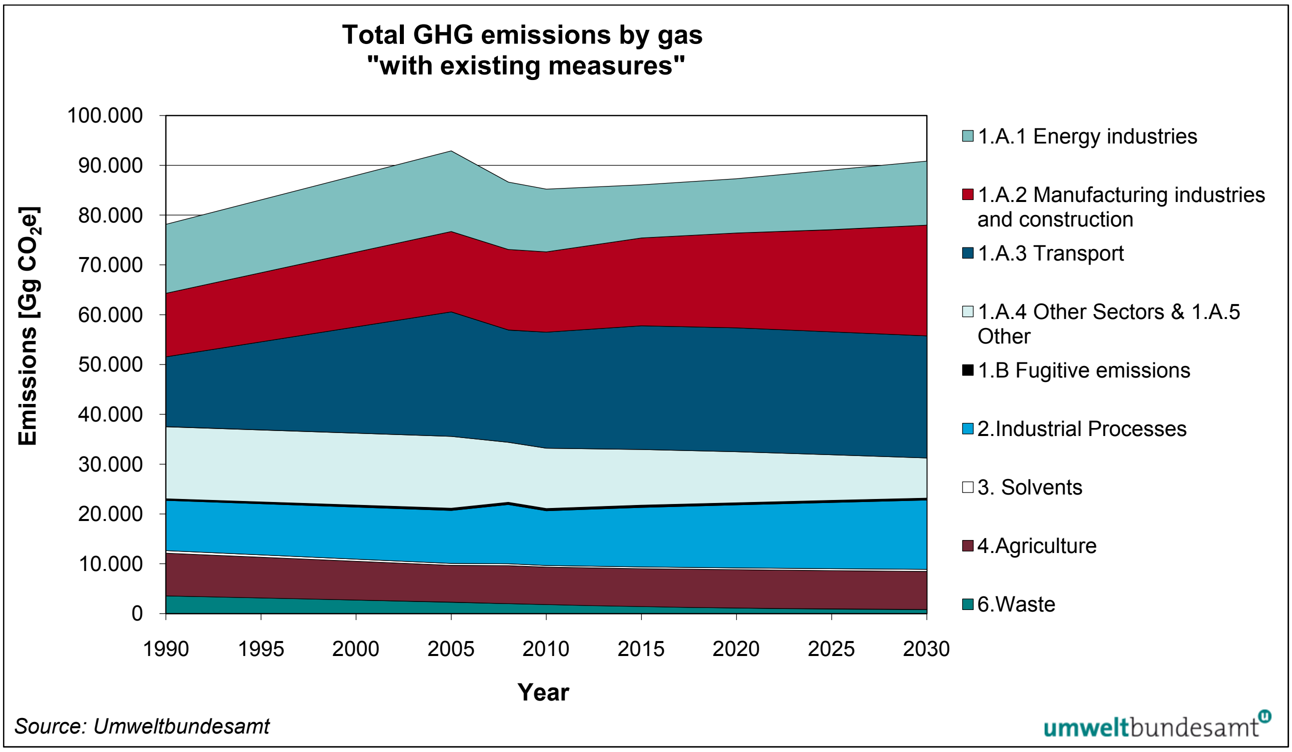


Figure 2: Trend and forecast (2010–2030) total GHG emissions by sector – scenario "with existing measures".

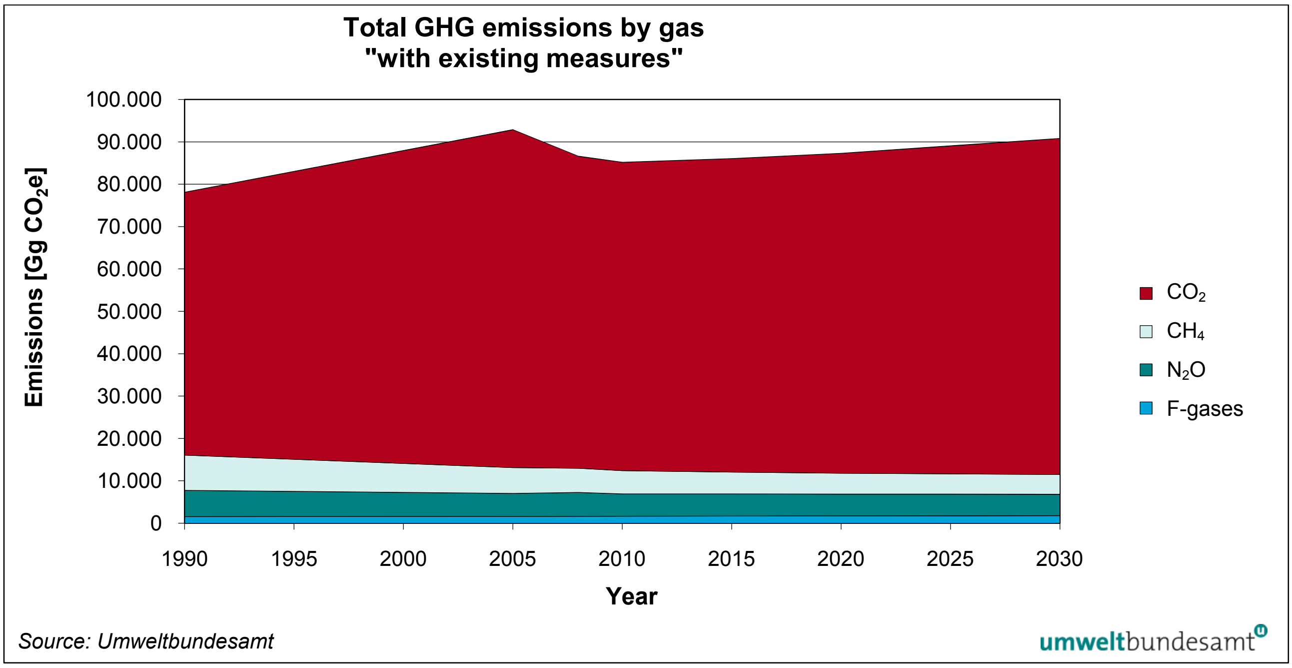


Figure 3: Trend and forecast (2010–2030) total GHG emissions by gas – scenario "with existing measures".

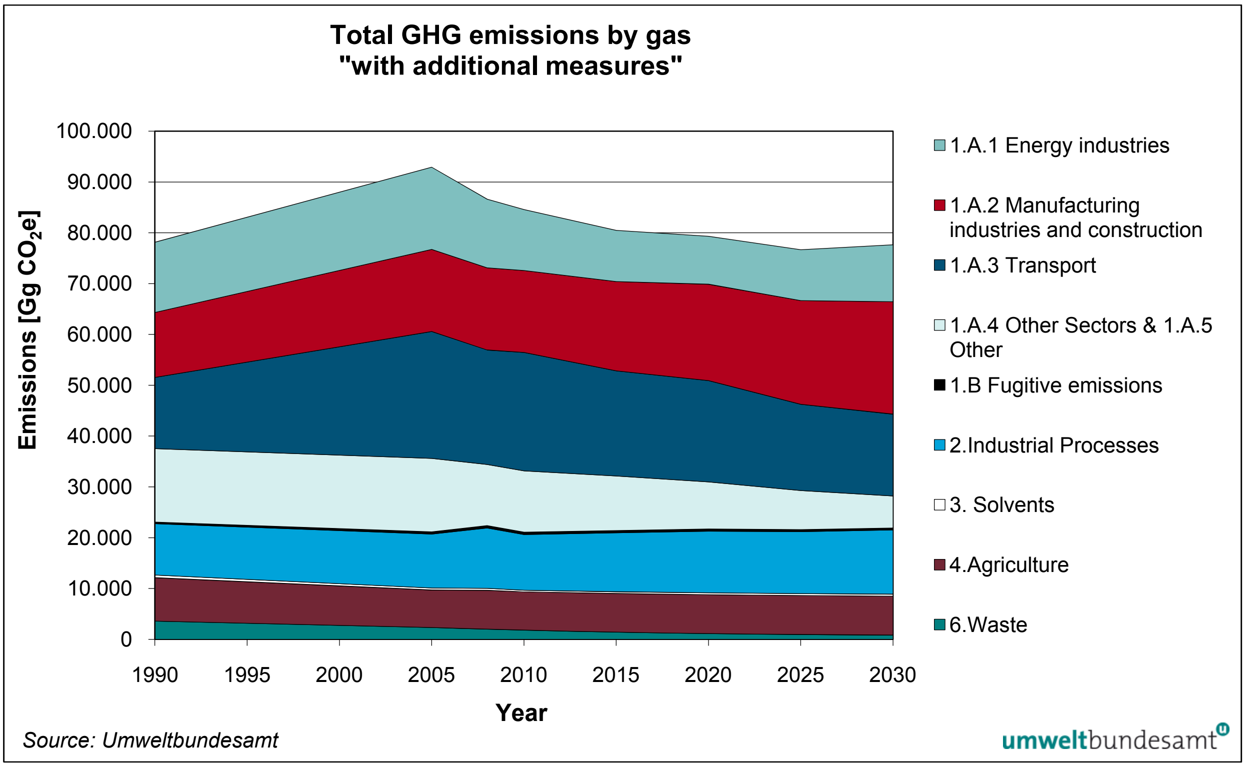


Figure 4: Trend and forecast (2010–2030) total GHG emissions by sector – scenario "with additional measures".

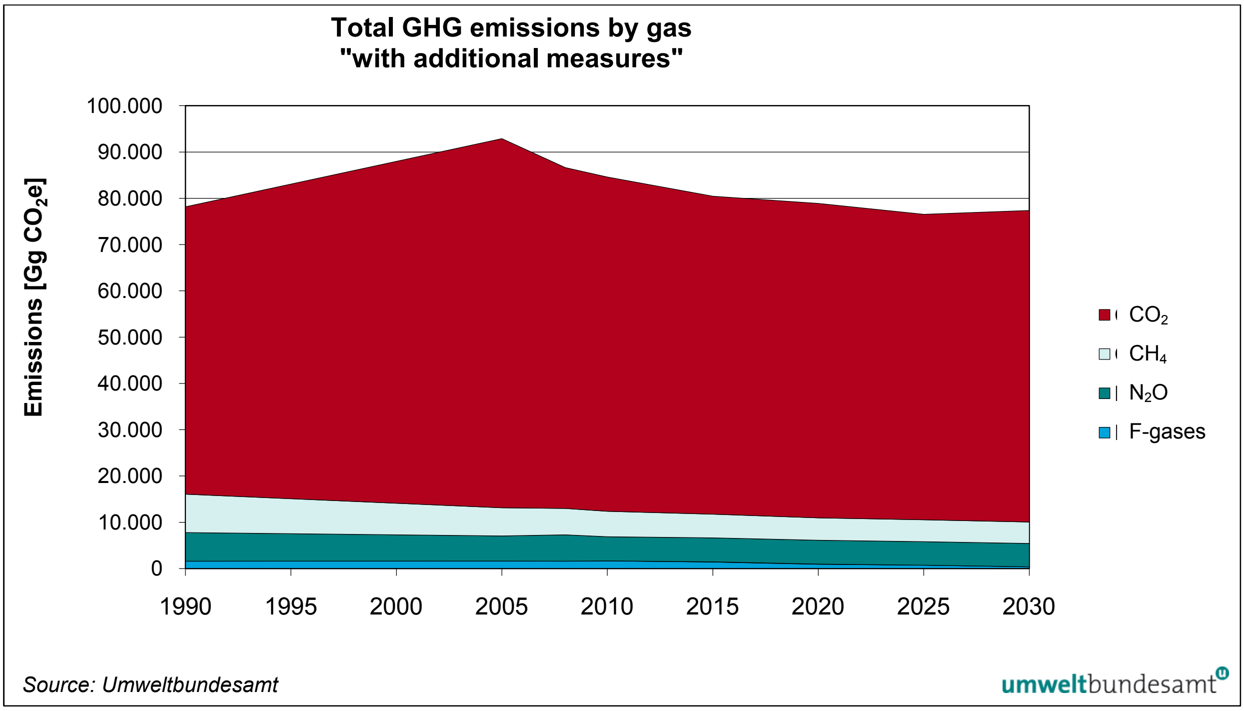


Figure 5: Trend and forecast (2010–2030) total GHG emissions by gas – scenario "with additional measures".

EU ETS/Non-ETS emissions

The GHG emissions within the EU emissions trading scheme (ETS) show (in the scenario "with existing measures") an increasing trend until 2030. The driving forces are the sector Energy with a projected increase of about 17% and the sector Industrial Processes with a rise of about 29% from 2008 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	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	32.004	30.071	31.563	33.447	36.058	38.604
1. Energy	22.711	21.394	21.430	22.628	24.633	26.581
2. Industrial Processes	9.293	8.677	10.133	10.819	11.425	12.023
Non ETS GHG emissions	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	54.637	55.166	54.533	53.886	53.040	52.243
1. Energy	42.016	43.167	43.323	42.858	42.130	41.447
2. Industrial Processes	2.576	2.328	1.818	1.824	1.873	1.893

Due to additional measures, the increase in EU ETS emissions in the wam scenario is (with about 15%) expected to slightly lower than in the wem scenario (29%) from 2008 to 2030. More specifically, the increase in EU ETS GHG emission in the sector Energy is about 10% and in the sector Industrial Processes 28%. Total non-ETS GHG emissions in the wam scenario are expected to decrease by 26% 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	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	32.004	29.479	30.979	32.041	34.132	36.929
1. Energy	22.711	20.789	20.966	21.364	22.902	25.044
2. Industrial Processes	9.293	8.690	10.012	10.678	11.230	11.885
Non ETS GHG emissions	**2008**	**2010**	**2015**	**2020**	**2025**	**2030**
Total (without LULUCF)	54.637	55.115	49.469	46.870	42.421	40.466
1. Energy	42.016	43.164	38.560	36.665	32.596	31.085
2. Industrial Processes	2.576	2.280	1.534	1.048	814	482

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 November 2010) up to the data year 2008. Because of methodical changes during the last inventory some sectors e.g. Solvents and Waste have used the latest submission from January 2011 as a basis for the projection until 2030.

1.2.2 Emission projections

Emission projections are generally calculated by applying the same methodologies as for the national GHG inventory. These are reported in Austria's National Inventory Report 2011 (UMWELTBUNDESAMT 2010a).

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

Emission factors and underlying parameters are described in the methodological subchapters 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 2011), supported by calculations with the bottom-up models:
  - TIMES (AEA): electricity demand and public electrical power and district heating supply
  - ERNSTL (EEG): domestic heating and domestic hot water supply
  - GLOBEMI & GEORG (TU Graz): 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 new 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 Economical Research (SINABELL et al. 2011a).
- Waste Forecast, based on the Umweltbundesamt forecast of the quantity of waste deposited as well as quantities of biologically and mechanical-biologically treated waste. For the forecast of the subsector wastewater the population forecast of Statistik Austria has been used as basis (because of the method applied).

Two scenarios were modelled: "with existing measures" includes all measures implemented by 2nd February 2010; "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.

1.3 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

Year	2010	2015	2020	2025	2030
GDP [billion € 2008]	279.78	305.92	339.70	376.66	420.41
Population [1 000]	8 388	8 556	8 726	8 877	9 021
Stock of dwellings [1 000]	3 662	3 851	4 042	4 227	4 401
International coal prices [€/GJ]	5.71	7.18	8.61	10.40	12.56
International oil prices [€/GJ]	10.41	13.09	15.70	18.97	22.91
International gas prices [€/GJ]	8.33	10.47	12.56	15.17	18.33

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

1.4 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 CO_2 emissions from Transport, Energy Industries and from Manufacturing Industries and Construction, as well as the influence of fuel price changes and changes of subsidies on CO_2 emissions in the Residential and Commercial sector. In the sensitivity analysis for the agricultural sector the assumption was made that the programme of rural development in Austria would be abolished.

All these assessments are based on model results, obtained by calculating the effects on energy or live stock. 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 value of the given parameters.

1.5 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, performed e.g. by documentation of data inputs and changes in the calculation files. A fixed 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 in each sector. Often the person who is responsible for the sectoral emissions is identical with the person who is responsible within 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 & .... Alexander Storch, Melanie Sporer
  General chapters .... Andreas Zechmeister
- Energy Industries & .... Siegmund Böhmer, Michael Gössl,
  Manufacturing Industries ... Thomas Krutzler, Herbert Wiesenberger
- Transport .... Gudrun Stranner
- Other Energy Sectors .... Andreas Zechmeister
- Fugitive Emissions.............. Stephan Poupa
- Industrial Processes .... Herbert Wiesenberger, Maria Purzner
- Solvents .... Traute Köther

- Agriculture .... Michael Anderl, Gerhard Zethner
- Waste .... Katja Pazdernik, Christoph Lampert, Stephan Poupa
- LULUCF........................... Peter Weiss, Matthias Braun

1.6 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 changed input data. The methodological subchapters 3.1–3.6 additionally include qualitative discussions of uncertainty in the specific sectors.

2 SECTORAL SCENARIO RESULTS

2.1 Energy (CRF Category 1)

2.1.1 Energy industries (1.A.1)

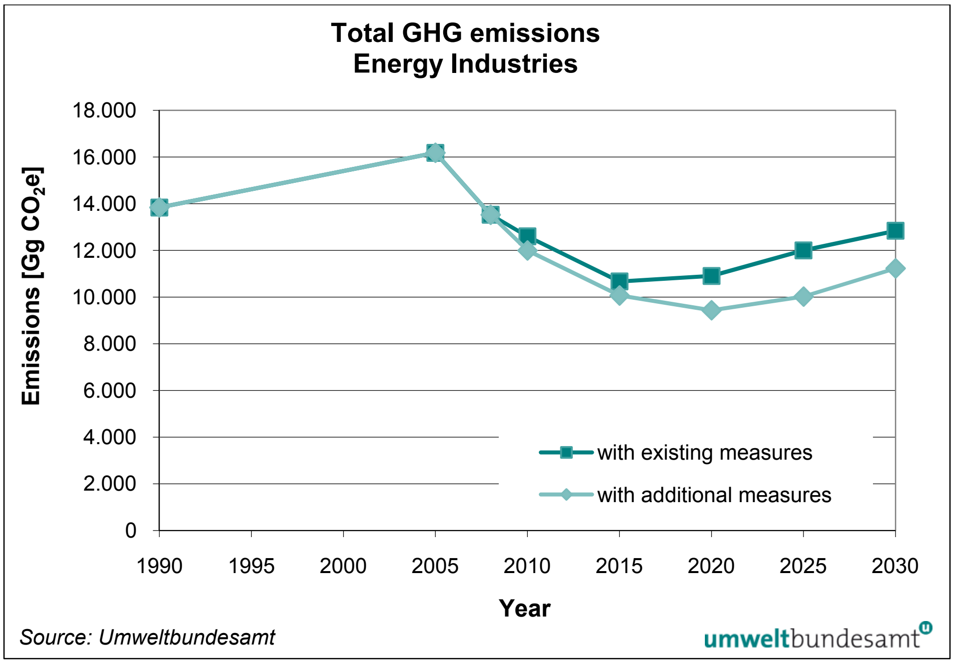


Figure 6: Trend and forecast (2010–2030) GHG emissions from 1.A.1 – Energy Industries.

In the energy industries sector GHG emissions have dwindled as a result of the economic recession in 2008 and 2009. The reduction in emissions will continue due to a fuel shift from oil and coal to gas and renewables. The installed capacities of biomass plants, hydro power plants and wind plants will significantly increase. After 2017 the first biomass plants will be decommissioned, which will lead to higher emissions, unless more subsidies are provided, than in the scenario WAM. After 2020 all existing and additional measures will slowly expire, and emissions are expected to increase again.

The major driving force for the emissions in this sector is the electricity demand. In the scenario WEM the demand in the year 2015 is still expected to be below the 2008 value, in 2020 3% higher and in 2030 16% higher. In the scenario WAM, demand in 2020 is expected to be slightly below the level of 2008, and 12% higher in 2030.

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

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

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

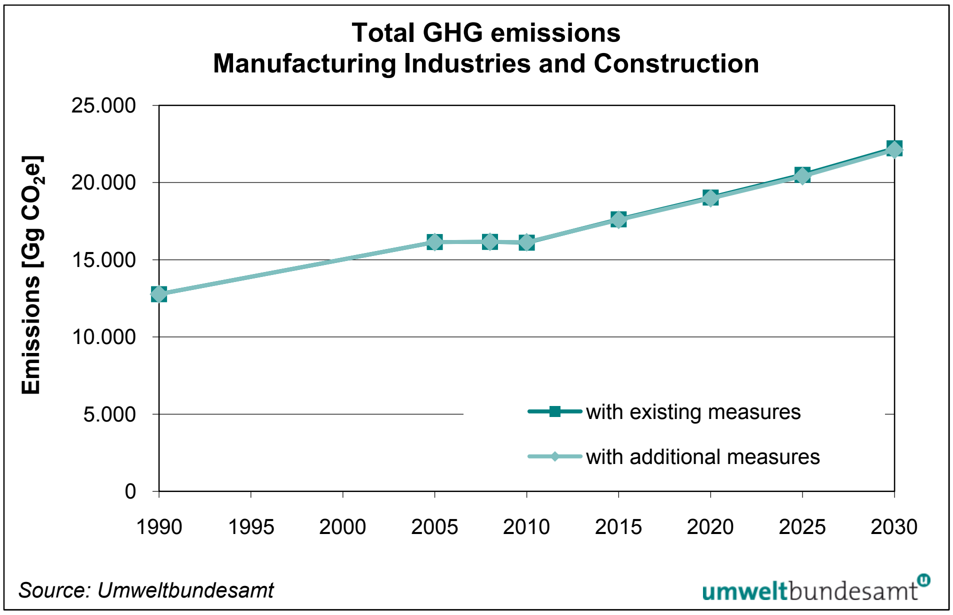


Figure 7: Historical and forecast (2010–2030) GHG emissions from 1.A.2 – Manufacturing Industries and Construction.

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

During the period 1990 and 2005 the industry sector was characterised by an emission increase of more than 20%. Since 2005 emissions have slightly decreased. For the period 2010–2030 a stable increase of CO_2 emissions, based on higher sectoral GDP projections, is assumed.

2.1.3 Transport (1.A.3)

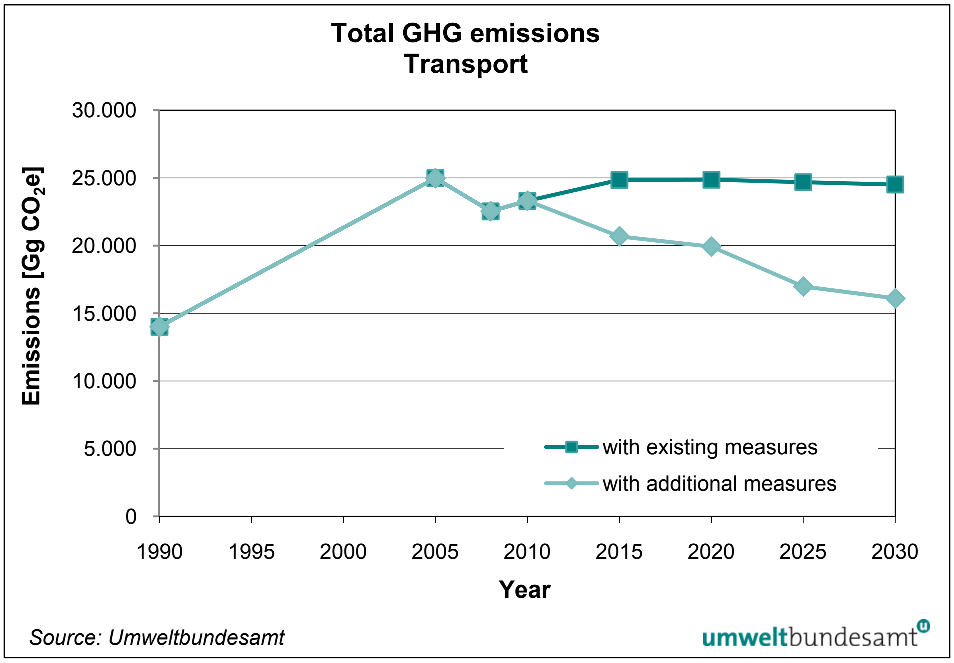


Figure 8: Historical and forecast (2010–2030) GHG emissions from 1.A.3 – Transport.

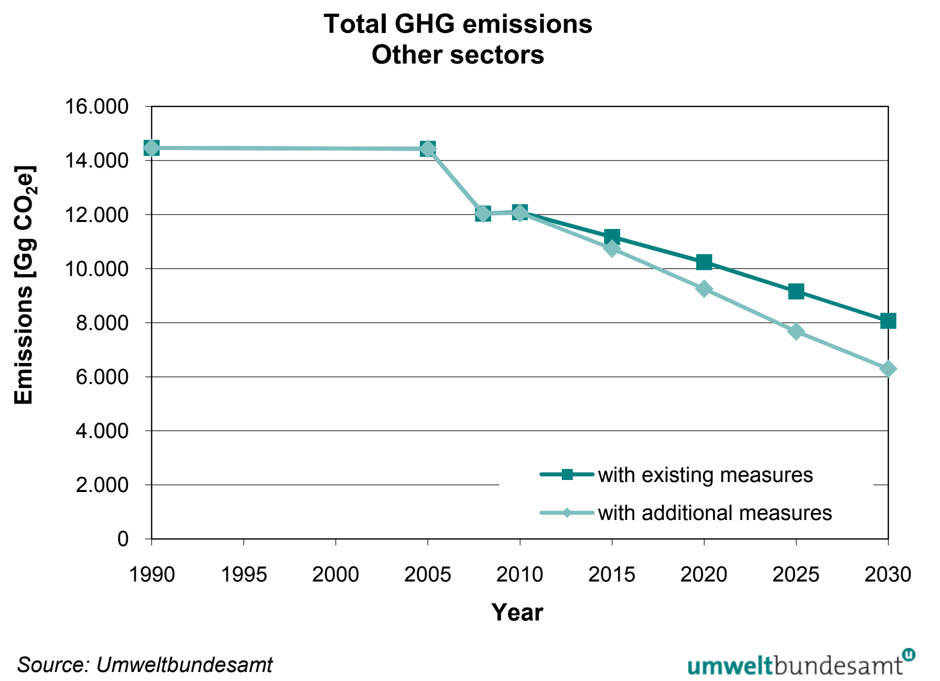
The transport sector is one of the main sources of greenhouse gases in Austria. While emissions from gasoline vehicles are declining steadily, emissions from diesel are increasing constantly. About one third of the GHG emissions are caused by fuel export due to persistently low fuel prices in Austria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

GHG emissions saw a steep increase in recent years and reached their peak in 2005. The implementation of the EU biofuels directive and declining fuel exports changed the trend. In addition, the economic downturn resulted in a further decrease of emissions especially in 2008 and 2009, but emissions are expected to rise again because of increasing economic and transport activities from 2010 onwards. Up to 2015 the implemented measures (scenario WEM) will not change this trend and it is assumed that emissions will reach the same peak level as in 2005. From 2015 onwards, electro-mobility initiatives – in addition to higher fuel efficiency standards of the fleet and increased use of biofuels in the transport sector – are expected to help moderate the increasing trend and keep it on a constant or slightly decreasing level.

In the scenario WAM the gradual increase of the Austrian fuel tax is the main measure responsible for the estimated reduction of GHG emissions after 2010.

Another source of GHG emissions in this sector are pipeline compressors. These amounted to 2% of the emissions in the transport sector in 2010 and are forecast to rise up to 5% in 2030 since there are new compressor projects.

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



Source: Umweltbundesamt

Figure 9: 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 be considerably reduced by 2030 for the scenario "with existing measures" and even further reduced for the scenario "with additional measures".

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

2.1.5 Fugitive emissions (1.B)

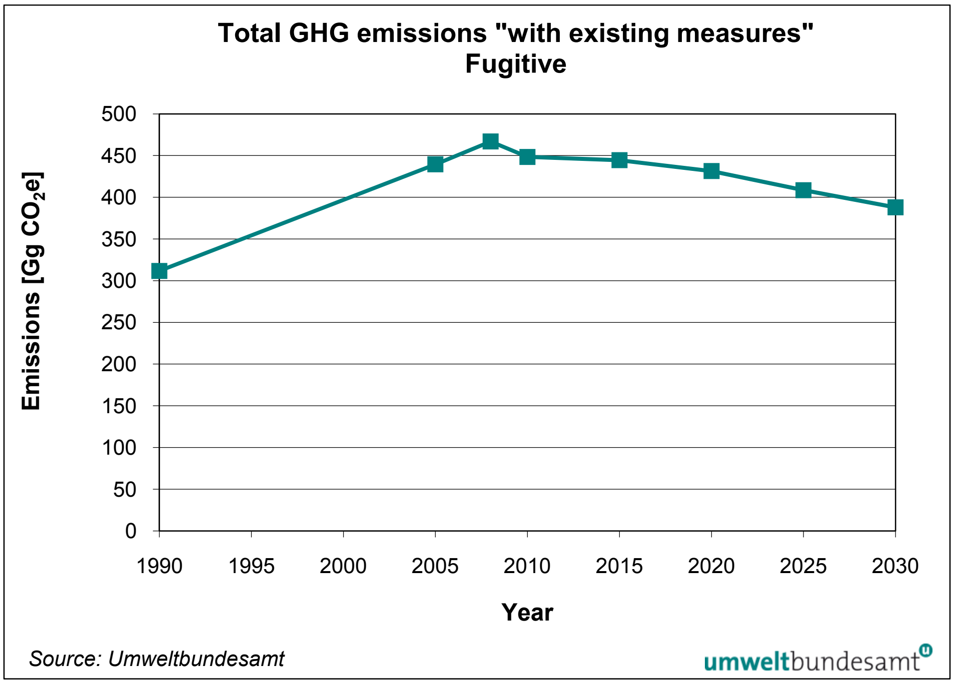


Figure 10: Historical and forecast (2010–2030) GHG emissions from 1.B – Fugitive emissions.

Between 1990 and 2008 fugitive emissions from fossil fuel exploration, refining, transport, production and distribution increased by 50%. The main driving force behind this increase was the extension of the natural gas distribution network and the increasing natural gas and oil extraction. However, it is expected that total emissions will be decreasing due to a steady decline in oil and natural gas exploration which will overcompensate the increase of emissions from the gas distribution network, gas storages and pipeline network.

2.2 Industrial Processes (CRF Category 2)

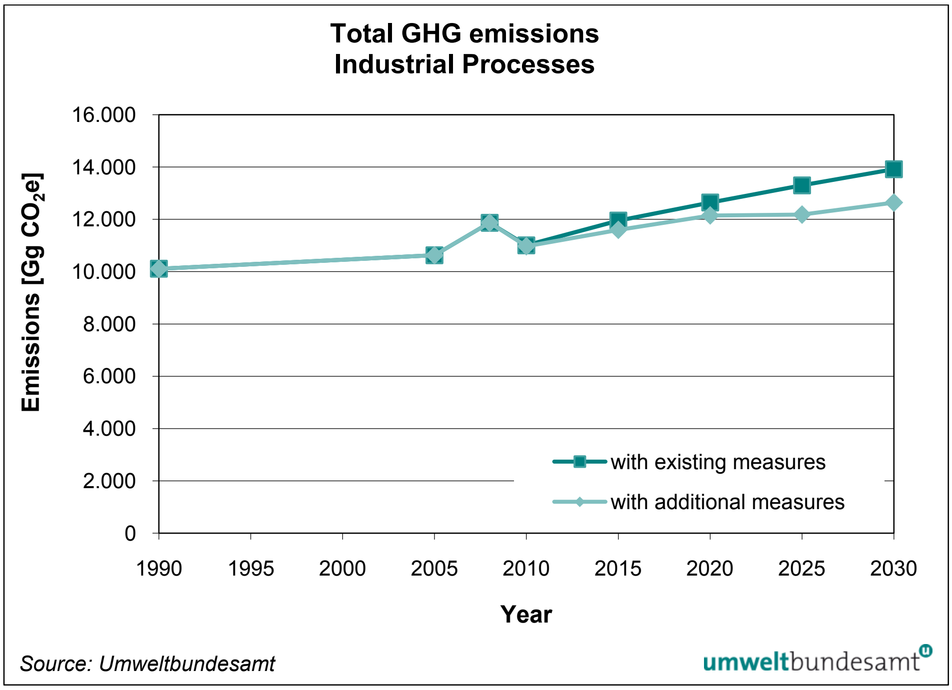


Figure 11: Historical and forecast (2010–2030) GHG emissions from 2 – Industrial Processes.

For the projection of N_2O emissions reduction measures implemented at a nitric acid plant in 2009 have been taken into account.

For the years from 2008 up to 2030 emissions from industrial processes are assumed to rise 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 13.6% of the emissions in the industrial processes sector in 2008 with a projected decrease to 13% by 2030. This decrease is mainly due to several legislative measures (see chapter on methodology for more information).

2.3 Solvents (CRF Category 3)

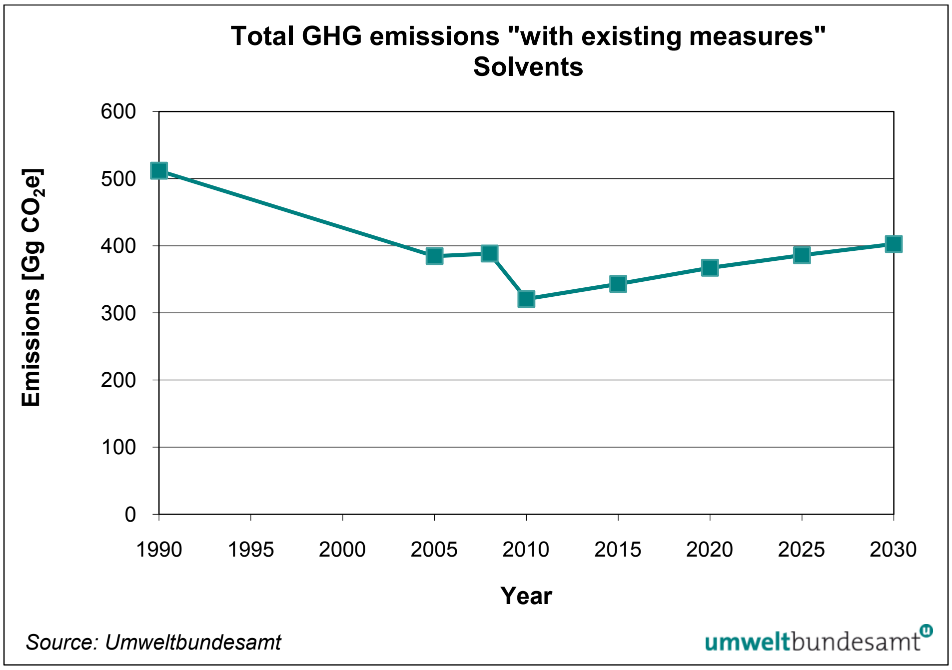


Figure 12: Historical and forecast (2010–2030) GHG emissions from 3 – Solvents.

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 24% between 1990 and 2008 due to decreasing solvent and N_2O use and as a result of the positive impact of the laws and regulations enforced in Austria. Since 2010 a slight increase of GHG emissions has been observed due to increasing solvent use as a result of a growing population. This trend is projected to continue up to 2030. In the scenario “with existing measures” (WEM), which is equal to the scenario “with additional measures” (WAM), emissions are forecast to increase by 4% up to 2030 (compared to 2008).

2.4 Agriculture (CRF Category 4)

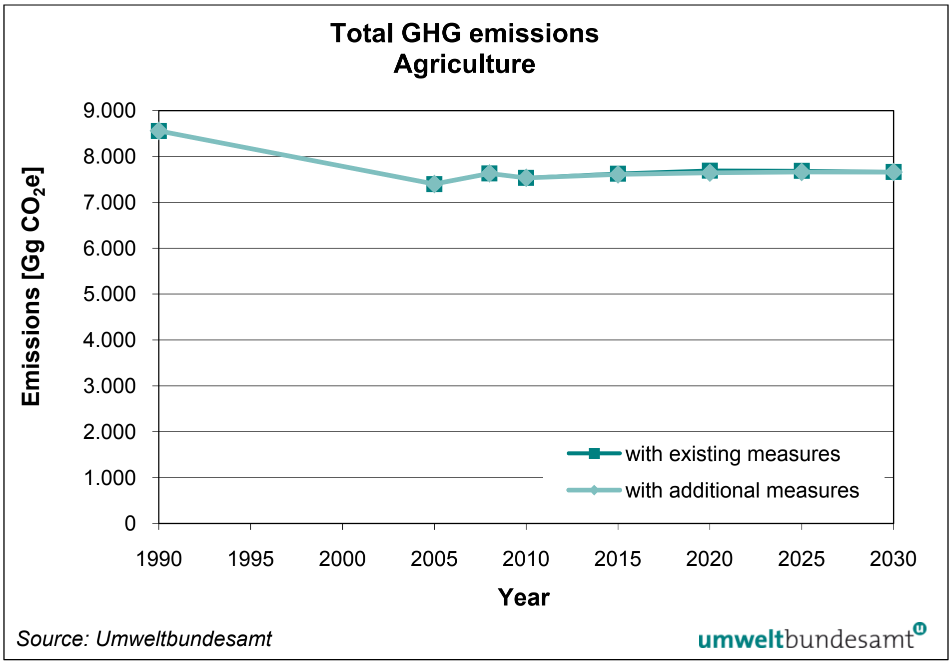


Figure 13: Historical and forecast (2010–2030) GHG emissions from 4 – Agriculture.

From 1990 to 2005, emissions showed a stable decrease, mainly due to decreasing livestock numbers. From 2005 onwards animal numbers have stabilised. Between 2010 and 2020 a slight increase is expected, and from 2020 up to 2030 animal numbers are expected to remain constant again. Additionally, consumption of the mineral fertilizer N is expected to decrease slightly. The trend of switching to liquid animal waste management systems is responsible for increasing CH_4 emissions from manure management. Anaerobic digestion in biogas plants could slightly lower CH_4 emissions from manure management.

2.5 LULUCF (CRF Category 5)

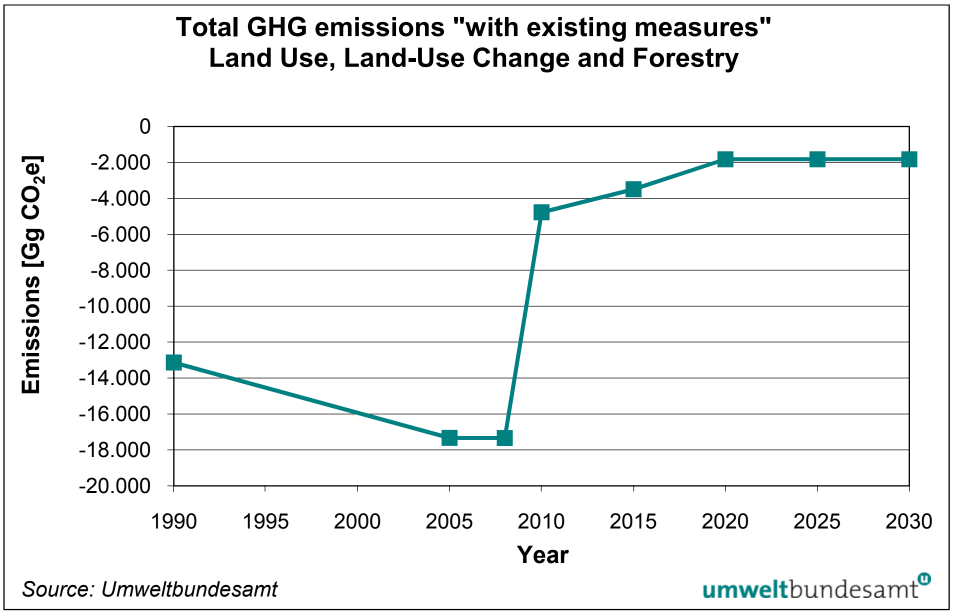


Figure 14: Historical and forecast (2010–2030) GHG emissions from 5 – Land Use, Land-Use Change and Forestry.

From 2010 onwards, modelled data for CRF 5.A.1 – forest land remaining forest land, which is the most important sub-category of CRF Source Category 5, show a reduction in the net sink up to 2020 in a range of – 2 900 to 2 300 Gg CO_2 equivalents. The most likely reduction will be – 980 Gg CO_2 equivalents. Projections for the period beyond 2020 are not available, which is why the 2020 value has been assumed to remain constant for 2020 and 2030. It should be also noted that the reported values for sector 5.A.1 for the years after 2002 (thus for the years 2005 and 2008) will be revised for the 2012 submission on the basis of the results of the new NFI 2007/09. This NFI shows clearly higher harvest rates than in the NFI 2000/02, with the result that the net sink of 5.A.1 for the years after 2002 will be significantly lower than reported in the 2011 submission and indicated in Figure 19. The new figures for 2005 and 2008 will be close to the forecast value for 2010 in Figure 19.

For the other LULUCF sub-sectors no projections are available. Emissions/removals reported for 2008 are reported also for the future years.

2.6 Waste (CRF Category 6)

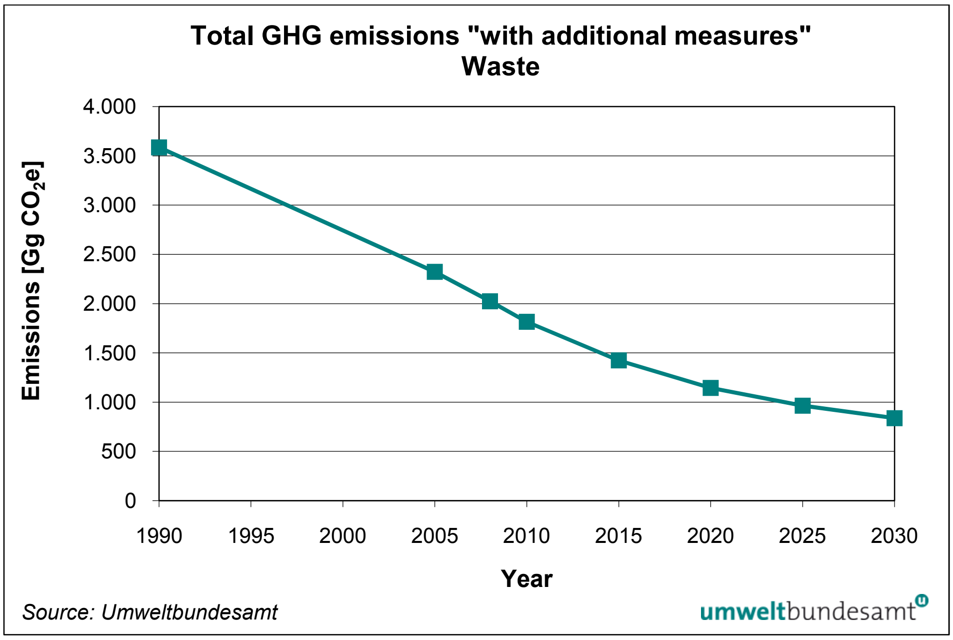


Figure 15: Historical and forecast (2010–2030) GHG emissions from 6 – Waste.

The scenario "with existing measures" shows a further downward trend for waste treatment and disposal up to 2020/2030. This development follows the decreasing amount of untreated solid waste as a result of legislative regulations. As the sub-sector CH_4 emissions from solid waste disposal on land is responsible for a major part of greenhouse gas emissions from the sector waste treatment (76% in the year 2009) the projected increase in N_2O emissions from the sub-sector wastewater handling will not change the declining trend. Emissions from the sub-sectors compost production and waste incineration are minor. Emissions from waste incineration without energy recovery have been of minor importance since 1993. Waste incineration with energy recovery is reported under category 1.A Fuel Combustion.

3 SECTORAL METHODOLOGY – PROJECTIONS

3.1 Energy (CRF Source Category 1)

The total energy demand and production was evaluated on the basis of energy scenarios developed by a consortium of 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 2011). The scenarios were developed with the help of several models:

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

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

The macroeconomic model DEIO combines a private consumption module with an energy and environment module. The latter is based on the NAMEA energy data. Important input parameters are energy prices, population and household income (WIFO 2011).

For evaluating the demand of electricity a model based on TIMES has been used. The model has been especially adapted for Austria. For the calculation of 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 2011).

For projecting the production of electricity and district heating the same model has been used. It is based on available capacities for all types of power plants in combination with energy prices and demand of electricity and district heating (taken from the model ERNSTL). Subsidies (e.g. from the green electricity act) and fees (like emission allowances) are also important input parameters (AEA 2011).

To describe the energy consumption for domestic heating and domestic hot water supply the software package *Energetisches Raumwärme-Simulations-Tool* (ERNSTL[1]) (TU WIEN 2011) 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:

- availability of resources,
- market penetration of different technologies,

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

- maximum replacement and refurbishment periods,
- minimum and maximum lifetime of technical installations.

The results obtained with the different models are balanced within a few cycles. Umweltbundesamt experts have combined the data from the different models and included additional calculations on

- energy input for the iron and steel industry,
- production of electric power and district heating within industry,
- use of waste as fuel in power plants and industry,
- energy input of compressor stations,
- demand of the energy producing sector,
- 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 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 2010a).

As regards the only refinery operated in Austria, no major changes of production capacities or used technologies are expected from the current point of view. Relevant restructuring programmes and start-up of new production units have been undertaken in previous years, the last one finished in 2008. Thus, the average emission rate of the years from 2005 to 2007 has been used for the projection.

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

3.1.1.2 Assumptions

The assumptions for both scenarios of gross total inland consumption and total input into and output from power plants, all split by fuel type, can be seen in Annex 1 and Annex 3. Moreover, the energy demand by sectors is shown, split by delivered fuel (final energy consumption).

The assumption for the basic weather parameter – the heating degree days – is explained in chapter 1.3.

EU ETS/non-ETS

In "Public Electricity and Heat Production" (1A1a) no non-ETS installations use 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 be valid throughout the reporting period. "Petroleum Refining" (1A1b) is completely covered by the ETS except for non-CO_2 greenhouse gas emissions. The ETS emissions of "Manufacture of Solid Fuels and Other Energy Industries" (1A1c) are expected to remain constant based on a 2007–2009 average as no additional installations will be covered by 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:

- 16 €/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

Scenario "with existing measures":

As regards the implementation of the Water Framework Directive, assumptions have been made as summarised in Table 10. For the year 2015 losses are projected in a range of 360 GWh, in 2020 720 GWh and 1 489 GWh in 2030.

Table 8: Projected losses due to implementation of the Water Framework Directive.

	losses until 2030 [GWh]	starting after the 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 (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 2008 (Federal Law Gazette I No. 44/2008) will be fulfilled. The Act aims at a construction of hydroelectric power plants with a capacity of 700 MW, wind farms with 700 MW and biomass plants with 100 MW_{th} up to the year 2015 (with all constructed plants expected in full operation by the year 2017). The Green Electricity Act stipulates no specific goals beyond the year 2015. However, the projections are based on the assumption that the growth rates for individual renewable energy sources remain at the same level until 2020.

kli.en

In the working programme of the climate and energy fund (kli.en) 8 million € per year are dedicated to the subsidisation of photovoltaic plants with a peak performance of less than < 5 kW_p. It is assumed that the programme will continue until 2030.

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 allocated for the first installed capacities to prevent decommissioning.

Energy efficiency measures (see chapter 5.3) are fully implemented, leading to a decrease of the electricity demand.

3.1.1.3 Activities

Scenario "with existing measures"

The transformation input to Austrian heat and power plants for the scenario WEM is depicted in Figure 16. As can be seen, the transformation input is expected to be slightly reduced by the effects of the economic recess up to 2012, and to remain at this level until 2020. After that, the input is expected to steadily increase up to 2029.

While the input of coal and residual fuel oil is expected to decrease, the increase of the input of gas, biomass and waste is expected to be more pronounced (not depicted in Figure 16). Additionally, the amount of wind power is assumed to increase significantly.

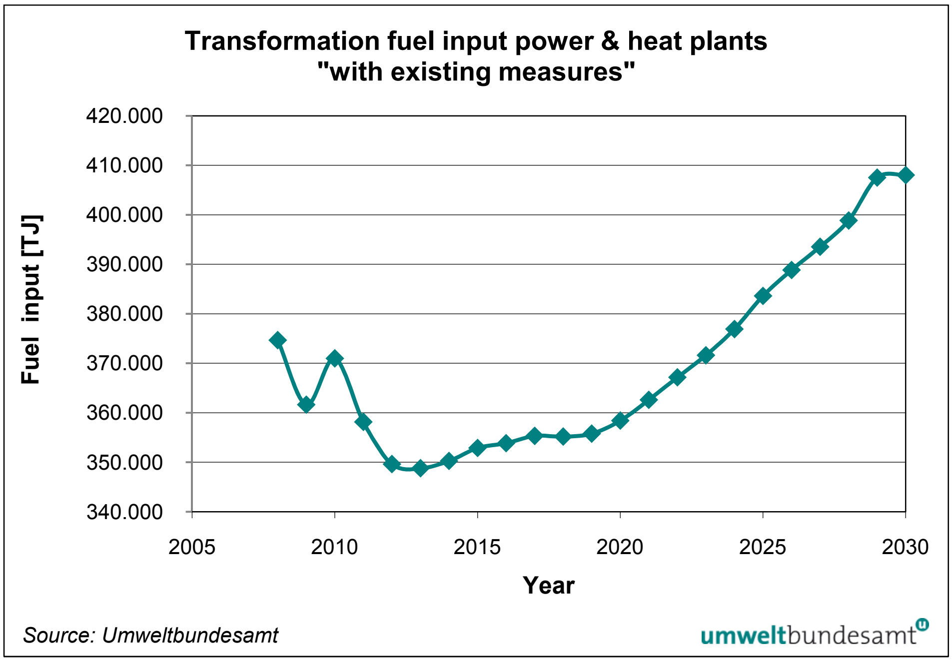


Figure 16: Transformation fuel input in Austrian heat and power plants (1.A.1.a), – scenario "with existing measures".

Emissions of the only refinery (and therefore its energy input) 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 increase by 46% up to 2015 and to remain more or less constant afterwards (see Figure 17).

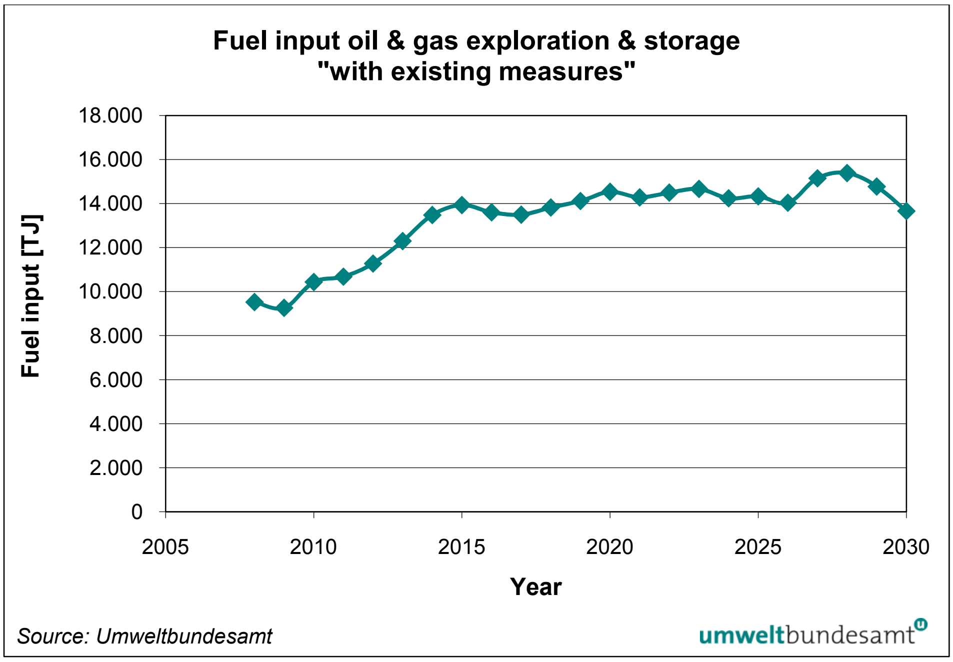


Figure 17 Fuel input in oil and gas exploration and storage (1.A.1.c) –scenario "with existing measures".

Scenario "with additional measures"

The transformation input to Austrian heat and power plants in the scenario WAM is depicted in Figure 18. Trend and effects are similar to the scenario WEM, the input is generally lower.

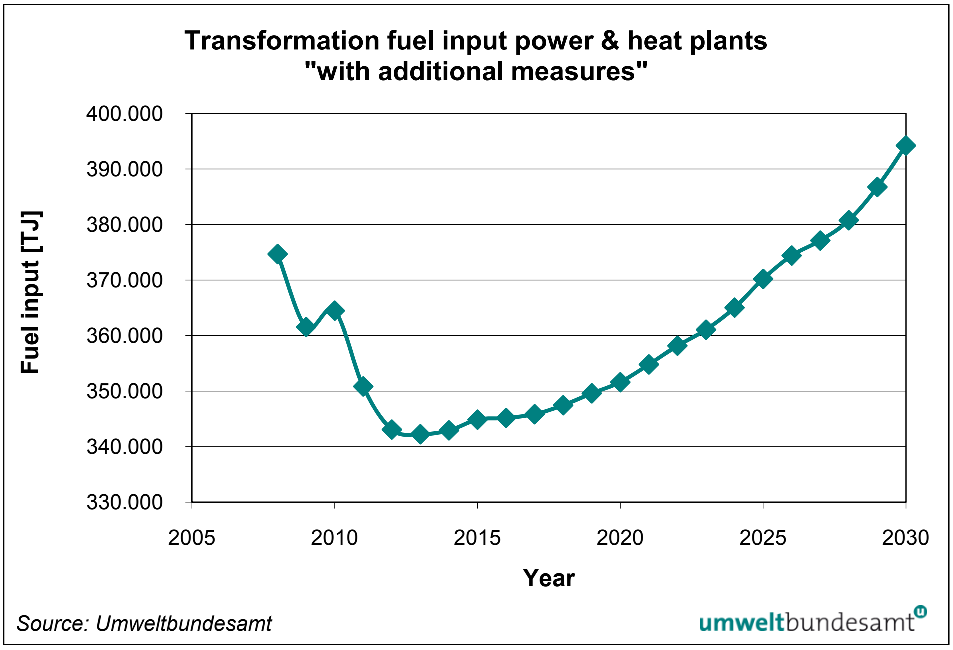


Figure 18: Transformation fuel input in Austrian heat and power plants (1.A.1.a) – scenario "with additional measures".

3.1.1.4 Sensitivity Analysis

For the sensitivity analysis of the heat and power generation the impact of the GDP growth has been evaluated. In the scenario sensitivity scenario a GDP growth of 1.5% p.a. has been assumed. Growth in the scenario WEM is 2% p.a.

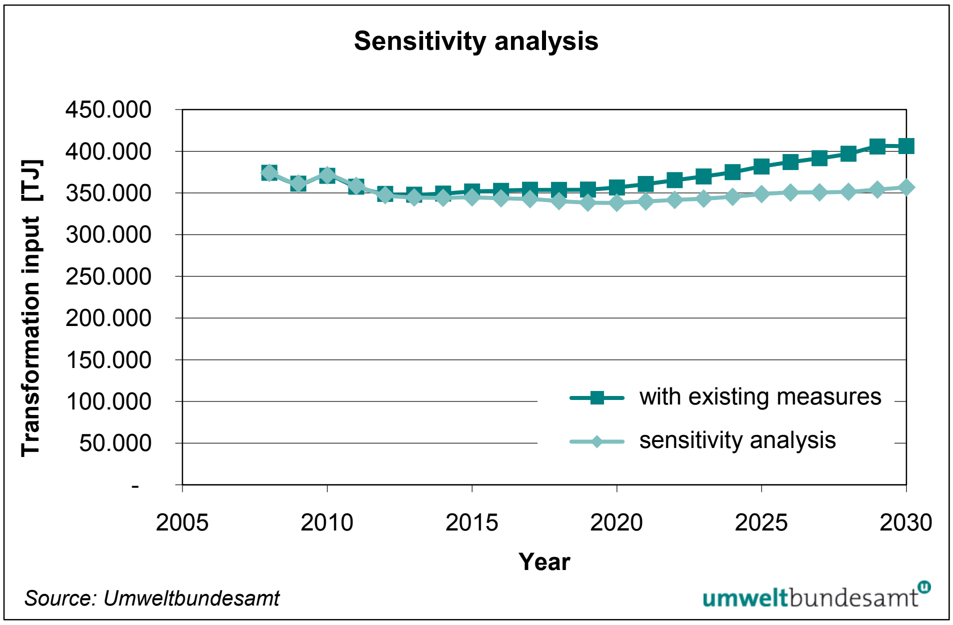


Figure 19: Changes in transformation input according to GDP growth.

Figure 19 depicts the changes of tranformation input resulting from lower GDP growth. The tranformation input is expected to remain nearly constant from 2012 to 2030. The growth of 1.5% p.a. is expected to be compensated by efficiency measures. In 2015 the difference between the scenarios is expected to be 2% or 7 PJ, in 2020 5% or 18 PJ and in 2030 it is 12% or 49 PJ.

For the only Austrian refinery no change due to GDP growth is expected. For public electricity and heat production a significant decrease in emissions is expected if GDP growth is lower, amounting to 11% in 2020 and 27% in 2030. Expected changes are similar but less pronouced for the Manufacture of Solid Fuels and Other Energy Industries (see Table 9 and Figure 20).

Table 9: Effects of gas price on electricity generation for the years 2010–2030 (in GWh).

kt CO_2e	2010	2015	2020	2025	2030
Public Electricity and Heat production					
„with existing measures“	9 096	6 975	7 194	8 303	9 176
sensitivity	9 226	6 707	6 406	6 869	6 679
sensitivity percentage		96%	89%	83%	73%
Manufacture of Solid Fuels and Other Energy Industries					
„with existing measures“	579	773	806	795	758
sensitivity	588	701	705	661	625
sensitivity percentage		91%	87%	83%	83%

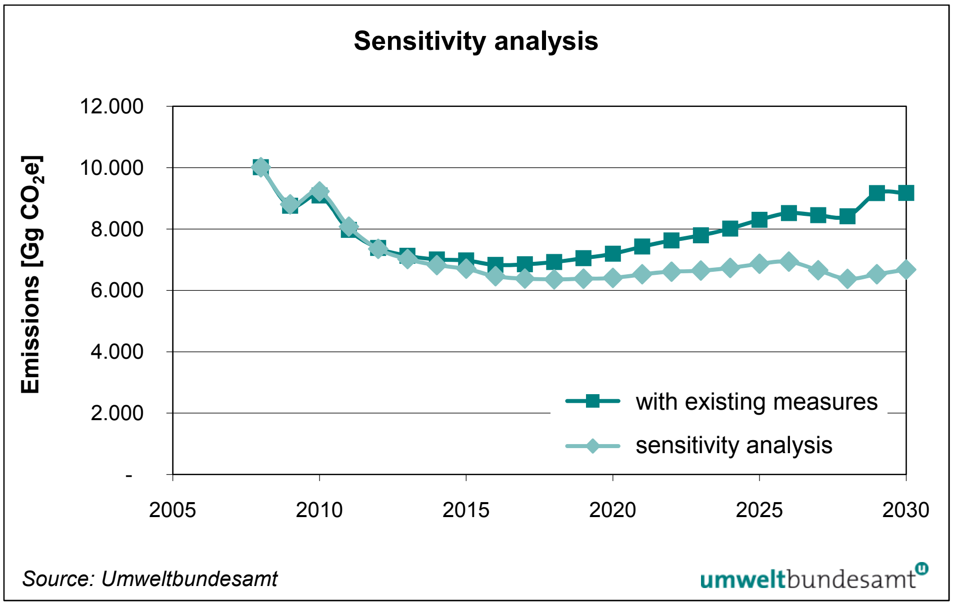


Figure 20: Changes in emissions according to GDP growth.

3.1.1.5 Uncertainty

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

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

Another very important parameter is the global oil price subsequently developments 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 development of the stock of heat and power plants in Austria. Any long-term decisions whether new coal-fired power plants will be built in Austria strongly depend on the coal/oil price ratio, the availability of CCS and national and international policies.

Less uncertainty is associated with the development of the population 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 chapter 3.1.

3.1.2.2 Assumptions

Scenario "with existing measures"

Assumptions for the global oil price are given in US$ starting from 2008 (see Table 10). After a decline until 2010 a continuous increase of the oil price is expected. GDP growth averages at 2.08% per year until 2030. The ratio US$/€ is expected to rise from 1.37 to 1.40 until 2016 and to remain stable afterwards.

Table 10: Global oil price in scenario "with existing measures" and sensitivity analysis (in US$ 2008).

Global oil price [US$ 2008]	2008	2010	2015	2020	2025	2030
WEM	97.01	78.98	93.21	102.16	111.97	122.72
WEM sensitivity	97.01	78.98	85.70	93.00	100.92	109.50

Scenario "with additional measures"

The scenario differs from the scenario „with existing measures" mainly with respect to electricity. Due to increased efficiencies induced by the measures described in chapter 5.3 the electricity demand is expected to decline. The difference is depicted in Table 11 and Figure 21. In the year 2020 the difference is expected to be 6 PJ, and in 2030 9 PJ for electricity demand and 10 PJ for the total industry demand.

Table 11: Energy demand of Total Industry and electricity demand (in PJ).

Energy demand [PJ]	scenario	2010	2015	2020	2025	2030
Total Industry	WEM 2011	278	309	340	371	403
Total Industry	WAM 2011	275	306	334	363	393
Electricity	WEM 2011	89	95	104	113	121
Electricity	WAM 2011	87	92	98	105	112

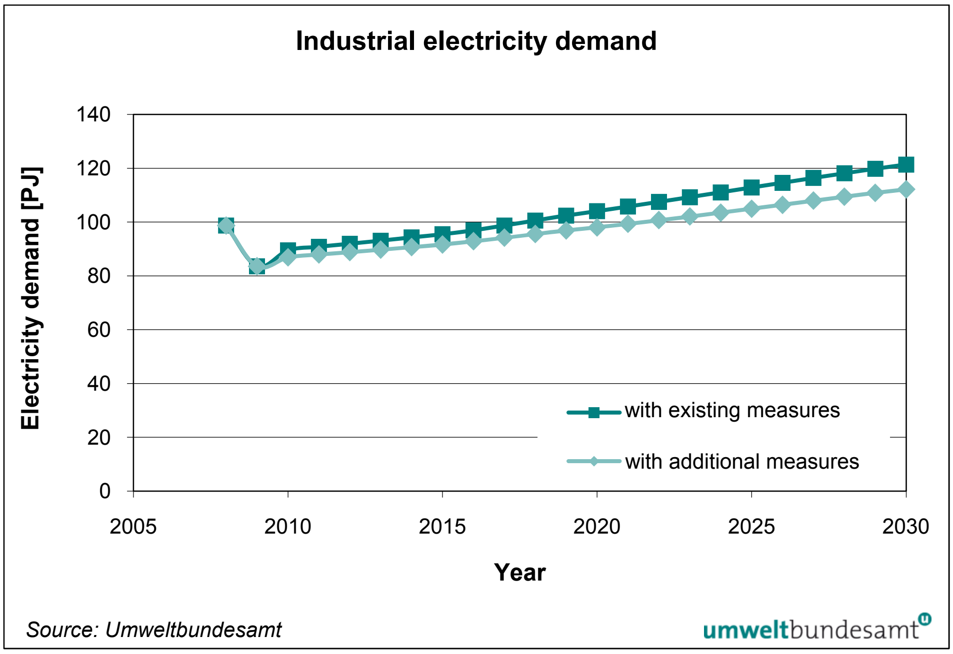


Figure 21: Industrial electricity demand.

3.1.2.3 Activities

Scenario "with existing measures"

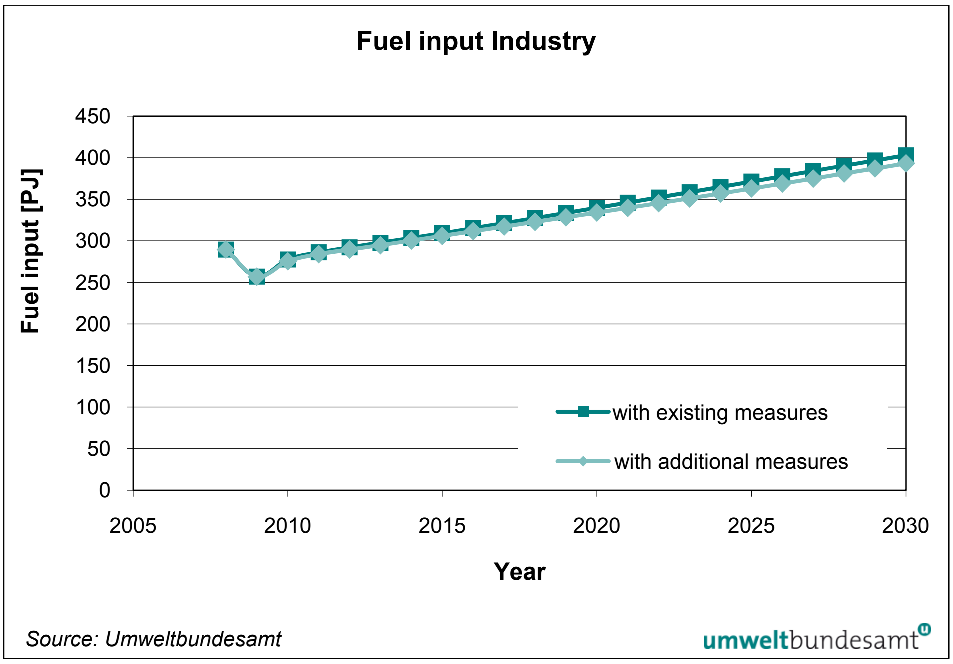


Figure 22: *Industrial fuel input.*

The energy input in industrial sector continuously increases from 2010 to 2030. The difference between the scenarios WEM and WAM is mainly due to efficiency measures with respect to electricity demand (see Figure 22 and Table 11).

Detailed figures are given in the Annexes.

Scenario "with additional measures"

The difference to the scenario „with existing measures" is described in chapter 3.1.2.2.

3.1.2.4 Sensitivity Analysis

The impact of GDP growth on energy demand has been assessed by calculation of a scenario featuring a GDP growth of 1.5% p.a. (instead of 2% p.a. as in WEM).

As can be seen in Figure 28, fuel input is expected to be 8% lower in 2020 and 16% lower in 2030.

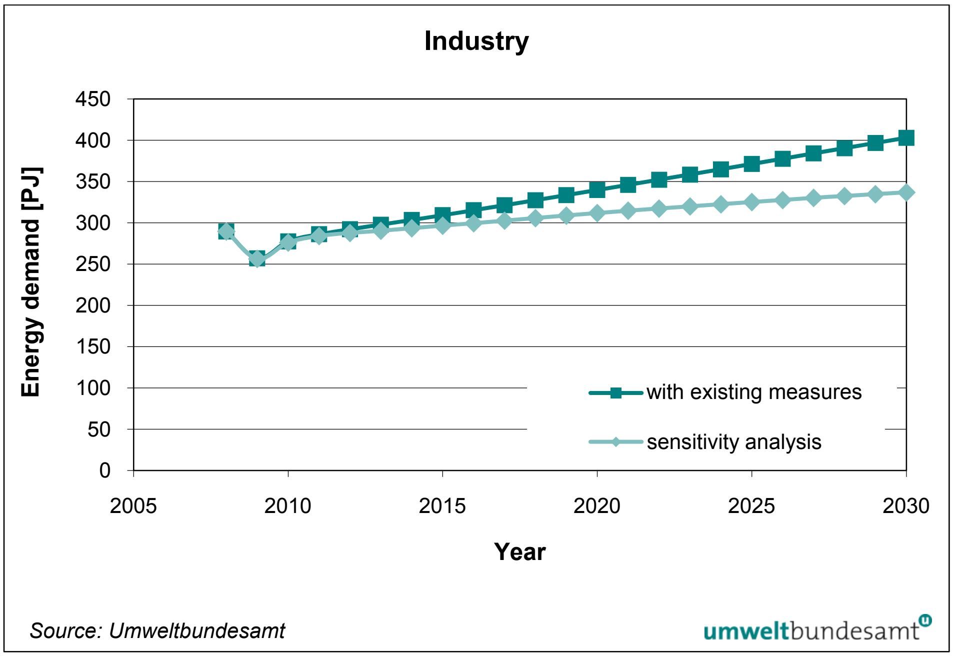


Figure 23: Energy demand of industry

3.1.2.5 Uncertainty

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

The economic development (gross value added) directly influences the energy demand and is the most important parameter. As can be seen in the sensitivity analysis a drop 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 the energy prices. For the wood and the pulp and paper industries the availability of biomass and the costs involved are a key priority.

Less uncertainty is associated with population development 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:

- **Transport demand model**

  Transport demand data, which is the basis for emission modelling, is derived from calculations and forecasts made by a team of authors who compiled the Austrian "Environmental Balance of Transport" 2006/2008. The Environmental Balance of Transport is a multidisciplinary inter-modal analysis of transport demand in Austria since 1950 and its impact on the environment, human health and climate.

  Transport volumes for road and rail are based on an amalgamation as well as an analytical synthesis of official background statistics relevant for travel and freight transport demand by Statistik Austria. Available information such as population data, motorisation rates, vehicle fleet sizes, economic and income development statistics were used. Transport volumes for all other modes (i.e. inland waterways, local buses and trams) were derived from data collected by official Austrian bodies such as Statistik Austria, the Austrian Federal Ministry of Economy, Family and Youth (BMWFJ) or the Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management.

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

  For the calculation of road emissions the GLOBEMI model is used (HAUSBERGER, 1998, 2010, 2011). 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)**

  The 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 may be scrapped by the next year). With this approach the stock of each category of mobile sources is calculated according to the year of their first registration and the vehicle's propulsion system (gasoline 4-stroke, gasoline 2-stroke, diesel > 80 kW, diesel < 80 kW).

1 A 3 a – Aviation

The projection of energy consumption in the aviation sector up to 2030 is based on a forecast by the Austrian Institute of Economic Research (WIFO) for jet fuel.

1 A 3 e – Other transportation – pipeline compressors

The projection of energy demand for pipeline transport up to 2030 is based on expert judgment resulting from several interviews with Austrian pipeline operators.

3.1.3.2 Assumptions

1 A 3 a – Aviation

Scenario "with existing measures" (WEM)

The projection of energy consumption in the aviation sector up to 2030 is based on a forecast by the Austrian Institute of Economic Research (WIFO) for jet fuel which was elaborated within the greater project framework of forecasting energy demand in the different CRF sectors in Austria (UMWELTBUNDESAMT 2010a). This forecast is more robust than the former extrapolation of the trend of the latest years as generally accepted parameters for annual GDP growth or domestic income are used.

Based on the WIFO forecast the average annual growth rate of energy consumption is assumed to be 1.34% in the scenarios WEM and WAM.

Scenario "with additional measures" (WAM)

No additional measures are planned in the scenario WAM.

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 constantly increased since 1990. It is assumed that passenger kilometres will increase further until 2030. Therefore, elasticities[2] for passenger transport based on the assumed GDP development up to 2030 have been calculated. This increase will not affect all means of transport in the same way. Passenger car transport will increase rapidly including assumptions about the future stock of electric and plug-in hybrid cars (assumptions about the development of electro mobility are given below). Also, passenger rail and electric local public transport will increase. Transport by busses, mopeds, motorcycles, bicycles, pedestrians and national aviation will neither increase nor decrease but remain constant on a low level.

Table 12: The growth of inland passenger kilometers in absolute numbers (in million pkm).

	passenger cars	busses	mopeds	motor-cycles	rail	electric local public transport	pedestrians	bicyles	national aviation
1990	55 677	7 969	443	308	8 912	2 796	1 914	1 213	NE*
1995	62 156	8 700	369	510	10 124	3 300	1 857	1 264	NE*
2000	66 668	9 223	348	812	8 740	3 577	1 817	1 304	172
2005	70 557	9 319	332	1 005	9 508	3 770	1 793	1 345	211
2010	72 052	9 513	355	1 205	10 823	4 059	1 698	1 430	192
2015	77 206	9 597	355	1 179	11 481	4 266	1 603	1 515	205
2020	84 552	9 690	355	1 202	12 320	4 380	1 508	1 600	219
2025	93 214	9 765	355	1 209	13 204	4 390	1 413	1 685	234
2030	103 963	9 841	355	1 216	14 229	4 400	1 318	1 770	250

** not estimated*

The following figure describes the modal split for inland passenger transport (excl. pkm from fuel export) given as the percentage of travelers using different means of transport.

[2] 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 commonly used: elasticity = (percentage change in Z)/(percentage change in Y).

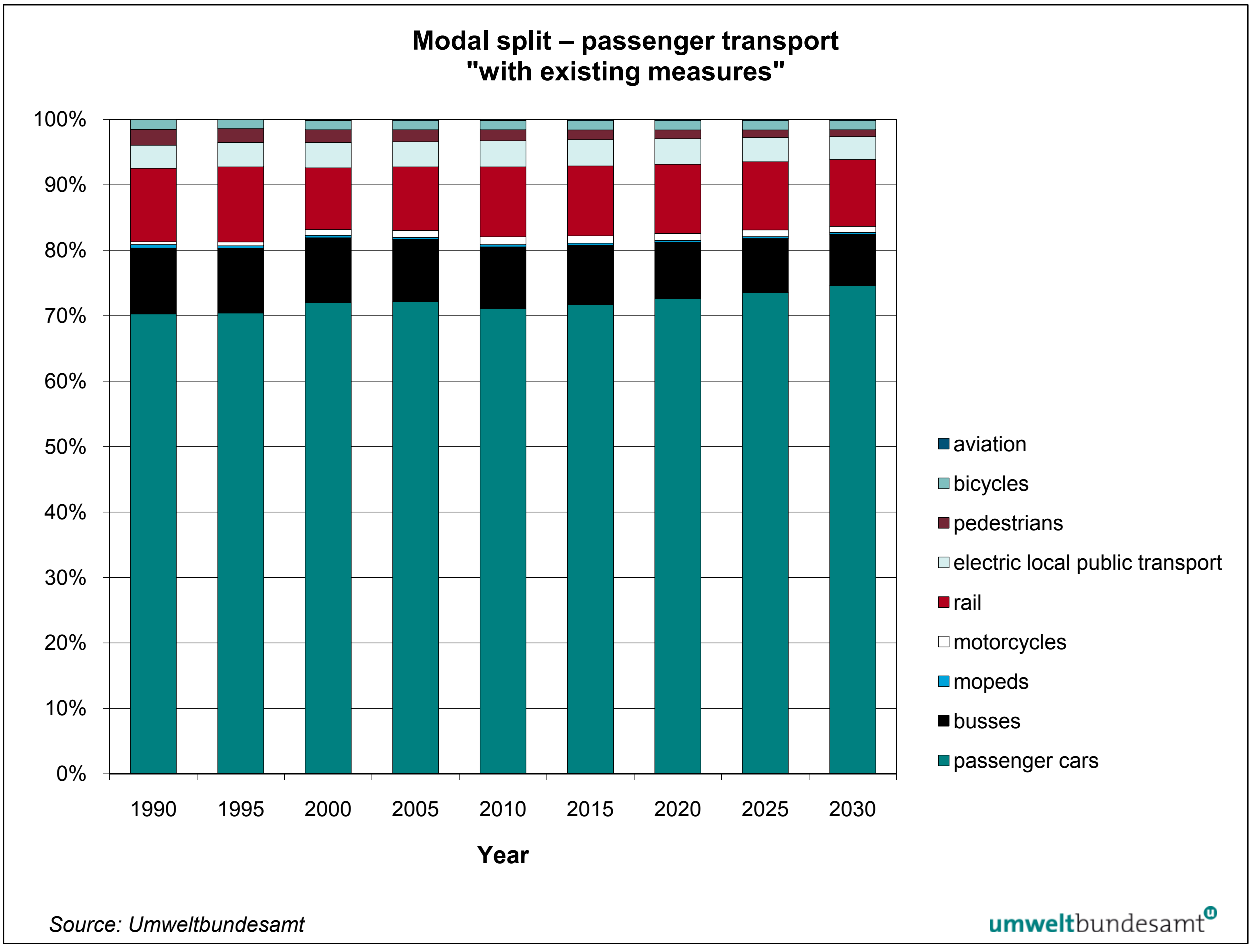


Figure 24: Historical and forecast (2010–2030) modal split of passenger transport – scenario "with existing measures".

Scenario "with additional measures" (WAM)

Elasticities in passenger transport are taken from the scenario WEM. However, the modal split has slightly changed in the scenario WAM compared to the scenario WEM. This results from the transport relevant measures which are included in the scenario WAM leading to a decrease in individual motorised transport and an increase in public transport.

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

Scenario "with existing measures" (WEM)

The situation of freight transport is similar. The transport performance of heavy duty vehicles has increased since 1990 and it is assumed that it will increase unimpededly until 2030, assuming GDP dependent freight transport elasticities up to 2030. Freight rail transport will increase slightly. Light duty vehicles, navigation and aviation will remain constant on a low level.

Table 13: The growth of inland freight tonne kilometres (in million tkm).

	light duty vehicles	heavy duty vehicles	rail	navigation	aviation
1990	426	18 459	11 349	1 663	NE
1995	485	24 565	12 321	2 046	NE
2000	559	31 066	15 331	2 444	2
2005	630	35 965	17 253	2 760	3
2010	662	40 767	17 169	2 598	1
2015	709	44 404	18 869	2 868	1
2020	748	47 872	20 569	3 167	1
2030	853	55.213	23.969	3.860	2

** NE: not estimated*

The following figure shows the modal split for inland freight transport (excl. tkm from fuel export) describing the percentage of freight being shipped by different means of transport.

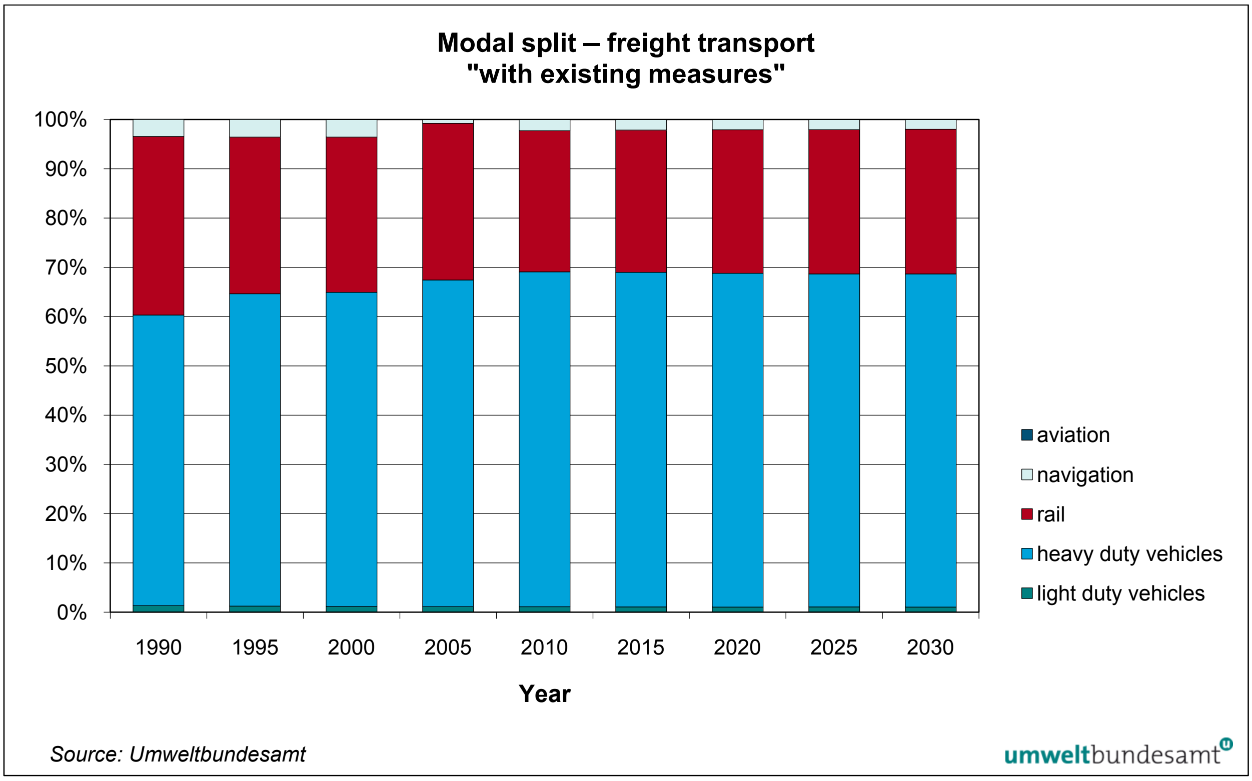


Figure 25: Historical and forecast (2010–2030) modal split of freight transport – scenario "with existing measures".

Scenario "with additional measures" (WAM)

Elasticities in freight transport are taken from the scenario WEM. However, the modal split has slightly changed in the scenario WAM (compared to the scenario WEM). This is the result of transport relevant measures which are included in the scenario WAM leading to a shift from road to rail transport.

- **Development of renewable energy carriers 1990–2030 (WEM/WAM)**

There are several market and policy driven developments in the following fields of action which are – besides other measures – responsible for the stagnating trend and taken into consideration in the scenarios WEM and WAM:

- Stricter emission standards and more efficient automotive engineering.
- Increasing use of biofuels.
- Increasing substitution of fossil fuels by renewable energy used for electro mobility.

Biofuels

The forecast for the use of biofuels up to 2030 has been estimated for both scenarios based on the Energy Strategy Austria (BMWFJ & BMLFUW 2010), on present circumstances (initiatives, promotion, current infrastructure etc.) as well as on foreseeable developments on national and international level.

Electro mobility

The development of electro mobility up to 2030 has been estimated for both scenarios on the basis of a study carried out by the Umweltbundesamt for one of the biggest energy suppliers in Austria (UMWELTBUNDESAMT 2010b). The estimated scenarios are based on ideal political, economical, technical and market circumstances for the introduction of electric vehicles. Based on this study, the stock of electric cars (EVs) and plug-in hybrid electric vehicles (PHEVs) is estimated to amount to 60 000 cars in the scenario WEM and 210 000 cars in the scenario WAM (in 2020). In 2009 the stock of electric vehicles amounted to 223 units (STATISTIK AUSTRIA 2010a).

Measures like the Action Programme ”Electro Mobility“ or the ministerial steering group “Electro Mobility” are included in the scenarios WEM and WAM. However, resistance in the population to adaptations to the new technology is assumed to be higher in the scenario WEM. Demand is much weaker than in the scenario WAM, which makes the market slower in coming up with solutions for the mass production of reasonably priced electric vehicles.

In the scenario WAM it is assumed that all additional measures (Masterplan “Electro Mobility” including an electric mobility boosting roadmap where involved ministries, counties, companies and research institutions are coordinated) are implemented successfully and that there is hardly any resistance in the population to adaptations to the new technology. There is a strong demand for electric vehicles, which drives the market to invest much more in the necessary technologies and the mass production of electric vehicles.

In the forecast only electric passenger cars are included. The freight transport sector is excluded, as long distance electric powered haulage is as yet not technically feasible.

In the estimation it is assumed that conventional diesel and gasoline cars will be substituted to the same extent by electric vehicles. The increased use of electricity in the transport sector and resulting GHG emissions are considered in the energy producing sectors (industry sector: power plants, agricultural sector: increased production of energetic resources etc.) (UMWELTBUNDESAMT 2011). At the moment it is not clear how the use of exclusively renewable energy for electro-mobility can be guaranteed.

1 A 3 c – Railways

Scenario "with existing measures" (WEM)

No measures are planned in the scenario WEM.

Scenario "with additional measures" (WAM)

A set of measures referred to as "modal shift in passenger transport" is included in the scenario WAM. It is aimed at the improvement of public transport systems. It is assumed that these measures will help to make public transport more attractive, which will lead to a slight modal shift from individual motorised transport to public transport.

1 A 3 d – Navigation

Scenario "with existing measures" (WEM)

No measures are planned in the scenario WEM.

Scenario "with additional measures" (WAM)

No additional measures are planned in the scenario WAM.

1 A 3 e – Other transportation – pipeline compressors

EU ETS/non-ETS

Up to 2012 emissions of "Other Transportation" (1A3e) will be non-ETS emissions. However, from 2013 onwards this sector will be completely covered by the ETS except for emissions of greenhouse gases other than CO_2.

Scenario "with existing measures" (WEM)

No measures are planned in the scenario WEM.

Scenario "with additional measures" (WAM)

No additional measures are planned in the scenario WAM.

Fuel price assumptions

For several years an Austrian fuel tax referred to as mineral oil tax (Mineralölsteuer – MöSt) has constantly been very low, in contrast to the neighbouring countries (see Table 14 and Table 15). This has caused a phenomenon known as "fuel export" – namely the transport abroad of fuel in vehicle tanks.

Table 14: Historical fuel prices (in €).

	Austria		**neighbouring countries**	
	gasoline	**diesel**	**gasoline**	**diesel**
2003	1.014	0.739	0.920	0.644
2005	0.933	0.642	1.069	0.769

Table 15: Current differences in gross diesel prices (in €/l fuel; 10/01/2011).

Austria	Czech Republic	– 0.07
Austria	Italy	– 0.07
Austria	Germany	– 0.06
Austria	Hungary	– 0.01
Austria	Slovakia	– 0.003
Austria	Slovenia	– 0.02

Scenarios "with existing measures" (WEM)/"with additional measures" (WAM)

For both scenarios it is assumed that the Austrian fuel price will remain lower than the price in neighbouring countries. Therefore, fuel export is expected to continue.

In the scenario WAM a measure is included where the fuel price for diesel and gasoline is increased three times by 5 cents each time (increases in 2011, in 2015 and in 2021).

3.1.3.3 Activities

1 A 3 a – Aviation

The economic downturn resulted in a decrease of energy demand between 2008 and 2009 by 13%. The projection of energy consumption in the aviation sector up to 2030 is based on a forecast by the Austrian Institute of Economic Research (WIFO) for jet fuel. For 2010 it is assumed that energy demand will increase slightly by 1%. However, from 2010 onwards it will take the aviation sector another 5 years to reach the energy demand level of the peak year 2008.

CO_2 emissions from national aviation are estimated to increase by 30% between 2010 and 2030.

1 A 3 b – Road Transport

Since the end of the 1990s an increasing discrepancy between total Austrian fuel sales and computed domestic fuel consumption has become apparent. From 2003 onwards this gap has accounted for roughly 30% of total fuel sales. A possible explanation for this discrepancy is the "fuel export in the vehicle tank" – due to the relatively low fuel prices in Austria (in comparison to the neighbouring countries), which means that fuel is filled up in Austria and consumed abroad. This assumption is underpinned by a national study (MOLITOR et al. 2009).

The "fuel export" problem is relevant for climate policy, e.g. the Kyoto commitment, because emissions are allocated according to national fuel sales. For this reason GHG emissions from "fuel exports" are assigned to Austria and included in the national total.

In 2009 about 6 million tonnes CO_2 result from fuel exports in vehicle tanks. CO_2 emissions are expected to remain steady until 2030 (in relative terms). CO_2 emissions are projected to remain more or less constant and rise only by 3% between 2010 and 2030.

These trends lead to decreasing CO_2 emissions in the transport sector, with the level of fuel exports remaining constant, as shown below:

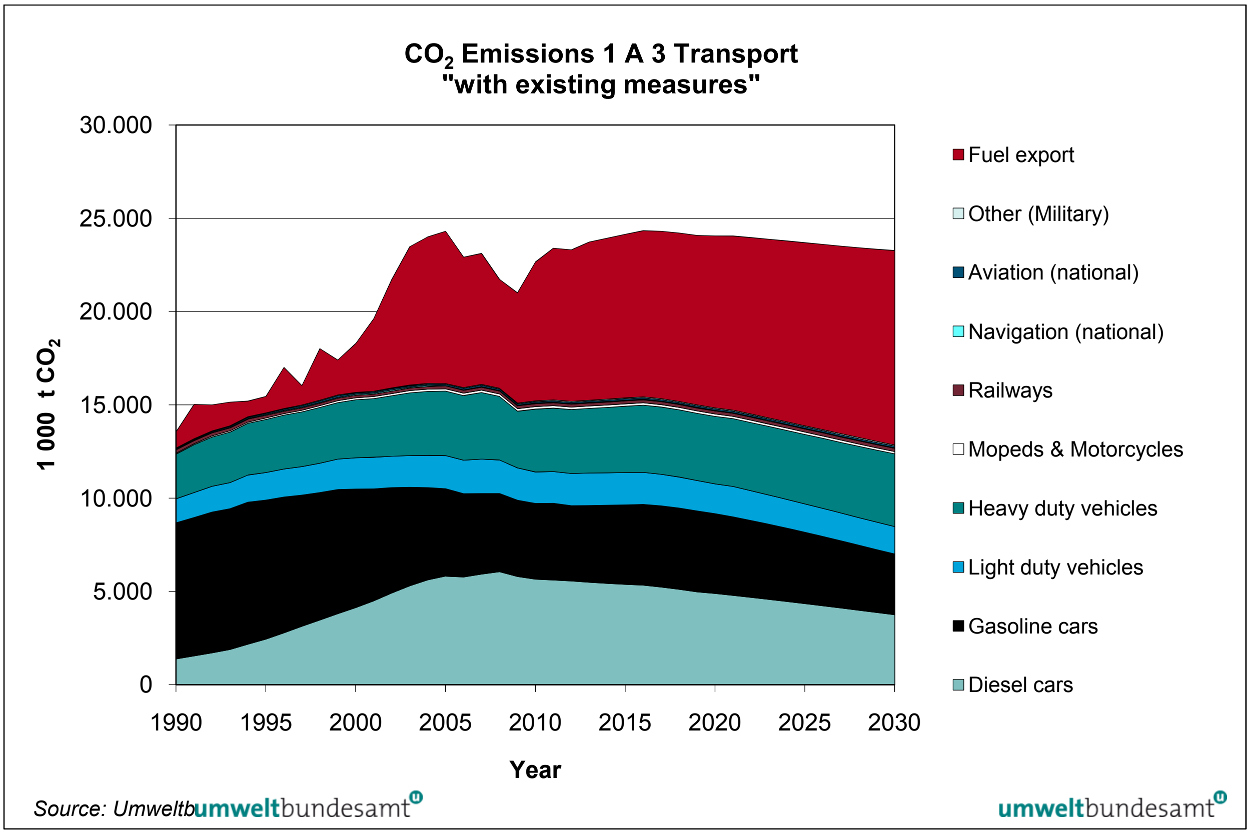


Figure 26: Historical and forecast (2010–2030) development of CO_2 emissions in Transport – scenario "with existing measures".

- **Development of renewable energy carriers 1990–2030**

Biofuels

Since 2005 biogenic fuel (biodiesel, bioethanol, and vegetable oil) has been used in the Austrian road transport sector. Biodiesel and bioethanol are mainly used for blending fossil fuels, whereas vegetable oil is distributed in pure form. For the year 2009 a consumption of 522,000 tonnes of biodiesel, and 99,000 tonnes of bioethanol (for blending with gasoline) and 18,000 tonnes of vegetable oil is used as input data for the calculation model based on the results of investigations on biodiesel in the transport sector in Austria (UMWELTBUNDESAMT 2010c). In 2009 the energetic substitution by biofuels amounted to 7% in the transport sector. Compared to 2005, the first year of biofuel blending, the substitution amounted to only 0.8% (UMWELTBUNDESAMT 2006, 2010c).

The following figure shows the forecast development of biodiesel, bioethanol, vegetable oil and biogas deployment up to 2030 for the scenarios WEM and WAM. Details on energy consumption by fuel type can be found in Annex 3.

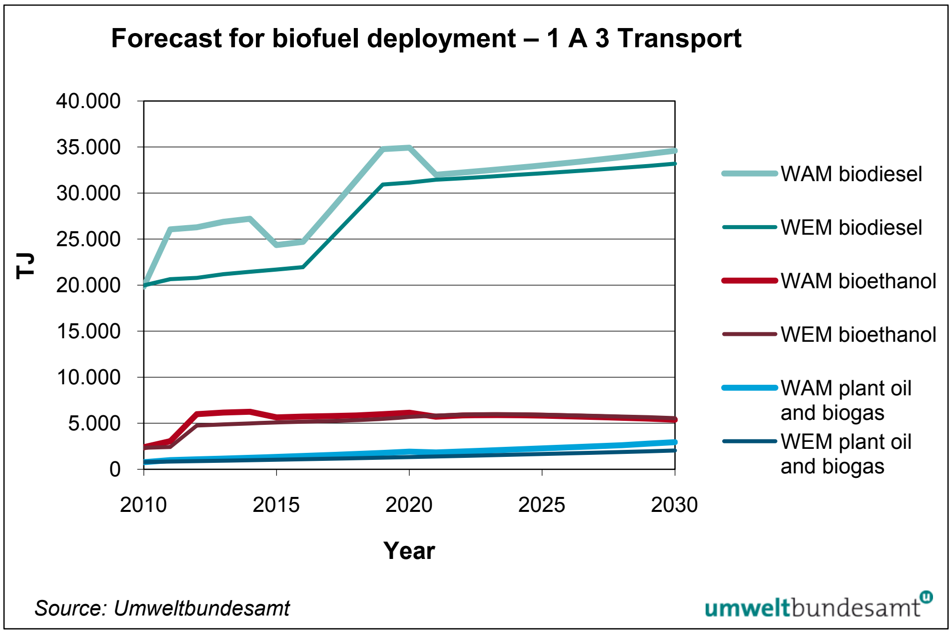


Figure 27: Forecast for biofuel deployment in Austria – scenarios WEM and WAM.

Electro mobility

The fuels/energy carriers CNG, biogas, hydrogen & electricity (for passenger cars) are also included in the energy scenarios.

The following figure shows the estimated energy demand for electro mobility of electric vehicles (EVs) and plug-in hybrid *electric vehicles (PHEVs)* in road transport in Austria up to 2030 for the scenarios WEM and WAM:

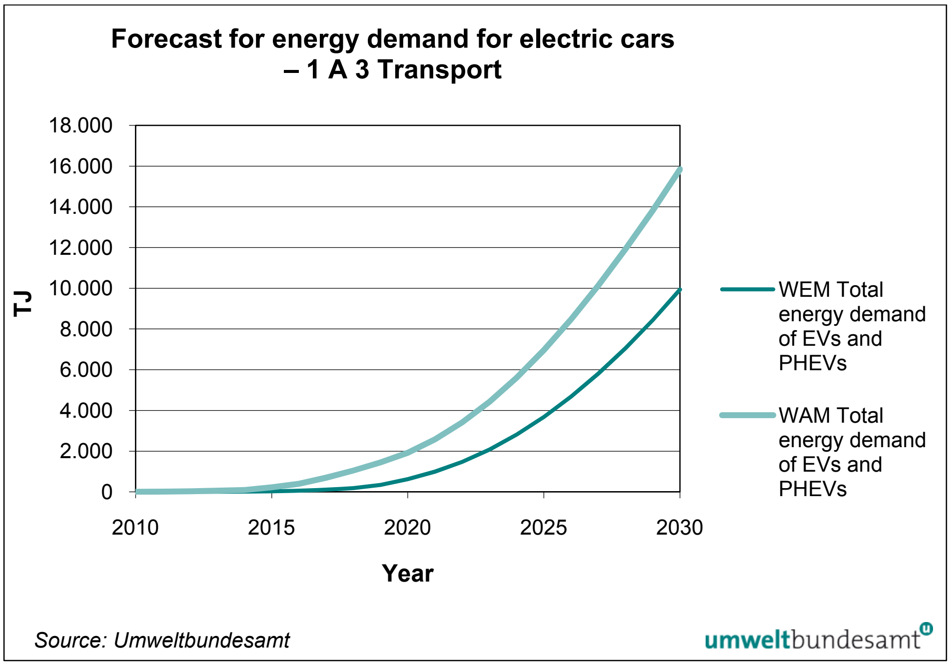


Figure 28: Forecast for electro mobility in Austria – scenarios WEM and WAM.

1 A 3 e – Other transportation – pipeline compressors

The economic recession at the end of 2008 also affected pipeline transport. Energy demand decreased sharply in 2009 (by 14%). From 2010 onwards, energy demand is expected to increase by approximately 5% until 2030.

3.1.3.4 Sensitivity Analysis

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

- *Scenario WEM*: Is the present scenario with fuel price differences held constant from 2010 onwards and an average GDP growth of 2% per year.
- *Scenario WEM sens:* The fuel price differences are held constant from 2010 onwards, the average annual GDP growth, however, amounts to only 1.5%.

The results of the two scenarios show that a higher annual GDP growth rate results in an increase of total CO_2 emissions from the transport sector. This effect is mainly caused by the resulting intensified economic activities between Austria and its neighbouring countries and, consequently, increased export quotas and road transport performance throughout Austria. On the one hand this results in an increased share of fuel export, on the other hand in a generally rising performance of the road freight transport sector and here especially of heavy duty diesel vehicles. Accordingly, CO_2 emissions are rising.

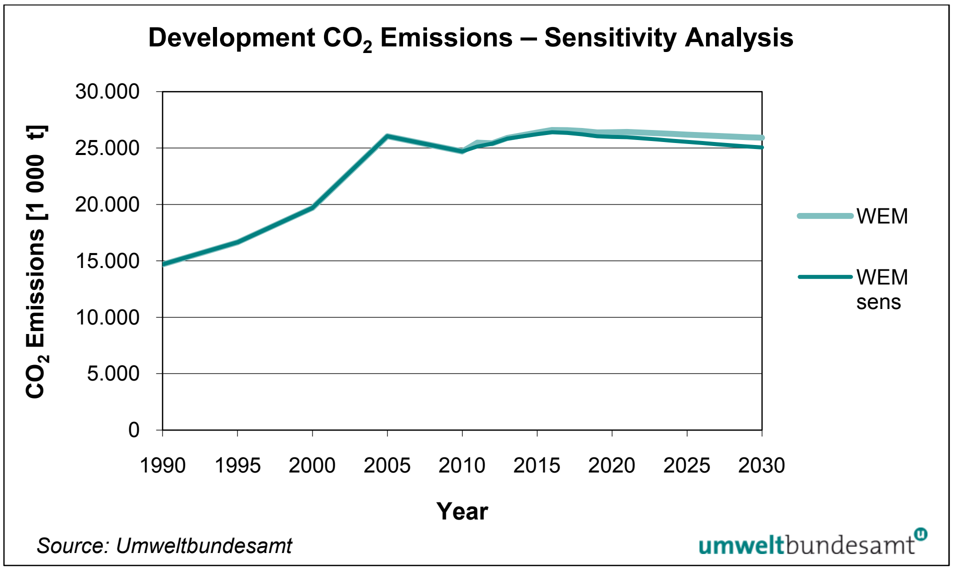


Figure 29: Historical and forecast (2010–2030) CO_2 emissions in different scenarios (Transport & Off Road, without aviation).

3.1.3.5 Uncertainty

Numerous exogenous factors influence projections:

- road pricing for Heavy Duty Vehicles,
- development of fuel prices,
- fuel export due to lower fuel prices,
- development of the fuel efficiency of 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 of the sectoral emission forecast

To calculate energy consumption separately for stationary sources in the subsector residential and commercial, a comprehensive building model (ERNSTL) is used. For the stationary sources in 1A4c (e.g. greenhouses, drying facilities) the macroeconomic model DEIO (WIFO 2011) has been used.

Emissions for 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 2010a).

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

The energy demand model for the heating of buildings: Methodology

This model, operated by the Energy Economics Group (EEG) of the Vienna University of Technology, is called ERNSTL and is a comprehensive dynamic bottom-up simulation tool (TU WIEN 2011).

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 involved for society when promoting certain strategies. Furthermore, the ERNSTL 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. ERNSTL 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, which is based on a complete survey of all Austrian buildings for the year 2001. For model calibration the sampling period from 2003 to 2007 has been used. Based on the development of the energy demand (primary fuels) in this sector, a model calibration of non-monetary parameters has been performed.

The basic decision algorithm

The basic decision/selection process works on an annual basis and decides for each building segment if the system (regarding 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 has to be chosen.

The overall costs (in the sense of 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 technology/measure which is most cost-effective is chosen.

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

Modelling energy demand

Energy demand is modelled depending on service demand and efficiency. The two energy services considered are space heating and water heating. Behavioural aspects with respect to space heating (such as the level of indoor temperature, ventilation habits) are considered through a service factor. This parameter describes the relation 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 water heating is modelled as dependent on the number of people living in the dwelling being considered, 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 year to year.

Overview of technology options

The technology options to choose from 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 options for space heating systems (with the possibility of hot water integration) and 5 different options for stand-alone hot water systems. Solar hot water generation and solar combi systems (solar space and water heating) are integrated into the model. In terms of modification of the building shell, up to 10 different insulation materials for different parts of the building and 6 different window types are implemented. The thickness of insulation is calculated by an optimisation algorithm (with upper and lower boundaries).

Austrian stock of buildings and heating systems

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

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

3.1.4.2 Assumptions

Despite the decrease of population growth rates in Austria, the number of permanently occupied dwellings (principal residence) is assumed to increase by about 20% from 2010 to 2030 (see Annex 1 and 2). This reflects the fact that the trend to single households is stronger than the overall population growth.

In terms of the number of buildings, an overall increase of 10% is expected from 2010 to 2030, whereas the number of buildings with more than two apartments is expected to rise by about 10% in this period. Residential buildings with one or two apartments, which make up the majority (with about 88% of total residential buildings) in Austria, are expected to increase also by around 10% from 2010 to 2030. The strongest increase (with about 29% until 2030) is expected for commercial (non-residential) buildings.

The total gross floor area in residential buildings is assumed to increase by 10.7% until 2030, whereas the total gross floor space, which is a better indicator for huge buildings, is expected to increase by about 27% for commercial buildings from 2010 to 2030.

Price assumptions are especially important in this sector because they may influence decisions as to which fuels are going to be preferred in the long term, and decisions regarding the quality and quantity of thermal renovation activities. Over a period of about thirteen years this can have a noticeable effect on the specific energy demands. Energy prices are assumed to rise considerably for all fossil fuels (about 20–30%) from 2010 to 2030. Up to 2030 a more moderate increase is expected for bio fuels, wood logs, wood chips and wood pellets (around 13%).

Detailed assumptions can be found in Annex 1 and 2.

Furthermore, there are assumptions that differ between the scenarios WEM and WAM.

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 individual rates differ between the local authorities. On average, subsidies are granted for district heating (15% of total installation costs), log wood and wood chips (20%) and pellets (23%) as well as solar heat (20–25%). It is further assumed that these percentages will remain constant over the forecast period in the scenario WEM.

The renovation rate indicates the proportion of buildings (or households) where improvement measures on the thermal building envelope (like house front, windows, top and bottom floor ceiling) are accomplished. It is therefore an indicator for the renewal of buildings, which usually reduces their heating demand. The renovation rate for residential buildings is assumed to increase from 0.6% in 2008 to 1.3% in 2030 and for commercial buildings from 0.6% in 2008 to 1.6% 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 1.5% in 2008 to 4% in 2030.

Moreover, the average heating demand for residential buildings is expected to decrease from 169 kWh/m² in 2010 to 121 kWh/m² in 2030, while the average heating demand for commercial buildings is expected to decrease from 152 kWh/m² to 106 kWh/m²

Scenario "with additional measures"

On average, subsidies are granted for for district heating (15% of total installation costs), log wood (35%), wood chips and pellets (38%) as well as solar heat (33–38%). It is further assumed that these percentages will remain constant over the forecast period in the scenario WEM (for specific details see Annex 2).

The total renovation rate in the scenario WAM is (with up to 1.6% by 2030) noticeably higher for residential buildings than in the scenario WEM. Moreover, the boiler exchange rate for residential buildings is expected to increase up to about 4% until 2030.

In the scenario WAM the average heating demand is further improved and expected to be 109 kWh/m² for residential buildings in 2030. The average heating demand for commercial buildings is expected to decrease to 102 kWh/m² by 2030.

In chapter 4.2.4 more information on measures included in the scenario WAM can be found.

3.1.4.3 Activities

Emissions were calculated on the basis of the energy 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 ERNSTL.

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 2008 to 2030. Alternative energies like solar heat and ambient energy are expected to increase by 218% and 154% in residential buildings until 2030. As regards log wood, energy consumption is expected to decline by around 40%, 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 53% reduction in the use of heating gasoil is expected until 2030, as well as a 26% decline in natural gas consumption and a 70% decrease in coal use.

Whereas overall energy consumption without electricity is expected to decline by 20% in the residential sector, total energy demand without electricity will only decrease by 4% in the commercial sector (until 2020). This leads to a less pronounced decrease in fossil fuels like heating gasoil (– 38%) and coal (– 39%) and natural gas (– 21%) in commercial buildings until 2030. Wood chips are expected to rise by 247%. With respect to the low use of pellets in 2008, an approximately 10 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 33% until 2030. A considerable gain in energy demand is expected for solar heat (229%) and ambient energy (1 265%). Detailed data are included in Annex 1 and 3.

Scenario "with additional measures"

Due to additional measures bringing about a quicker increase in the renovation rate, the overall demand of 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 scenario WEM.

For detailed information see Annex 1 and 3.

3.1.4.4 Sensitivity Analysis

The ERNSTL model provides projected results for the energy demand for stationary sources in residential and commercial buildings. To verify the stability of the modelled WEM outcome, a sensitivity analysis is conducted to examine changes of the following parameters:

- Sens – EP 0: constant energy prices until 2030 (from 2008 onwards)
- Sens – EP 2: growth rate doubling of energy prices until 2030
- Sens – FQ 0.8: 20% reduction of implemented funding quota
- Sens – FQ 1.2: 20% increase of implemented funding quota

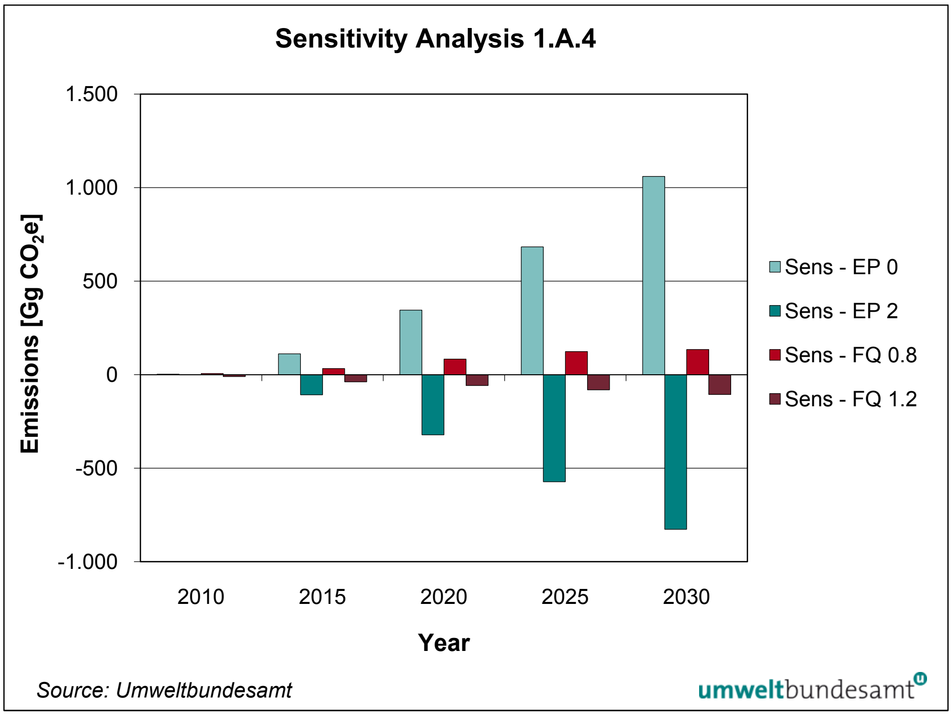


Figure 30: 1.A.4 Other Sectors (stationary sources), results of sensitivity analysis.

The variation of the funding quota at the stated rates shows that the influence of these parameters alone is low. The greenhouse gas emissions vary at most by 2%. A more significant impact is produced by the alteration of prices. Doubling the growth rate for energy prices will reduce GHGs by about 12% in 2030, whereas constant energy prices will lead to a gain of around 15% in greenhouse gas emissions.

A detailed analysis of the robustness of the used model (ERNSTL) was described in the last submission for GHG projections (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 a variation of the assumptions for the price of fossil energy influences 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 the development of the population in Austria, as well as 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 of 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 summed up, 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 of the sectoral emission forecast

The same methodology as in the Austrian inventory (UMWELTBUNDESAMT 2010a) is applied for calculating projected emissions.

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 2008. 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 2008. Projected emissions are calculated by multiplying the oil or natural gas production by the averaged implied emission factors 2004–2008.

3.1.6.2 Assumptions

No policies and measures are considered for the emission forecast.

In 2006 the last brown coal open surface mine closed in Austria and it has been assumed that no coal mines will be operated until 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.

Natural gas storage is forecast on the basis of extension plans for storage sites from the Austrian Oil Exploration Company (RAG, Rohöl-Aufsuchungs AG). It is planned to extend capacities to 5.7 billion m³ until 2017.

3.1.6.3 Activities

Natural gas consumption, refinery intake and natural gas production are taken from energy projection (WIFO 2011).

Historical and forecast pipeline and distribution lengths and natural gas storage are presented in Table 16.

Table 16: Historical and forecast (2010–2030) activity data for 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
2008	6 545	28 348	2 949
2010	6 800	28 554	3 583
2015	7 438	29 069	5 168
2020	8 075	29 585	5 700
2025	8 075	30 100	5 700
2030	8 075	30 615	5 700

3.1.6.4 Sensitivity Analysis

For the sensitivity analysis the impact of GDP growth has been evaluated. Therefore a scenario WEM sens with a 1.5% GDP growth p.a. has been assumed for the estimation of the distribution network growth. The resulting difference in total GHG emissions of the scenarios WEM and WEM sens is 1% in 2020 and 3% in 2030.

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

3.1.6.5 Uncertainty

The uncertainty of the projections for fugitive emissions is closely linked to the uncertainty in the Energy Industries (see chapter 3.1.1.4). Higher uncertainty is expected with respect to CO_2 emissions from natural gas refineries which 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.

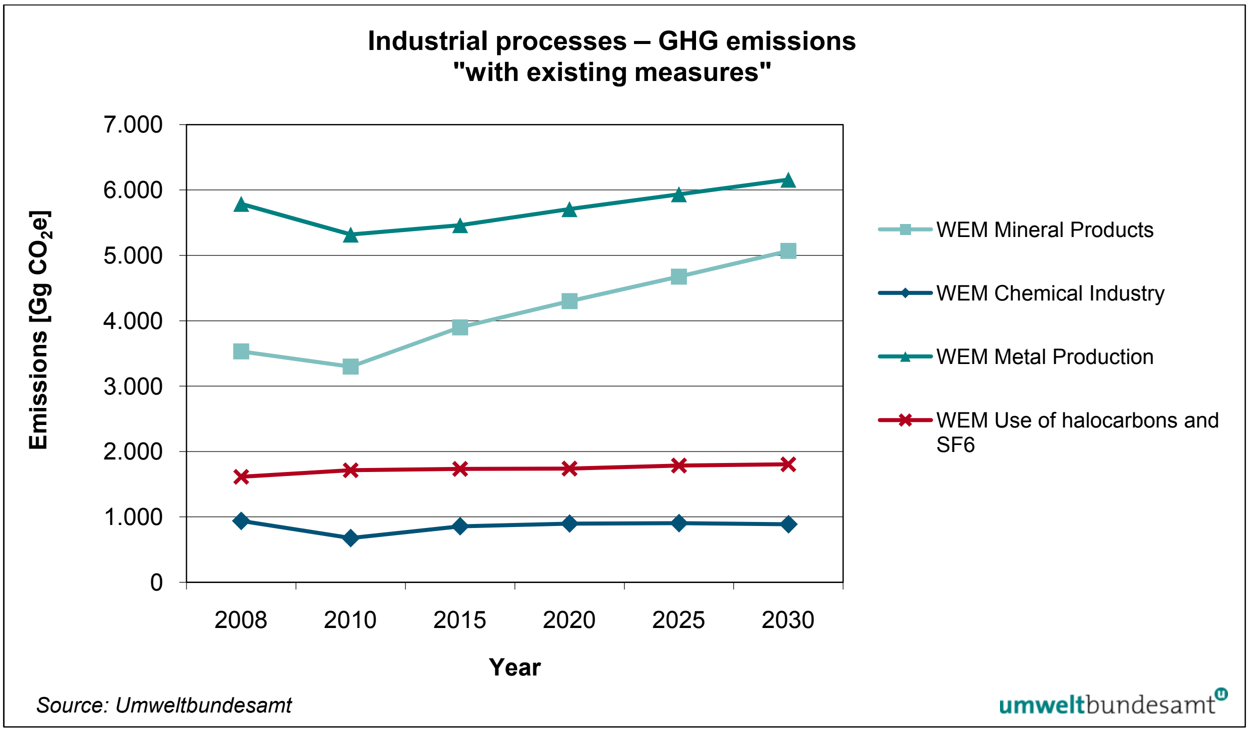


Figure 31: GHG emissions from industrial processes – scenario WEM.

Figure 31 shows greenhouse gas emissions for three categories of industrial processes. Due to the economic crisis the sectors mineral products, chemical industry and metal production experienced a decrease in the period 2008 to 2010.

For emissions from chemical processes a slow decrease until the year 2010 is projected to be followed by a minor increase of the emissions.

Concerning emissions from metal processes and mineral products, the decrease over the period from 2008 to 2010 is expected to be followed by a stable increase of GHG emissions during the period 2010–2030.

3.2.1 Mineral Products (2.A)

3.2.1.1 Methodology of the 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 2010a).

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 of energy inputs. For the lime industry, the demand for lime stone in the iron and steel industry has been considered.

There are no differences between the assumptions for the scenarios "with existing measures" and "with additional measures".

3.2.1.3 Activities

Figure 32 presents the assumptions for the production of cement clinker.

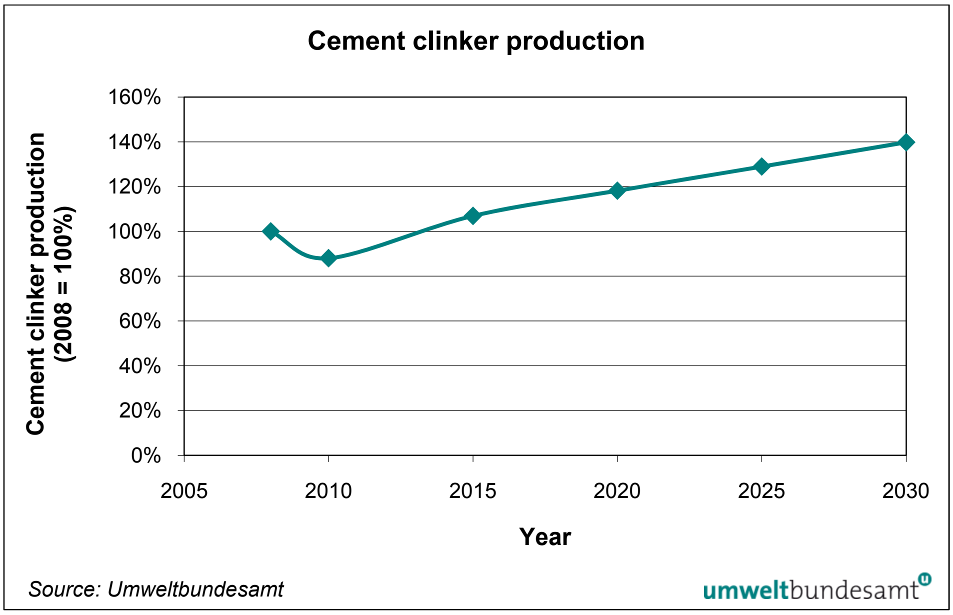


Figure 32: Assumption for the production of cement clinker.

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

3.2.2 Chemical Industry (2.B)

3.2.2.1 Methodology of the 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 2010a).

3.2.2.2 Assumptions

Activities for the production of ammonia have been based on energy projections (non-energy use of natural gas). Other productions (nitric acid) have been combined with these activities.

The scenario includes the opt-in of N_2O from nitric acid plants into the EU-ETS at the beginning of 2010.

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

3.2.2.3 Activities

Figure 38 presents the assumptions for the production of urea and fertiliser.

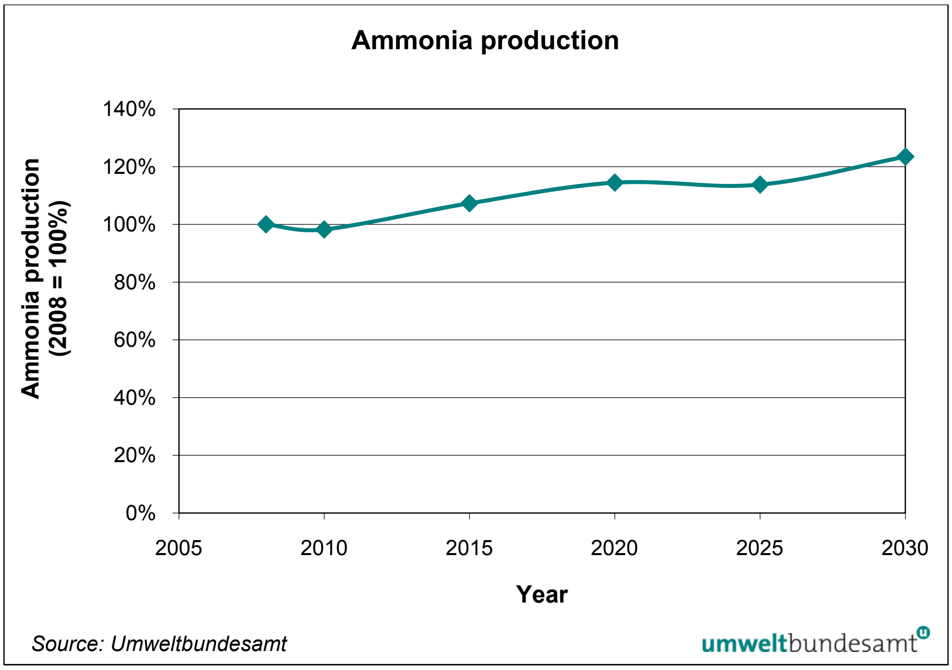


Figure 33: Assumption for the production of ammonia.

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

3.2.3 Metal Production (2.C)

3.2.3.1 Methodology of the sectoral emission forecast

The methodology for the emission factors is discussed in the Austrian Inventory Report (UMWELTBUNDESAMT 2010a). 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 during 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 the coal and coke inputs included in the macroeconomic model from WIFO (WIFO 2011).

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

3.2.3.3 Activities

Figure 34 presents the assumptions for the production of crude steel and pig iron.

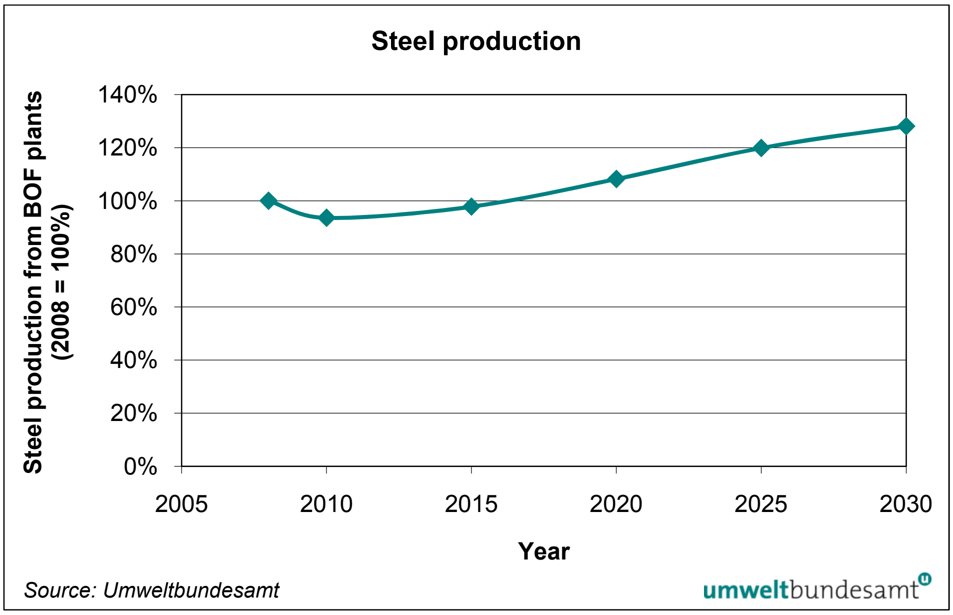


Figure 34: Assumption for the production of steel (only from basic oxygen furnace plants).

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 until 2020.

Halocarbons and SF_6 (fluorinated gases) have been used in Austria for a wide range of applications. Among them is the use of HFC and PFC as refrigerants in refrigeration and air conditioning systems (2.F.1), the use of HFC as blowing agents in the production of foams (2.F.2), the use of HFC and PFC as fire extinguishing agents (2.F.3), the use of HFC as propellants in aerosols (2.F.4), the use of HFC as solvent (2.F.5), the use of HFC, PFC and SF_6 as etching gases in semi-conductor manufacturing (2.F.7), the use of SF_6 as insulating gas in electrical equipment (2.F.8), and other uses of SF_6 (2.F.9) in soundproof windows, tyres and research.

Although fluorinated gases are not used in big amounts (1–1.8 kt per year) they contribute approximately 1.75% 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 thus, 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 the same methodology as the one used in the Austrian GHG inventory, and performed with the same level of detail; for more information see Austria's National Inventory Report 2010 (UMWELTBUNDESAMT 2010a). Calculations are based on a new study published in 2010, in which the whole chapter on fluorinated gases was updated. Part of this study was a chapter on projections (until 2020), which provided the basis for calculations for this publication (GSCHREY 2010). For the years 2025 and 2030, trends based on the assumptions made in this study were extrapolated.

Emissions were calculated from projected annual stocks and emission factors. Annual stocks correspond to the amounts of halocarbons and SF_6 stored in applications the year before, minus emissions of the year before, plus consumption of the year considered. Additional emissions occur from the disposal of products containing fluorinated gases.

3.2.4.2 Assumptions

Scenario "with existing measures"

(a) The Austrian Ordinance on reducing and phasing out HFCs, PFCs and SF_6 remains fully applicable (in terms of bans and restrictions).

(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.

Projections for annual stocks and emission factors are, as far as provided, taken from projections of an updated study on the use of F-gases in Austria. These are based on expert judgments and industry inquiries. If not yet considered, prohibitions, restrictions, and regulations on the prevention of leakages and on the recovery and destruction of fluorinated gases under Austrian and EU legislation have been used to forecast stocks and emission factors.

The same emission factors as those used for the inventory have been applied for emission projections.

The assumptions used to project the annual consumption 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 it is exported) is in force. This results in 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 commercial refrigeration equipment and industrial refrigeration equipment. This results in the assumption that emissions from commercial refrigeration as well as transport refrigeration, industrial refrigeration and stationary Air Conditioning will remain constant.

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 introduces 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. For the forecast the consumption of fluorinated gases is assumed to be zero, except for XPS foams with a layer thickness of more than 8 cm, for which HFCs with a GWP < 300 have still been allowed from 2007 onwards. Regarding One-Component Foams, the placing on the market of OCFs containing propellant gas mixtures with a GWP > 150 is assumed to have stopped. The production of OCFs containing a higher GWP is still allowed in case they are required by national safety standards or if they are exported outside the EU (see Reg. 842/2006). In Austria, OCFs are additionally regulated under the national F-gas Ordinance, which allows the use of OCFs only in case of safety requirements. As a consequence, HFC emissions of approximately 2 tonnes remain unabated, as OCFs with a higher GWP are considered necessary to meet national safety standards.

Fire Extinguishers, Solvents: A constant emission factor of 1.5% is assumed as well as a constant annual consumption of HFCs until 2030, the baseline being the average annual consumption over the period 2000–2008. It is assumed that no HFC emissions from solvents will occur from 2004 onwards.

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 medical dose inhalers are not affected. These are assumed to grow at a rate of 6% per annum, given the levels over the period 2000–2008. It is assumed that HFC emissions from novelty sprays and technical aerosols will no longer occur after 2009.

Semiconductors: Emissions are based on emissions in 2008 and include the expected growth of the industry until 2020. A voluntary agreement of the semiconductor industry is taken into account which included the European goal for PFC emission reductions to 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 already reached in 2002, and amounted to 50% in 2008. Thus it is assumed that the rate of 50% will be sustained throughout the whole time period.

Electrical equipment: It is assumed that end-of-life gas recovery will be enhanced so that the disposal emission factor will decrease from 5% to 1.5%. Total emissions in this sector are projected to decrease by 4–5 kt CO_2 equivalents per year.

Other use 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 sub category 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, only emissions from SF_6 banks and disposal are taken into account.

Scenario "with additional measures"

Stationary Refrigeration and Air Conditioning: This scenario assumes a total ban on the use of HFCs in domestic refrigeration as well as improved rates for the recycling of refrigerants when disposing of them, which will result in a 5% decrease of emissions from waste disposal. It also assumes a 50% reduction of manufacturing emissions from commercial refrigeration through technical improvements as well as the substitution of HFCs in new commercial refrigeration equipment from 2015 onwards. It also includes reductions of the emission factors in transport refrigeration, resulting in a decrease of use phase emissions to 10% (which could be achieved through improved leakage control measures) and a decrease of disposal emissions to 20%. As alternatives to HFCs in new industrial refrigeration equipment are common and readily available, a ban on the use of HFCs in new industrial refrigeration equipment from 2010 (and in all types of central air conditioning systems and heat pumps from 2012) onwards is assumed.

Mobile Air Conditioning: it is assumed that the scope of the MAC Directive will be extended to all vehicle types, and that alternative refrigerants are to be used from 2015 onwards.

Foam Blowing: It is assumed that the use of HFCs will no longer be intended from 2010 onwards, not even for panels thicker than 8 cm which can be manufactured without HFC-152a. Thus the only emissions are those from HFC banks built up before 2005.

Fire Extinguishers/Solvents: No additional measures were taken into account.

Aerosols: Based on the estimation that MDIs cover approximately 50% of asthma sprays, it is assumed that the share of powder – inhalers will increase significantly and that HFC emissions from MDIs could be reduced to 50% of the projected emissions from 2015 onwards.

Semiconductors: more ambitious targets for emission reductions in the semiconductor industry, such as a maximum emission factor of 20% (emission reduction of 80% in relation to consumption) have been taken into account. The scenario assumes emissions of 48% in relation to consumption in 2010, 30% in 2015 and 20% in 2020.

Electrical equipment: A reduction in use phase emissions is taken into account. The emission factor is assumed to decrease by 50% (from 0.6% to 0.3%) from 2013 onwards.

Other use of SF_6: No additional measures were taken into account.

3.2.5 Activities

Activities in the sector Halocarbons and SF_6 can be expressed as potential emissions and as annual stocks. Annual stocks are defined in the methodology subchapter. Potential emissions correspond to the amounts consumed in the year considered. As potential emissions are usually reported together with the actual emissions in the National Inventory Report, potential emissions are reported as activity data in Annex 3.

3.2.6 Sensitivity Analysis

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

- Scenario WEM: is the present scenario with an average GDP growth of 2% per year.
- Scenario WEM sens*:* The average annual GDP growth amounts to 1.5% and a lower oil price is assumed (cf. chapter 3.1.2.2).

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. The effect is mainly caused by an increase in the GDP.

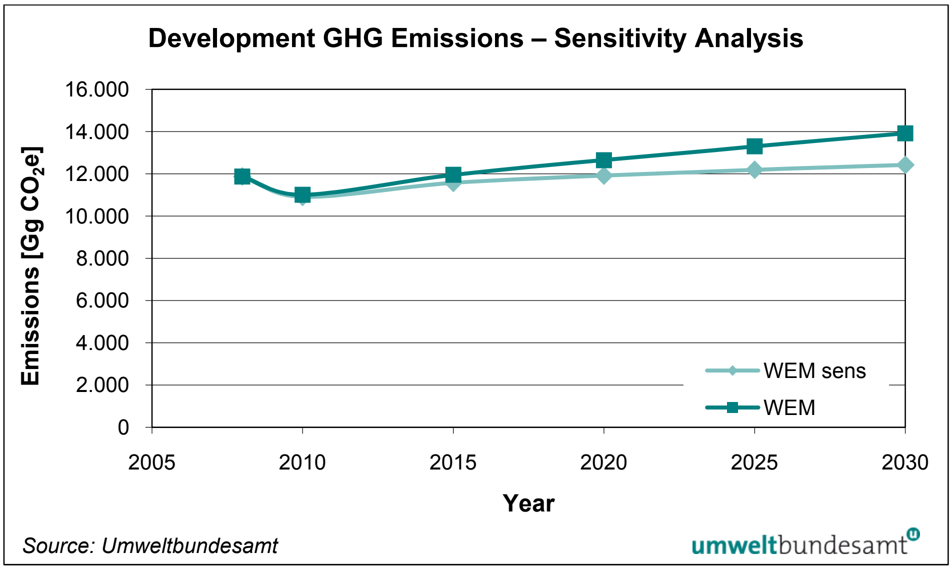


Figure 35: Forecast GHG emissions in different scenarios (industrial processes).

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

3.2.7 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 and the leakage rates of fluorinated gases. Because of a lack of experiences from the past, assumed changes in leakage rates have a particular influence on the overall uncertainty of the 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, glues, ink, rubber, plastic, pesticides or for cleaning purposes (degreasing). After 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 are calculated by multiplying emissions in the latest inventory year (2008; submission 2010) by the population growth rate until 2030.

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

To determine the quantity of solvents used in Austria for the various applications, a combination of a bottom-up and a top-down approach has been used. The top-down approach provides the total quantities of solvents used in Austria. The share of the solvents used for the different applications and the solvent emission factors have been calculated on the basis of the bottom-up approach. By linking up the results of the bottom-up and the top-down approach, the quantities of the solvents annually used and of the solvent emissions for the different applications have been obtained.

N_2O Emissions from Solvent and Other Product Use

The basis for the data of the Austrian air emission inventory (OLI) 2010 (data basis 2008) is provided by the Austrian Industrial Gases Association (Österreichischer Industriegaseverband, ÖIGV) and default emission factors according to IPCC Guidelines. The recommended methodology of the IPCC Guidelines has been applied.

For the projections of N_2O emissions from "Other Product Use" the population growth rate is used.

3.3.2 Assumptions

Scenario "with existing measures"

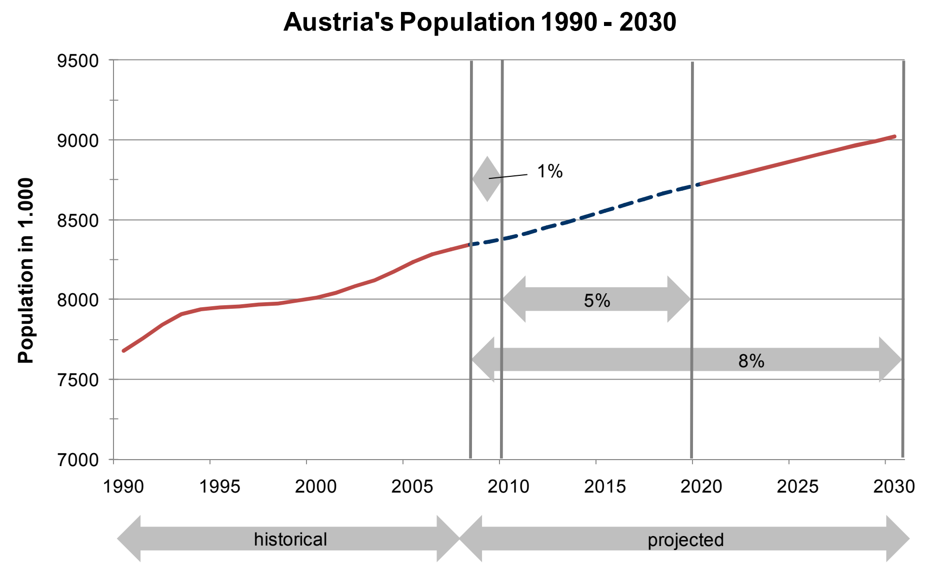
Most of the demand for solvents comes from the paint and coatings industry but also from household cleaners, disinfectants, personal care products and the printing industry. Besides paint which is used in the sub-sector "Construction and buildings", most consumer products are coated with paint. Furthermore, solvents are used in many industrial cleaning applications, including cleaning for maintenance and cleaning in the manufacturing process. Solvents are also important 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 2008–2030 correlates with/corresponds to 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 2010b umweltbundesamt

Figure 36: Historical and forecast (2010–2030) population in Austria (STATISTIK AUSTRIA 2010b).

From a demographic perspective, Austria's population growth shows a positive net migration (difference of immigrants and emigrants), with the natural increase (difference between births and deaths) accounting for only a comparatively small contribution of population growth. The population increase during the period 1990–2008 was 8%.

The Austrian population projection is based on a study prepared by STATISTIK AUSTRIA (2010b) and commissioned by the Austrian Conference on Spatial Planning (ÖROK)[3]. According to this study (and based on the reference year 2008), the population growth rate is about 1% for the period 2008–2010, about 5% for the period 2008–2020 and about 8% for the period 2008–2010.

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". Therefore the uncertainty can be considered high.

[3] Österreichische Raumordnungskonferenz (ÖROK)

3.4 Agriculture (CRF Source Category 4)

3.4.1 Sector Overview

With respect to agricultural activities, 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 2010–2030.

3.4.1.1 Farm policy and market

The 2008 CAP Reform

On 20 November 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 policy change will be the abolition of the EU milk quota system in 2015. Many other changes, like the abolition of the setting aside of arable land, the decoupling of direct payments and reforms for the sugar sector have taken place in recent years. The farm sector has already made adjustments to most of these changes.

The programme for rural development

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.

The current period of the programme for rural development will end in 2013 and a new programme will start in 2014 if a political agreement will be reached. The effects of the programme in Austria have recently been evaluated (SINABELL et al. 2011b) and the results corroborate the view that this programme is of major importance for the agricultural sector in general.

International food markets

European farm commodity markets are interlinked with international food markets in many ways. When looking at the imbalance between supply and demand on many markets, the EU is a major exporter, in particular of cereals, milk and white meat. 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 population, urbanisation and changes in dietary patterns) and technological progresses will be expected as the major driving forces of agricultural production during the next decade.
The times of lower prices for farm commodities seem to be over and due to higher commodity prices more intensive farming systems will become more profitable in Europe.

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 are one of the major alternative sources. Two major legal documents are of interest in this context: the Austrian law for the provision of green electricity (Ökostromgesetz) and the European Biofuel Directive, recently repealed by the EU Directive on Renewable Energy (Directive 2009/28/EC).

Both measures are designed to have an effect on the agricultural system via a price system. First, the law for boosting bioenergy crop production works like a subsidy for farm commodities because Austrian feedstock sources are not favoured over imported ones. Second, the relevant production incentives in Austria are dominated by price signals from regional and global markets.

In view of the mechanism of the bioenergy policies currently in place, the best approach to model them is to take prices which are relevant for markets within the EU as a reference and to analyse their effects on local production.

3.4.1.2 Methodology of 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 2010 (UMWELTBUNDESAMT 2010a).

Input parameters for activity data projection have been obtained from 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 crop, forestry, livestock, and farm tourism activities by 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.

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). Projections of the EU Commission (CEC 2010) show very similar assumptions about the future development of key economic indicators (see Annex 2).

Other exogenous economic assumptions for Austria (like the GDP or population size) are not explicitly 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. Input prices were considered to be consistent with recent forecasts for the Austrian energy sector (UMWELTBUNDESAMT 2011). Since production is driven by resource availability, prices and technological development, and because Austrian agriculture is an integrated part of the common market, carry-over effects from European demand patterns are noticeable and determine the results.

The forecast period in this study is until 2030. For the period beyond 2019 OECD-FAO forecasts are not available. Therefore, the assumption is that beyond 2030, prices will follow the inherent trend.

Technological progress

Information on storage facilities on Austrian farms was obtained from the Austrian farm survey of 1999. Other assumptions, in particular technical progress in plant and animal production, are based on (SINABELL & SCHMID 2005). Deviating from this source, estimates of increasing milk yields per dairy cow have been somewhat reduced according to the estimates discussed in 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. The average milk production at sector level is the consequence 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 input of all other nutrients is determined by a model based on nutrient balances.

The forecasts for mineral fertiliser reflect the consequences of land use (e.g. more legumes (pulses) where organic farming is expanding) and changes 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 among the two scenarios can be summarised as follows:

Scenario “with existing measures” (WEM)

In the scenario „with existing measures“ the following policy measures are implemented:

- implementation of the CAP health check reform 2008 (mainly abolition of milk quota);
- special attention is given to the Austrian way of implementation (maintenance of the premiums for suckling cows – including heifers);
- given the uncertainties over the flow of funds through the modulation mechanism it is assumed that the amount that Austrian farmers who might be the beneficiaries receive will be the same as the amount that other farmers will lose through this measure;
- land is maintained in good agricultural and ecological condition ("cross compliance");
- the programme for rural development is maintained in an unmodified way;
- introduction of a regional decoupled farm premium (instead of the historical premium model).

Scenario "with additional measures" (WAM)

- slightly more efficient use of mineral fertiliser (efficiency of N from manure increases by 12,5%);
- further stimulation of organic farming by granting higher subsidies than for the implementation of an agri-environmental measure with lower environmental benefits (technically speaking, funds of UBAG measures from the Austrian agri-environmental programme are shifted to organic farming);
- energy crop production on 10 000 hectares;
- abolition of the premium for suckler cows.

Sensitivity analyses

- abolition of the programme of rural development in Austria for the two main scenarios.

3.4.1.3 General trends shown in the scenarios

The PASMA model indicates the following trends (SINABELL et al. 2011a):

Milk and beef

As a consequence of the abolition of the milk quota milk, the output of milk 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 increase 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 of relative prices. If the bull production in the neighbouring countries becomes more competitive it is likely that more calves will be exported. This would limit the production possibilities for bull fattening in Austria. Currently there are no hints that this will be the case.

The similarity of the results does not come as a surprise. In all scenarios, the EU farm policy reform of 2008 is implemented and the analysed variations are only small modifications of a continuation of the situation before 2010. We would expect significantly different results if we abandoned the programme of rural development which is extremely important for maintaining production in marginal areas. The results for such a scenario are presented below.

3.4.1.4 Sensitivity

In the sensitivity scenarios the assumption is that the programme of rural development will be abolished. The results are in line with findings recently published by (SINABELL et al. 2011b) who analysed the same scenario for the year 2013:

- 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 two sensitivity scenarios (relative to the scenarios BAU and WEM) are as follows:

Table 17: Sensitivity analysis agriculture.

indicator	year	abolition of the programme of rural development relative to	
		BAU*	WEM
		percentage change	
LU cattle conventional	2010	0.3	0.2
	2015	1.2	1.1
	2020	1.9	1.6
	2030	0.2	0.1
LU cattle organic	2010	– 7.3	– 5.3
	2015	– 13.7	– 11.2
	2020	– 19	– 16
	2030	– 20.2	– 18.1
mineral fertiliser	2010	– 11.7	– 10.4
	2015	– 15.1	– 13.8
	2020	– 17.9	– 16.1
	2030	– 18.9	– 15.9

** scenario "business as usual"*

3.4.1.5 Uncertainties

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 in-

put 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.

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 2010 (UMWELTBUNDESAMT 2010a).

3.4.2 Enteric Fermentation (4.A)

3.4.2.1 Methodology for the sectoral emission 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 2010 (UMWELTBUNDESAMT 2010a).

3.4.2.2 Assumptions

GE intake

Feed intake parameters and the methane conversion rate are the same as the ones used in the national greenhouse gas inventory (UMWELTBUNDESAMT 2010a). GE intake of dairy cows was calculated on the basis of projected milk yields (see Annex 3 and the relevant description in chapter 3.4.1.2 and 3.4.1.3)

3.4.2.3 Activities

Input data based on PASMA model results

On the basis of the results obtained with the PASMA model (SINABELL et al. 2011a), animal numbers are given for 2010–2030 (see Annex 3). Cattle numbers are available for conventional and organic production.

Figure 42 shows the trends and projections for the Austrian cattle and swine population. As the PASMA model gives very similar results for the animal numbers in both scenarios, no separate figures have been generated.

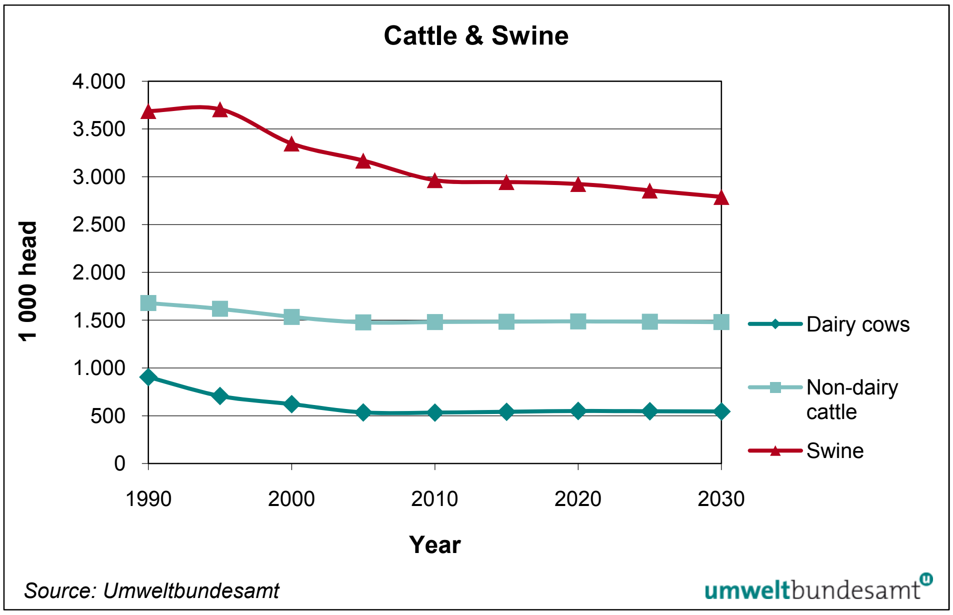


Figure 37: Historical and forecast (2010–2030) cattle and swine numbers.

The PASMA 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.

Livestock projections – scenario "with existing measures":

- the number of cattle is likely to increase, which is a result that would change a declining trend over decades; the reason is that milk production is likely to expand after the abolition of the milk quota (2015), which would lead to an increase of the dairy cattle;
- the number of suckling cows is less affected because the premiums per head will still be coupled to production in Austria even after the reform; a given share of heifers qualifies for such premiums as well, therefore the number of suckler cows and heifers is expected to remain relatively constant;
- since farmers will receive coupled premiums either for suckling cows or heifers while other premiums for cattle will be abandoned, the population of suckling cows will not necessarily increase – the reason being that the model takes account of the profitability of the whole cattle production simultaneously – with the implication that the value of calves will drop;
- as a consequence of lower prices for pork and poultry and lower feeding costs, outputs of these products will not be expanded – this being a consequence of the modelling approach which prevents an expansion of an activity if the relation between product prices and production costs deteriorates; this result is consistent with previous observations (SINABELL & SCHMID 2005);

Livestock projections – scenario "with additional measures":

- The number of cattle is slightly decreasing while the number of dairy cows is practically the same. The most plausible reason is that the slight expansion of organic farming lowers the output and that the expansion of bioenergy crops limits the production of fodder and therefore makes livestock production less competitive.

- The number of suckling cows is lower than in the baseline scenario. The reason is that the assumption is that the premium for suckling cows will be abolished. According to our results suckling cow production will prevail in several regions even under such detrimental conditions. This is explained by the fact that sufficient low-cost grassland is available and that investments in more productive activities in these regions are not likely to be economical.

The projections show that milk production will increase in Austria after the abolition of the milk quota in 2015. Expected milk prices will be high enough to make milk production the most competitive livestock activity in Austria.

3.4.2.4 Sensitivity Analysis

The validity of the model and the forecast results were proved by repeated sensitivity tests (see chapter 3.4.1.4).

3.4.2.5 Uncertainty

A qualitative discussion of uncertainties is provided in chapter 3.4.1.5.

3.4.3 Manure Management (4.B)

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

3.4.3.1 Methodology for the sectoral emission forecast

Emissions are calculated by applying the methodology used in the Austrian Greenhouse Gas Inventory. A comprehensive description can be found in the Austrian National Inventory Report 2010 (UMWELTBUNDESAMT 2010a).

Projected activity data are a result of calculations carried out within the Positive Agricultural Sector Model Austria (PASMA), developed by the Austrian Institute of Economic Research (WIFO) (SINABELL et al. 2011a).

3.4.3.2 Assumptions

VS and N excretion values

The feed intake parameters applied here are the same as those applied in the national greenhouse gas inventory (UMWELTBUNDESAMT 2010a). Austria-specific VS and N excretion values of dairy cows have been calculated on the basis of projected milk yields (see Annex 3).

Animal Waste Management Systems

The projected animal waste management system (AWMS) application corresponds to the AWMS data used in the 2009 inventory. The data is based on a comprehensive investigation of Austria's agricultural practices in 2005 (AMON et al. 2007).

In the scenario ”with additional measures“, special attention has been given to the anaerobic digestion of animal manures: for biogas production a use of 700 000 m³ slurry in 2015 has been assumed and a use of 800 000 m³ from 2020 onwards.

3.4.3.3 Activities

Input data based on PASMA model results

The applied data on Austrian livestock are a result of calculations carried out within the PASMA model (SINABELL et al. 2011a). Animal numbers for 2010–2030 are discussed in chapter 3.4.2.3 and presented in Annex 3.

3.4.3.4 Sensitivity Analysis

The validity of the model and the forecast results were proved by repeated sensitivity tests (see chapter 3.4.1.4).

3.4.3.5 Uncertainty

There is a high level of uncertainty because at the time of producing this study no projections on specific GHG reduction techniques were available (e.g. cover of slurry storage tanks).

A qualitative discussion of uncertainties is provided in chapter 3.4.1.5.

3.4.4 Rice Cultivation (4.C)

There is no rice cultivation in Austria and the scenario assumes that there will be none until 2030.

3.4.5 Agricultural Soils (4.D)

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

3.4.5.1 Methodology for the sectoral emission 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 2010 (UMWELTBUNDESAMT 2010a).

Underlying activity data are estimated by the Positive Agricultural Sector Model Austria (PASMA) (SINABELL et al. 2011a).

3.4.5.2 Assumptions

The major driving forces for the sectoral development are the prices on farm commodity markets, technological progress, and policy variables (SINABELL et al. 2011a).

In the scenario ”with existing measures“ the agricultural land has to be maintained in goodecological condition and the programme for rural development is maintained in an unmodified way (see chapter 3.4.1.2).

In the scenario "with additional measures" more land is used for the production of energy crops (short rotation poplars) and organic farming is more attractive (because more support is provided under the agri-environmental programme); and nutrients from livestock are used more efficiently (see chapter 3.4.1.2).

The PASMA model indicates the following trends (SINABELL et al. 2011a):

Scenario ”with existing measures“:

- the size of arable land will be reduced mainly due to the secular trend of competition for land from urbanisation and traffic infrastructure;
- crop production will decline due to reductions in area size and the increase of output prices will not besufficient (compared to rising input costs) to make significant expansions economical;
- the size of grassland will be reduced considerably; the category declining at the fastest rate will be extensive grassland – because of its low productivity it will be less economical to use in the light of increasing energy costs;
- the production of manure will shrink along with the development of the number of heads of livestock;
- organic farming will not expand significantly assuming that premiums of the agri-environmental programme will stay in place and prices of organic products will be higher while opportunity costs will be lower after the implementation of the reform;

Scenario “with additional measures“:

- More land will be used for crop production and the production situation will be better for organic farming; more land will be designated for legumes.
- The size of land designated for bioenergy short rotation poplar will be 10 000 hectares assuming that policies to boost bioenergy production will be in place.
- The output of crops (mainly cereals and corn) will increase, the reason being that in the policy scenario the assumption is that the agri-environmental measure “UBAG” will be abolished and that premiums will be shifted to organic farming,with the consequence that organic farming will be slightly more attractive but that on the remaining acreage, production will be more intensive and thus compensate the output decreasing effect from organic farming.

3.4.5.3 Activities

Input data based on PASMA model results

Mineral fertiliser application data are derived from scenario calculations carried out within the PASMA model (SINABELL et al. 2011a).

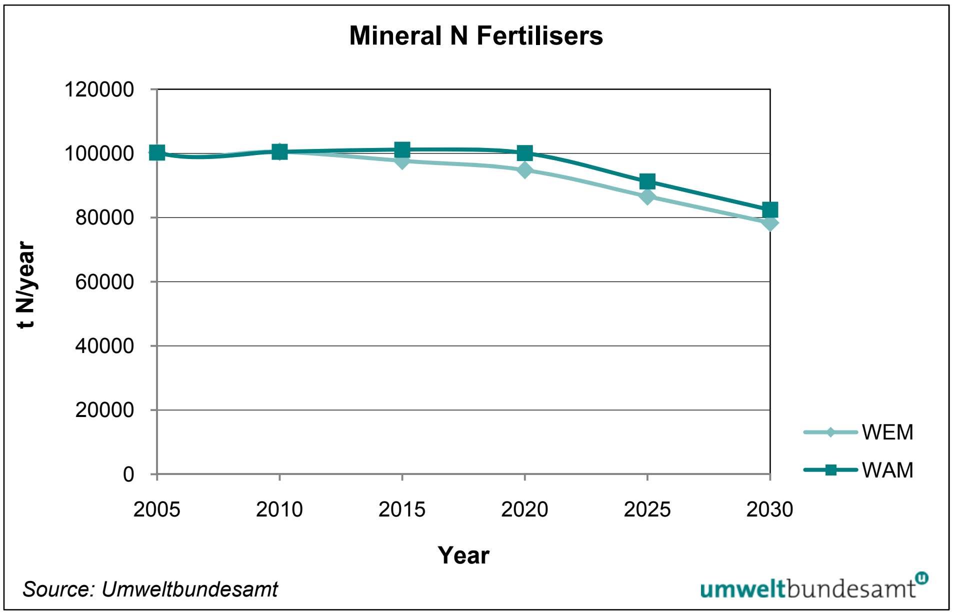


Figure 38: Trend and forecast (2010–2030) mineral fertiliser application.

Mineral fertiliser application increases slightly in a situation where organic farming is expanding and the efficiency of fertilisers from manure increasing (scenario WAM). According to (SINABELL et al. 2011a) the reason is the intensification effect brought about by the abolition of UBAG (see above) as well as an expansion of cereal and corn production (crops mainly produced with mineral fertilisers).

3.4.5.4 Sensitivity Analysis

The results of the sensitivity analyses are described in chapter 3.4.1.4.

3.4.5.5 Uncertainty

A qualitative discussion of uncertainties is provided in chapter 3.4.1.5.

3.4.6 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.

3.4.7 Field Burning of Agricultural Residues (4.F)

A federal law restricts the burning of agricultural residues on open fields in Austria. It is only occasionally permitted 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 simple approach has been applied: the arithmetic mean of the area burnt from 2005–2009 has been used as activity data.

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-categories other than forest land remaining forest land (5.A.1) in CRF category 5.

3.5.1 Methodology for the sectoral forecast

PROGNAUS (PROGNosis for AUStria) (LEDERMANN 2006) is a yield and silvicultural science-based model, which was developed and applied in 1995 for the first time and is updated continuously. PROGNAUS consists of several submodels, 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).

3.5.2 Assumptions

Special importance was attached to the silvicultural relevance of tending activities through intensive preliminary cuttings and thinnings. Final cutting was considered to apply to 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 revenues gained from diverse price scenarios[4].

Harvests on forest inventory plots with a positive profit margin (free of harvesting costs) 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 cutting of the smaller dimensions in stands.

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4 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)

Table 18: Projection parameters for LULUCF (silviculture scenario).

	Price scenarios	2010	2015	2020
data on harvest:				
million m³ 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 m³ o.b.	71–162 €	29.8	29.8	29.8
Gg CO_2e	71–162 €	– 37 700	– 37 700	– 37 700
Net C uptake/release:				
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

3.5.3 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, land use changes from and to forests, stock, increment and drain (NIR; UMWELTBUNDESAMT 2010a).

The results of the latest available NFI (2000/02) therefore form the basis for the modelling of the Austrian forest carbon stock changes in the years 2010, 2015 and 2020.

Projections are based on the results 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 referred to above. This study includes projections for 2020, using the growth and harvest models implemented in a simulation programme 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/).

3.5.4 Sensitivity Analysis

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

3.5.5 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 elements of the emission factors contribute significantly to the uncertainty of sector 5.A.1 estimates: conversion factors from stemwood to biomass as well as equations to estimate branch and root biomass. The uncertainty over historical figures for net removals listed in 5.A.1, as reported under UNFCCC (for years covered by NFIs), is of the order of ± 40%.

3.6 Waste (CRF Source Category 6)

This chapter includes information on and descriptions of the methods of greenhouse gas projections, as well as references to activity data projections concerning waste management and waste treatment activities. The projections described in this chapter include projections from the CRF Classification Solid Waste Disposal on Land, Wastewater Handling, Waste Incineration and Other Waste (Compost Production). 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 are 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 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 method has been applied in line with the GHG inventory.

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 oxidised methane amounts.

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

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*
$MSW_T(x)$	*total municipal solid waste (MSW) generated 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_{feucht}]
MCF(x)	*methane correction factor in year x (fraction)*
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)*

Where available, country-specific parameters are used and checked if they are in the proposed range of the IPCC guidelines. If country-specific parameters are not available IPCC default values are used. The parameters which have been used here can be found in Austria's National Inventory Report (UMWELTBUNDESAMT 2010a).

For calculating emission projections for solid waste disposal on land, deposited waste is separated into two categories: "residual waste" and "non residual waste".

"Residual waste" is waste from households and similar establishments remaining after separation of paper, glass, plastic etc. at the source. It originates from private households, administrative facilities of commerce, industry and public administration, kindergartens, schools, hospitals, small enterprises, agriculture, market places and other generation points covered by the municipal waste collecting system. Residual waste is directly deposited on landfills without any treatment – a practice that has been prohibited by law (Landfill Ordinance) in Austria since the beginning of 2009.

Once disposed of, waste emits landfill gas for many years. The amount of gas emitted per year is not constant. It declines exponentially over time. To calculate the emitted gas, the amount of landfill gas produced in the year of disposal and over a specified period thereafter is taken into account. The number of years accounted for in the emission calculation for a particular year differs between the different waste fractions and amounts to 41 years at least (country-specific approach)[5] and a period of 5 half times at most (as stipulated in the IPCC GPG).

Further parameters used in the emissions calculation are organic carbon (DOCx), the fraction of degradable organic carbon dissimilated (DOCf), a methane correction factor accounting for the fact that all landfills are managed and the CH_4 fraction in landfill gas (55%).

To determine the total amount of the landfill gas emissions for one year, the amounts of waste which are disposed of in the years considered are summed up. After subtracting the recovered gas and multiplying it by an oxidation factor (10%), the quantity of CH_4 emitted from residual waste is obtained.

[5] For more details see NIR 2010 (UMWELTBUNDESAMT 2010a)

"Non-residual Waste" is directly deposited waste other than residual waste but with biodegradable compounds. Non-residual Waste comprises for example:

- bulky waste,
- construction waste,
- mixed industrial waste,
- road sweepings,
- sewage sludge,
- rakings,
- residual matter from waste treatment.

3.6.1.2 Assumptions

To make forecasts for the generation and disposal of waste materials with biodegradable compounds and waste streams, a large number of influencing factors were taken into account.

Estimations of waste (management) trends are:

- based on predictable future trends in waste management for a significant period of time as a result of the implementation of legal provisions at federal government level (Landfill Ordinance, Ordinance on the mechanical biological treatment of waste which is currently in preparation);
- in line with the population statistics of Statistik Austria;
- made according to information provided by relevant experts;
- made according to information provided by the relevant departments of the federal governments (surveys and reviews, measures planned, …).

A study on landfill gas collection in Austria (UMWELTBUNDESAMT 2008) shows that the amount of gas collected has been decreasing steadily since the year 2002. This is due to the fact that landfilled waste has been subjected to preceding pre-treatment processes (like mechanical biological treatment), resulting in a reduced gas formation potential.

The average share of collected landfill gas (with respect to generated landfill gas) for the years 2002 to 2007 has been used for the projection too.

3.6.1.3 Activities

"Residual waste" is no longer allowed to be landfilled. This is due to the Landfill Ordinance, which has been in force since 2009 and must be adhered to without exception (see chapter 4.2.11). The Ordinance has an effect on the amounts of deposited "non residual waste" with biodegradable compounds too. The only fractions taken into account in the projections are:

(1) landfill fractions (residues, stabilised waste) from the mechanical biological treatment of residual wastes; this fraction is expected to decrease, which is also assumed for sector 6D (Other waste treatment), and to amount to zero in 2030.

(2) the landfill fraction from the mechanical treatment of waste.

Table 19: Historical and forecast (2010–2030) activity data for landfilled "Residual waste" and "Non-residual Waste".

Year	Residual Waste	Non-residual Waste	Total Waste	IEF CH_4
	[Gg/a]	[Gg/a]	[Gg/a]	[kg/Mg]
1990	1 995.7	648.7	2 644.4	59.7
2005	241.7	389.7	631.4	143.5
2008	129.3	319.9	449.3	166.5
2010	0	303.0	303.0	212.0
2015	0	303.0	303.0	149.6
2020	0	116.2	116.2	281.3
2025	0	85.1	85.1	281.7
2030	0	54.0	54.0	330.0

3.6.1.4 Sensitivity Analysis

The intended scenarios "High Emissions" and "Low Emissions" were not incorporated into the study of (DOMENIG & PERZ 2005). Parameters for a sensitivity analysis which have been agreed for the energy scenarios and the overall project respectively (oil price) are not relevant for this sector; other sector-specific assumptions for this sector were not considered useful.

3.6.1.5 Uncertainty

According to the Austrian National Inventory Report 2010 (UMWELTBUNDESAMT 2010a), the uncertainty for emission factors for 6 A Solid Waste Disposal is 25% and 12% for activity data, respectively.

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

3.6.2 Wastewater Handling (6.B)

3.6.2.1 Methodology for the sectoral emission forecast

The same method as the one described in the National Inventory Report 2010 (UMWELTBUNDESAMT 2010a) is used for estimating future emissions from wastewater treatment.

N_2O emissions arising from waste water treatment plants, i.e. waste water originating from households connected to a sewage system are calculated by using a country-specific method based on IPCC. N_2O emissions resulting from households not connected to the public sewage system – and taken into account in submission 2006 for the first time – are calculated as described in the Revised 1996 IPCC Guidelines. For the calculation of N_2O emissions from industrial waste water a simple assumption is made.

CH_4 emissions from urban waste water treatment (including emissions from cesspools and septic tanks) are calculated pursuant to the IPCC method, using mainly IPCC default values.

3.6.2.2 Assumptions

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 industrial waste water, it is assumed that they account for 30% of the N_2O emissions arising from the Austrian population connected to sewage treatment plants.

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 quite stable at the current level (2008: (79%) as no further improvements in the cleaning capacity are expected (the corresponding legal provisions anticipate a denitrification rate of 70%[6]). For the years 2010 until 2015 the denitrification rate is expected to remain at the current level (79%); after that only a very slight increase (to 80%) can be expected (taking into account smaller plants).
- The level of connection to sewage treatment plants will continue to increase. It is assumed that in the year 2015 about 94.2% (in 2020–2030 about 95%) of the waste water will be treated in sewage plants. Given the settlement structure in Austria, 100% cannot be achieved.

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

Table 20: Historical and forecast (2010–2030) indicators for waste water management in Austria.

	1990	2005	2008	2010	2015	2020	2025	2030
Inhabitants [1 000]	7 678	8 225	8 337	8 388	8 556	8 726	8 877	9 021
Annual protein intake per capita [g/day/capita]	103	107	107	107	107	107	107	107
Wastewater treatment [%]	59	89	93	94	94	95	95	95
Denitrification [%]	10	73	79	79	79	80	80	80

3.6.2.3 Activities

Data on the future development of the population are taken from recent statistics of (STATISTIK AUSTRIA 2010b) and also reported in Annex 1.

[6] Federal Law Gazette 186/1996

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 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. There was only one waste incineration plant without energy recovery which was operated until 1991 with a capacity of 22 000 tonnes of municipal waste per year. This plant was rebuilt as a district heating plant, starting operation in 1996. Since the re-opening of this plant, emissions have therefore been reported in the CRF sector 1 A – Fuel Combustion from 1996 onwards.

3.6.3.1 Methodology for the sectoral emission forecast

For this calculation the simple CORINAIR methodology is 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 2010a).

Table 21: 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 2008 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

Constant values (3 100 Mg of clinical waste and 3 000 Mg of waste oil) are forecast for incineration 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 for the sectoral emission forecast

To forecast emissions from compost production, bio-waste and green waste (mainly loppings, garden and park waste, graveyard waste, waste from roadside vegetation and private green waste) were taken into account as well as the emissions from mechanical biological treatment.

The increase of GHG emissions in this sector between the years 2005 and 2010 is due to the improvement of activity data collections for green waste in recent years (see Table 24).

Projected CH_4 and N_2O emissions were calculated by multiplying an emission factor by the quantity of waste.

In accordance with the Austrian National Inventory Report (UMWELTBUNDESAMT 2010a) the following emission factors (see Table 24) have been used.

Table 22: Emission factors for Compost Production.

[kg/t humid waste]	CH_4	N_2O
Biowaste and green waste	0.75	0.1
Mechanical biological treatment	0.6	0.1

For quality assurance purposes, the standards of the Austrian Inventory System have been applied.

3.6.4.2 Assumptions

According to expert judgement, it is assumed that the amount of bio-waste collected separately, as well as home composting, will increase/decrease according to demographic developments over the forecast period. Municipal garden and park waste is expected to stay constant.

For the amount of waste undergoing mechanical-biological treatment in Austria the following assumptions have been made:

- Until 2015, the amounts of waste treated in mechanical biological treatment plants will remain the same (as in 2009) as no further facilities are planned.
- From 2015 onwards, amounts of waste treated in mechanical biological treatment plants are expected to decrease as it is assumed that plants will close down in view of stricter regulations on waste air purification. A relevant Ordinance on the mechanical–biological treatment of wastes is currently being prepared. This ordinance is expected to enter into force in 2012. Transition periods of several years for existing plants are foreseen. It is very likely that this ordinance will affect the number of mechanical-biological treatment plants in Austria.

- It is assumed that in 2020 only 25% of the amounts currently treated will be subjected to mechanical-biological treatment. By 2030, no waste is expected to be treated in this way anymore. At the same time, other treatment methods such as dry stabilisation will probably gain importance.

3.6.4.3 Activities

On the basis of the assumptions made, the forecast for activity data for compost production is as follows:

Table 23: Historical and forecast (2010– 2030) activity data for Compost Production.

[Gg]	1990	2005	2008	2010	2015	2020	2025	2030
Biowaste and green waste	417.8	2 612.2	2 850.7	2 943.5	2 988.9	3 034.5	3 075.5	3 114.4
Mechanical biological treatment	345	623.4	684.3	684.3	684.3	171.1	85.5	0

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[7].

- 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 in order 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.

In Austria, jurisdiction is a responsibility shared by the federal government, the federal provinces *(Bundesländer)* and the municipalities. Hence, there are many climate change programmes at regional level in addition to the national climate strategy. Accordingly, coherent monitoring and evaluating 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.

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[7] 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

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 level. 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).

An important contribution to the effective implementation and evaluation of additional measures will be the Climate Change Act (Klimaschutzgesetz 204/ME (XXIII.GP)) which is currently being prepared.

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. Explanations are provided where quantification is not possible.

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 policies and measures for climate change mitigation detailed in the Austrian Climate Strategy 2010 (2002) and the revised Climate Strategy II (2007), as well as the Austrian Energy Strategy (2010).

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 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.

Cross-sectoral policies are presented where appropriate, e.g. the Green Electricity Act is discussed both in the chapter Energy Industries and in the chapter Manufacturing Industries and Construction. Usually such measures are quantified and discussed in detail in the section for which the policy is more relevant. In other cases the effect is subdivided and quantification is undertaken separately for the sectors affected. In any case, the procedure is documented in the respective chapters.

4.2.1 Energy Industries (1.A.1)

Policies & measures relevant for the sector energy industries are given in Annex 1 (P&M No.: 1-8_EN).

Where possible the GHG emission reduction effect of individual policies and measures has been estimated. However, for some measures (e.g. emission trading, promotion of CHP) the reduction effect could not be estimated; whereas for others, it was only possible to estimate the reduction effect achieved by 2010.

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/MWh.

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

01_EN Domestic environmental support scheme (UFI) (Federal Law Gazette No. 185/1993 amended by 34/2004) (WEM)

The main objective of this subsidy is to provide economic incentives for companies to implement measures in the field of energy efficiency, climate and environment 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.

The reduction effect for installations not affected by the ETS has been estimated on the basis of a combination of historical data and projections for amounts of future subsidies. It has not been possible to provide estimates for 2015 and 2020 due to the fact that future amounts of subsidies are unknown. The quantification is given in CO_2 equivalents and includes the combined CO_2, CH_4 and N_2O emission reduction effect; separate quantification per gas is not possible.

02_EN Green Electricity Act (Federal Law Gazette I No. 149/2002 amended by Federal Law Gazette No. 105/2006) (WEM+WAM)

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 harmonise 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 by wind, water, geothermal energy and photovoltaic. The objective of the Green Electricity Act currently in force is to raise the share of electricity produced from renewables in electricity consumption from the public grid to 10% by 2010. An amendment to the Green Electricity Act adopted by the Austrian government (but not fully approved by the European Commission) intends to raise the share of renewables in electricity consumption from the public grid 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.

The assumption is that the objective for the year 2015 will be reached and that the promotion of green electricity will continue thereafter. The indicated figures are the total reduction effect of the measure per year. The Green Electricity Act has no specific goals beyond the year 2015. However, the projections are based on the assumption that the growth rates for individual renewable energy sources remain at the same level until 2020. It is estimated that a vast part of the reductions will concern installations that take part in the emission trading scheme, mainly in the energy supply sector.

05_EN Austrian Climate and Energy Fund (KLI.EN) (Federal Law Gazette I No. 40/2007) (WEM)

The objective of the KLI.EN is to contribute to meeting Austria's Kyoto Protocol target by funding climate and energy related projects. Funds are provided (2007: 50 million €, 2008: 150 million €) for a number of projects and programmes targeting the increased use of renewable energies such as projects related to research on renewable energy, replacement of heating systems, photovoltaic, 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.

The reduction effects were calculated on the basis of the total yearly amount of subsidies, a production of 880 kWh/kW_p and a programme duration of three years.

07_EN Directive 2006/32/EC on energy end-use efficiency and energy services and the corresponding first Austrian energy efficiency action plan (WAM)

In the scenario WAM it is assumed that Austria will attain the objectives set out in the Directive.

It has not been possible to quantify the following policies and measures.

03_EN Emission Trading System (ETS) (Emission Trading Directive 2003/87/EC) (WEM)

The objective of emission trading is to limit CO_2 emissions from large power plants through a trading mechanism for emission certificates. Due to interactions with other measures the specific reduction effect of emission trading in the energy sector could not be estimated.

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

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 cannot be estimated.

08_EN Eco Design Directive and amendments (2005/32/EC) (WEM)

The reduction effect of this measure cannot be estimated.

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

The policies & measures relevant for the sector manufacturing industries and construction are given in Annex 1 (P&M No.: 01-03_IND).

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

01_IND Environmental support scheme for installations (Federal Law Gazette No. 185/1993 amended by Federal Law Gazette No. 34/2004) (UFI) (WEM)

An ex-post estimate of the total GHG reduction effect of this measure has been provided, but an ex-ante estimate for the industry sector cannot be given. The reduction effect includes both the installations affected and those not affected by the ETS.

02_IND Green Electricity Act (Federal Law Gazette I No. 149/2002 amended by Federal Law Gazette No. 105/2006) (WEM)

The total reduction effect of all sectors concerned is reported in the energy supply sector (sector energy industries). Therefore, no specific reduction effects are given for the sector manufacturing industries and construction. It is assumed that the major reductions will take effect in the energy supply sector.

03_IND Emission Trading Scheme (Directive 2003/87/EC) (ETS) (WEM)

Due to interactions with other measures the specific reduction effect of emission trading in the industry sector could not be estimated.

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

In this chapter the quantified measures relevant for the transport sector will be specified. It should be noted that the newly included measures P&M No.: 10-13. are described in the first section of the chapter. Former measures are listed under P&M No.: 01-09_TRA.

10_TRA: Increased fuel tax (WAM)

Increasing 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. The forecast increase in the fuel tax on diesel and gasoline is to be introduced gradually as shown in the following table. The increase per 1/1/2011 is based on the Federal Law Gazette No. 630/1994 as amended in Federal Law Gazette I No. 111/2010. With the final increase in 2021, fuel prices in Austria are assumed to be on the same level as in Germany and Italy (nominal tax increases in Germany and Italy included).

Table 24: Nominal increases in the fuel tax [€/l] in Austria– scenario "with additional measures".

	Nominal increased fuel tax [€/l]	
	gasoline	diesel
2011	0.04	0.05
2015	0.05	0.05
2021	0.09	0.07

The GHG potential has been calculated with GLOBEMI – emission model road and the GEORG model and is expected to amount to 5 774 Gg CO_2 equivalents in 2030, mainly caused by reduced fuel export emissions.

11_TRA Modal Shift in passenger transport (group of measures) (WAM)

The improvement of public transport systems aims at making public transport more attractive and supports the modal shift from individual motorised transport to public transport. By promoting and optimising public transport systems an increase in the share of public passenger transport should be achieved.

This group of measures includes

- **Measure 07_TRA: klima:aktiv mobil** (see below);
- **Measure 06_TRA: Measures concerning infrastructure, public transport and mobility management** (see below);
- **Upgrading of public transport systems** (multimodal connections);
- **Support of bicycle transport systems** (construction of new bicycle lanes, gap-filling of finished construction, bicycle parking areas, information systems, public relations initiatives).

The GHG potential has been calculated with GLOBEMI – emission model road and the GEORG model and is expected to amount to 716 Gg CO_2 equivalents in 2030.

12_TRA Promotion of feeder lines in freight transport (WAM)

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 GHG potential has been calculated with GLOBEMI – emission model road and the GEORG model and is expected to amount to 176 Gg CO_2 equivalents in 2030. For 2014 there is assumed to be a 2% reduction potential for road freight transport which is forecast to rise up to 3.6% in 2030.

13_TRA More efficient vehicle usage (group of measures) (WAM)

Speed limits and measures to increase biofuels and electro mobility aim at a more efficient vehicle usage in individual motorised transport.

This group of measures includes

- **Measure 09_TRA: Speed limits** (110 km/h instead of 130 km/h on motorways);
- **Measure 04_TRA: Promotion of biofuels and wider use of electric vehicles** (see assumptions in chapter 3.1.3.2).

The GHG potential has been calculated with GLOBEMI – emission model road and the GEORG model and is expected to amount to 1 972 Gg CO_2 equivalents in 2030.

Former measures (P&M No.: 01-09_TRA) – partly adopted, partly expired – that are relevant for the transport sector are specified in the text below:

04_TRA EU-Biofuels Directive and wider use of electric vehicles (Directive 2003/30/EC) (WEM+WAM)

Minimum shares of transport fuel from renewable energy sources should be implemented. In 2004, the Biofuel Directive was transposed into Austrian national law through an amendment (Federal Law Gazette II No. 417/2004) to the Fuel Ordinance. This amendment stipulates that all companies that put fuels on the market must, from 1 October 2005, replace 2.5% of the total energy provided by biofuels. From 2007, this percentage has been increased to 4.3%, and since October 2008 to 5.75%. Together with the amendment to the Fuel Ordinance, the Mineral Oil Tax was revised. Accordingly, tax concessions will be granted for fuels with a biofuel share of at least 4.4% (and a sulphur content of less than 10 mg per kg of fuel). The use of pure biofuel as motor fuel is exempt from tax.

In 2007 the share of renewable energy used within the transport sector attained a level of 4.23% (measured by the energy content). Biodiesel, bioethanol and straight vegetable oil (SVO) represent the main renewable energy carriers (distributed by blending them with fossil fuels at a rate of 5% (measured by volume)).

The outlook for 2030 is based on the present circumstances (initiatives, promotion, current infrastructure etc.) as well as foreseeable developments on national and international level.

07_TRA Klima:aktiv→mobile programme (WEM+WAM)

The programme klima:aktiv mobil provides financial support and consultation for mobility management. Measures in the context of klima:aktiv mobil focus on five target groups and comprise:

- Upgrading of the national campaign for ”ecodriving“ with the elements competition, certification of ”ecodriving trainer“ and co-operation with fleet operators for fuel-efficient driving. The objective is to increase public awareness of a fuel saving driving style.
- mobility management in business and public administration (financial support and consulting);
- communal/regional mobility management (”traffic saving communities“/”mobility centres“);
- mobility management in schools;

- environmentally friendly mobility in tourism & leisure;
- mobility management in land use planning (cities, communities and regions);
- mobility management for real-estate developers and investors;
- programme for the shaping of opinions to promote climate-friendly mobility with the main messages ”ecodriving“ and ”clean air – we do everything for our children“.

For this set of measures a fixed reduction effect of 250 000 tonnes per year has been assumed. This value is based on the expert judgement of the Umweltbundesamt and the Austrian Energy Agency.

08_TRA Enhanced fuel efficiency of cars (WEM)

The Community’s strategy to reduce CO_2 emissions from passenger cars and improve the fuel economy is based on three pillars, namely the commitments of the automobile industry on fuel economy improvements, the fuel-economy labelling of cars and the promotion of car fuel efficiency by fiscal measures.

First and foremost, the commitments of the European (ACEA), Japanese (JAMA) and Korean (KAMA) automobile manufacturers’ associations are designed to achieve a total of average CO_2 emissions of 140 g CO_2/km from the EU15 new passenger car fleet by 2008 (ACEA) and 2009 (JAMA and KAMA). The targets of the commitments must be achieved mainly by technological developments affecting different car characteristics and market changes linked to these developments.

These targets were not met; the European Commission therefore introduced legislation to reduce emissions from vehicles. On April 23rd 2009, an EU Regulation was published setting emission standards for newly registered passenger cars with the objective to reduce CO_2 emissions to 130 g/km in 2015. This measure also projects the specific CO_2 emission reduction per kilometre by an average car in 2020 from 143 g CO_2 to 122 g CO_2. This is equal to a 15% reduction.

The scenario assumes that Austria will reach the objective of the voluntary agreement mentioned above for newly registered cars in Austria. To reach the target of 140 g/km (CO_2 emissions per kilometre driven) higher rates of efficiency improvements would clearly be needed compared to the past 10 years. Over the periods from 2000 to 2003 and 2003 to 2006, the specific fuel consumption of the newly registered car fleet dropped by 2.2% and +/- 0% respectively. With respect to the figures of 2006 a reduction of more than 15% would be necessary to meet the desired target.

The effect of this measure can be seen in the reporting template in Annex 1. The relevant quantification is given in CO_2 equivalents and includes CO_2 and N_2O emission reduction effects. Separate quantification per gas is not possible.

09_TRA Control of speed limits (WAM)

Speed limits will be implemented area-wide: on motorways, country roads, major and secondary roads in town. Exceptions are permitted only in areas with a low accident risk apart from residential areas. Further, the enforcement of the speed limits will be stepped up.

The following policies and measures, although not quantifiable separately for that time being, are included in the underlying GLOBEMI model:

02_TRA CO_2 Labelling and other measures to reduce emissions from passenger cars (WEM+WAM)

03_TRA Mileage based toll for lorries (WEM+WAM)

05_TRA Euro classification (EURO 5&6 PC, EURO 5 HDV – assumption EURO 6 HDV, assumption Off Road stage 3b&4) (WEM+WAM)

06_TRA Measures concerning infrastructure, public transport and mobility management (WEM+WAM)

These measures are not quantifiable simply because no data is available to assess an emission reduction effect.

The following policies and measures have expired:

01_TRA ACEA – voluntary agreement (CO_2 emissions of newly registered vehicles) (Basis: Strategy [COM (95) 689])

Since the targets under the voluntary agreement were not met in the automotive sector, the agreement has not been extended.

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

The policies and measures included in the scenario “with existing measures” for the category “Other Sectors” are listed in Annex 1 (P&M No.: 1-7_B).

The policies and measures sector ID “RES“ for **res**idential and commercial buildings (used in the last report under the EU-Monitoring Mechanism) has been replaced by “B“ for **b**uildings in this report.

Given the large number of measures, policies and measures have been grouped together accordingly. Estimated effects on greenhouse gas emissions have been calculated separately for each group of measures.

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.

Measures 01_B–05_B have been estimated by applying the ERNSTL model, which is described in the section ”sectoral methodology – projection“ of this report.

01_B increased use of renewable energy in the sector residential and commercial (Erneuerbare)

In the updated scenarios of this report, measure 01_B has been included in measure 02_B, 03_B and 04_B.

02_B Stepping up the renovation of buildings (Sanierung) (WEM)

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 16.5 PJ (9.2 PJ fossil fuels) by the year 2020. In the sector residential and commercial, the calculated reduction of GHGs is approximately 600 Gg CO_2 equivalents.

03_B Stepping up the replacement of heating systems (Heizkesseltausch) (WEM)

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 systems should be replaced.

Measures are expected to result in savings of 24 PJ fossil fuels by 2030 – however, with an increase in non-climate-effective biomass demand by 11 PJ. With this group of measures a reduction of 1 723 Gg CO_2 equivalents can be reached by 2030.

04_B Public support for new buildings (Neubau) (WEM)

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

With these measures an estimated reduction of 8 PJ of fossil fuels can be achieved, inducing a decrease of approximately 469 Gg CO_2 equivalents by the year 2030.

05_B Additional measures to reduce energy consumption in the sectors residential and commercial (WAM)

The following measures are included in this set of measures:

- increase in the building renovation rate to 1.8% (2020) and 1.6% (2030);
- higher quality renovation results (further reduction of heating demand);
- higher energy standard of new buildings (further reduction of heating demand);
- obligation to use condensing boiler technology for new installations of fossil heating systems;
- alternative heating systems have to be used (at least partly) in new buildings or for the comprehensive renovation of existing buildings;
- Further subsidies for heating systems using renewable energy.

Based on these assumptions, a further reduction by approximately 26 PJ of fossil fuels can be reached until 2030, including 13 PJ savings in terms of heating oil. The overall GHG reduction will amount to 1 726 Gg CO_2 equivalents by the year 2030.

06_B National energy efficiency action plan (Energieeffizienzaktionsplan, EEAP) in the residential and commercial sector, excluding fuel energy for heating and hot water (WEM)

According to Directive 2006/32/EC on energy end-use efficiency and energy services, each EU member state has to set measures for improving energy efficiency by 9% until 2016. In the sector residential and commercial, mainly soft measures like information campaigns, labelling obligations and consulting services have been implemented.

It is thus expected that a reduction in electric energy consumption of 3 257 TJ in the commercial sector can be achieved by the year 2016. GHG emission reductions have not been estimated in this sector, but are included in measure 07_EN in the sector energy industries.

07_B additional measures to reduce electric power consumption in the sector residential and commercial, excluding energy use for heating and hot water (WAM)

In the subsector "commercial" the reduction potential has been estimated with the "ESP" database of the European Commission. The energy demand for office equipment (computer, monitor, copy and printing machines) and other engine-driven installations (assembly line, lift/elevator, …) is expected to be reduced by 10 209 TJ up to the year 2030. In the subsector "residential" only minor reductions can be expected.

GHG emission reductions have not been estimated in this sector, but are included in measure 07_EN in the sector "energy industries".

4.2.5 Other (CRF Source Category 1.A.5)

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

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

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

4.2.7 Industrial Processes (CRF Source Category 2)

Policies & measures relevant for the sector "industrial processes" are described in Annex 1 (P&M No.: 07_IP, 08_IP, 09_IP).

For a quantification of the policies and measures affecting the sub-category "halocarbons and SF_6" a scenario "without measures (WOM)" has been calculated. This scenario is based on the same assumptions as the scenario WEM but excludes assumptions on the effects of Austrian and EC policies. The average annual emission reduction has been calculated by subtracting the scenario WEM emissions from the scenario WOM. Some measures are included in both the Austrian Ordinance on fluorinated gases (Federal Law Gazette II No. 447/2002 amended by Federal Law Gazette II No. 139/2007) and the European Regulation on certain fluorinated greenhouse gases (842/2006/EC). The Austrian Ordinance was adopted in 2002 and can thus not be considered an implementation of the European Regulation. This is the reason why most effects have been attributed to the Austrian Ordinance.

07_IP Austrian F-Gas Ordinance (Federal Law Gazette II No. 447/2002 and its amendment 2007 Federal Law Gazette II No. 139/2007) (WEM)

Ban or restriction on the use of HFCs, PFCs and SF_6 for all sectors covered in the National Inventory, as well as reporting obligation for uses in areas where use is still allowed.

08_IP EU F-Gas Regulation (Reg. No. 842/2006) (WEM)

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).

09_IP HFC emissions from air conditioning in motor vehicles (Directive 2006/40/EC) (WEM)

Requires car producers to introduce refrigerants with a GWP < 150 in new passenger cars during the period 2011–2017.

Further (voluntary) measures are taken into account, depending on their technical feasibility.

4.2.8 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 (P&M No. 01–06_IP).

01_IP Solvent Ordinance *(*Federal Law Gazette II No. 398/2005) (WEM)

Limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products in order to combat acidification and ground-level ozone.

02_IP Ordinance for paint finishing systems (surface technology systems) (Federal Law Gazette No. 873/1995) (WEM)

Limitation of emissions of volatile organic compounds due to the use of organic solvents by activities such as surface coating, painting or varnishing of different materials and products along the entire chain in the painting process in order to combat acidification and ground-level ozone.

03_IP Federal Ozone Act (Federal Law Gazette No. 309/1994) (WEM)

Establishes an emission reduction effect for the ozone precursors NO_x and NMVOC by various measures.

04_IP Ordinance on chlorinated hydrocarbons in industrial facilities and installations (Federal Law Gazette No. 865/1994) (WEM)

For the limitation of emissions of chlorinated organic solvents from industrial facilities and installations where chlorinated hydrocarbons are applied.

05_IP Ordinance limiting emissions of volatile organic compounds (VOC) due to the use of organic solvents in certain activities and installations (Federal Law Gazette II No. 301/2002) (WEM)

The main objective of the policy is the limitation of VOC emissions.

06_IP Ordinance on the limitation of emissions during the use of solvents containingvolatile halogenated hydrocarbons in industrial facilities and installations (Federal Law Gazette II No. 411/2005) (WEM)

Limitation of VOC emissions due to the use of solvents containing volatile halogenated hydrocarbons in industrial facilities and installations.

In the sector "Solvent and Other Product Use" the effects of some PAMs have not been estimated.

4.2.9 Agriculture (CRF Source Category 4)

The following policies and measures are considered to have been implemented and are listed in Annex 1 (P&M No. 01–14_AGR). In most cases, quantification of individual policies and measures has not been possible. PAMs included in the scenario WEM are given in the following.

01_AGR Common Agricultural Policy (CAP) 2003 reform (Council Regulation No. 1782/2003) (WEM)

Implementation of the Common Agricultural Policy (CAP) 2003 reform.

02_AGR Austrian implementation of the CAP (WEM)

Special attention is given to the Austrian way of implementation (maintaining premiums for suckling cows and allocation of premium rights for farms).

An important part of the Austrian CAP implementation is to continue with the premium for suckling cows. In Austria, beef production complements the milk cattle market. As average milk yields per cow nearly doubled in the last twenty years, cattle holders have invested in milk production or abandoned their business and started keeping suckling cows instead. These developments have influenced the model outcome. Separate quantifications of GHG emissions are not possible as the cattle market is considered here as a whole.

03_AGR Funds transfer through ”modulation“ (WEM)

Due to uncertainties concerning the flow of funds via "modulation" the scenario makes the assumption that the amounts going to those Austrian farms that might be the beneficiaries will be the same amounts as those that other farms will lose through this measure.

Modulation suggests a shift of direct payments to the second pillar – the rural development programme with agri-environment measures – with the overall revenue being very small anyhow. This influences the model outcome. No separate analyses have been carried out on the possible effects.

04_AGR Land is maintained in good agricultural and ecological condition ("cross compliance") (WEM)

That land has to be maintained in good agricultural condition is one of the requirements of ”cross compliance“. Direct payments, decoupled from production, lead to increases in extensively managed agricultural land, with the potential to return to production. No separate analyses have been carried out.

05_AGR The programme for rural development is maintained in an unmodified way (WEM)

The Austrian rural development programme is a major programme in Europe. Assuming that it will not be possible to increase the premium amounts, a constant time line is the realistic scenario. It is expected that some efforts will be undertaken to increase the organic farming sector under the expanded programme without changing the financial perspectives.

06_AGR Implementation of the Biofuels Directive in Austria (WEM)

Austria has an ambitious plan to implement the Biofuels Directive. Most of the needed agricultural products will be imported. There is some evidence that a shortage of agricultural products could lead to periods of high prices and increases in domestic production – however, these effects are considered with caution in the scenario because of plausible phyto sanitary restrictions (e.g. for rapeseed). The growing demand should leave domestic crop production mostly unchanged. Some common crops are expected to increase their productivity via technical developments. This is part of the developments in the crop section and included implicitly in the model.

07_AGR Grassland maintenance (WEM)

Leaving grassland unchanged (i.e. not converting it to arable land) is one of the conditions of cross compliance and the decoupling of production from direct payments for farmers. As grassland is mostly found in less favoured locations, a change of grassland into arable land would lead to environmental damage and rising GHG emissions. Being part of the CAP developments, grassland maintenance is the subject of a specific set of measures. No separate analyses have been undertaken as yet.

08_AGR Prices increase for crops (WEM)

The demand for crops for bio fuel production might lead to higher prices for individual crops. Austria has an ambitious plan to implement the EU Biofuels Directive. Most of the agricultural products needed will be imported. There is evidence that shortages on the EU agricultural market would lead to higher prices and domestic production could be influenced. The growing demand should increase domestic crop production only slightly. These developments are reflected in the price fluctuations of the model.

In the scenario WAM (“with additional measures") the following modifications are implemented:

09_AGR More premiums for organic farming (WAM)

The agro-environmental measure “UBAG” is abolished and premiums are shifted to organic farming. Organic farming is more attractive but on the remaining acreage production is more intensive.

As no further funds are available under the rural development programme, other (less targeted) measures are implemented only to a limited extent.

10_AGR Payments for investments in emission reducing animal production technologies (WAM)

Payments for investments in emission reducing animal production technologies (funded by the programme for rural development), e.g. slurry and manure store facilities, slurry hose techniques.

It is assumed that investment in manure/slurry tanks and application techniques will lead to the best available technologies to reduce GHG emissions. In our view it is necessary to streamline existing conditions for incentives. Specific scenarios for animal waste management systems will be included in the calculations as soon as appropriate data is available.

11_AGR Set aside additional land for short rotation forests (WAM)

Setting aside additional land for short rotation forests (+ 10 000 ha) from 2015 onwards).

Short rotation of forest trees on arable land is an effective CO_2 sequestration strategy. It is necessary to check the impact of such short rotation production on biodiversity. As the resulting reduction effect in terms of CO_2 emissions accounted for in the energy sector shows, the effect in the agricultural sector (and the model) is a decrease in land area only.

12_AGR Use of 700 000 m^3 slurry in 2015 and 800 000 m^3 slurry from 2020 onwards for biogas production (WAM)

The anaerobic digestion of slurry and manure in biogas plants is a very effective measure to reduce methane emissions from manure management. This reduction potential should also be taken into account in the energy sector.

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

The following policies and measures for sector 5.A.1 are exactly the same as those described in the Austrian submission on the forest management reference level to be prepared according to Annex II of FCCC/KP/AWG/2010/CRP.4/Rev.4 (Cancun LULUCF decision) and submitted to the EU (EC LULUCF) and to the UNFCCC secretariat in March 2011.

The wording of the Austrian submission on the forest management reference level has been used as it stands in order to avoid differences between the above mentioned document submitted to the EU and the UNFCCC and this report. Some of the following information is therefore given more than once in this report.

Measures supporting and promoting an increase in the demand for woody biomass, thus leading to an increase in timber prices, are the most important drivers for harvest activities in Austria, which has also been observed in the recent past, as domestic harvest rates have increased substantially. For modelling future domestic wood and biomass supply, four different realistic timber price scenarios (71 €/m³, 81 €/m³, 100 €/m³, 162 €/m³[8]) were defined, on the basis of historical developments in biomass and fuel prices and in consideration of fu-

[8] 71 €: average biomass price for 2004–2006; 81 €: biomass price at the end of 2006; 100 €: assumption for a moderate increase in biomass prices compared to 2004–2006; 162 €: assumption that the biomass price will double (same development as oil price during the period 1985–2005).

ture domestic biomass demand. The reference level is the mean value of the results of the four price scenarios referred to above, resulting in an expected timber price below 100 €/m³ in 2020.[9]

GHG emissions projections[10]

According to Chapter 5 of the most recent Austrian National Communication (NC 5, to be downloaded from: http://unfccc.int/resource/docs/natc/aut_nc5.pdf), greenhouse gas (GHG) emission projections undertaken in 2008/2009 (UMWELTBUNDESAMT 2009a) included results for a scenario "with existing measures" (WEM) up to 2020, comprising climate change mitigation measures that were implemented and adopted under the Austrian Climate Strategy I (BMLFUW 2002) amended by Climate Strategy II (BMLFUW 2007) before 8th August 2008.

In line with the increase in demand for woody biomass for energy purposes in recent years, which mainly resulted from wood use in power plants, CHP plants and district heating (increase by 60% up to 2008) and an increase in the use of wood in the industry sector (increase by 25% up to 2008), the projections included in the scenario WEM show a further increase in demand for woody biomass for energy purposes by 20% up to 2020 (compared to 2008 and 2009), resulting in an additional biomass demand of around 3–4 million m³. In the recent past approximately 20% of the wood supply for energy purposes was imported; assuming a proportionate increase up to 2020[11], the domestic demand for woody biomass for energy purposes will increase by around 2.5–3 million m³ compared to 2008 and 2009.

Table 25: Gross domestic consumption of woody biomass.

		National energy statistics					Scenario WEM
		2005	2006	2007	2008	2009	2020
gross domestic consumption of woody biomass for energy purposes	PJ	120	120	135	145	145	170–175
	million m³	15	15	17	18	18	21–22
● domestic supply	PJ	96	96	108	116	116	136–140
	million m³	12	12	13.5	14.4	14.4	17–17.5
● imports	PJ	24	24	27	29	29	34–35
	million m³	3	3	3.5	3.6	3.6	4–4.5

9 The timber price exceeded 90 €/m³ in 2010.

10 The emission projections mentioned here are taken from the NC 5 and therefore consistent with the previous emission projections from 2009 (rather than the latest projections which are described in this report).

11 Info Memo: According to the national renewable energy action plan for Austria (to be downloaded from: http://ec.europa.eu/energy/renewables/transparency_platform/doc/national_renewable_energy_action_plan_austria_en.pdf), which was submitted in line with Art. 4 of the Directive to promote the use of energy from renewable sources (2009/28 EC) in mid-2010, around 80% of the biomass supply stemmed from domestic production in 2006, the remaining 20% was imported.

Policies and measures adopted and implemented until mid 2009

Energy demand related policies and measures (taken from NC 5):

Policies and measures relating to this subsector aim at increasing the share of renewable energy sources such as biomass and switching to fuels with lower (fossil) carbon content.

01_ED Increased use of renewable energy in the sector residential and commercial (”Erneuerbare“)

This group of measures comprises a large number of the policies and measures defined in the Climate Strategy (BMLFUW 2002) and its amendment (BMLFUW 2007). The overall objective is to increase the use of biomass (log wood, wood chips, wood pellets and wood briquettes) through specific subsidies for renewable energy sources.

Significant policy instruments that promote the implementation of these measures are the Housing Support Scheme of the regional authorities (”Wohnbauförderung” – WBF), Technical Building & Construction Regulations of the federal provinces, the Austrian Climate and Energy Fund (“Klima- und Energiefonds“ – KLI.EN), the Domestic Environmental Support Scheme (”Umweltförderung im Inland“ – UFI), and the klima:aktiv programme – the last three being funded by the national government (BMLFUW). For the KLI.EN see measure 05_EN in the subsector “energy supply”.

The Housing Support Scheme (WBF) promotes *inter alia* the use of renewable energy and building renovations. Most of the federal provinces in Austria support the replacement of old (fossil fuelled) heating systems by efficient new systems based on renewable energy (solar, biomass) or natural gas (using condensing boiler technology). In addition, the federal provinces continue to support connection to existing or new (often biomass-fired) district heating. A large number of dwellings are constructed or renovated with public support schemes in Austria.

A constitutional agreement between the Austrian provinces and the federal government came into effect in 2006 (Federal Law Gazette II No. 19/2006) and provided for further improved standards as a prerequisite for the allocation of subsidies and for a shift in subsidies to the thermal renovation of existing dwellings. This agreement according to Article 15a of the Federal Constitutional Act was amended (Federal Law Gazette II No. 251/2009) and came into force in August 2009. Additional areas covered by the amended agreement are the building code, commercial buildings and additional measures, e.g. the general exemption of fossil fuel fired heating systems from the existing subsidy scheme (see also measure 03_ED and 04_ED) to be implemented by the federal government. These extensions to the agreement are not included in the scenario WEM – but especially the exclusion of fossil fuel fired heating systems from the subsidy schemes is expected to promote an increase in woody biomass fired heating systems in the housing sector in the future.

The main objective of the domestic environmental support scheme (UFI) (Federal Law Gazette No. 185/1993 as amended) is to provide economic incentives to promote the implementation of measures in the field of energy efficiency, climate and environmental protection. The following table represents the relevant biomass related project categories for the energy demand subsector. Further information on the UFI is given in the chapters on energy supply (see chapter 4.2.1.2), industry (see chapter 4.2.4) and cross-cutting policies and measures (see chapter 4.2.7) of the most recent Austrian National Communication.

Table 26: The domestic environmental support scheme 2004–2007: subsector energy demand (UMWELTBUNDESAMT 2009b).

2004–2007	Number of projects	Environment related investment costs [million €]	Subsidy [million €]
Biomass	1 813	91	23
Biomass – CHP	15	66	12
Biomass district heating systems	455	12	3

There is a strong trend towards renewables, which is partly noticeable in an increase of wood chips and wood pellets consumption. Another aspect of the emission trend is the declining share of fossil fuels and the increasing share of district heating, electricity and ambient energy in the total amount of fuel used in residential buildings from 70% in 1990 to 64% in 2007. Decreasing CO_2 emissions per amount of fossil fuel from 74 t/TJ (1990) to 66 t/TJ (2007) indicate a shift to less carbon intensive fossil fuels in residential buildings (UMWELTBUNDESAMT 2009b).

03_ED stepping up replacements of heating systems (”Heizkesseltausch“)

The aim is to increase the boiler exchange rate through measures defined in the Austrian Climate Strategy. This will be achieved through financial support and by raising awareness of the fact that older, inefficient heating systems need to be changed. This measure also shows co-benefits in terms of emission reductions of air pollutants, i.e. PM and NO_x.

In Austria, the subsidy policy for heating systems aims at the installation of efficient low emission (CO_2) boilers. Therefore, the regional authorities grant financial support for biomass, district heating, heat pumps and solar heat. Individual rates differ between the regional authorities. Model-based results predict a rise of the boiler exchange rate from about 1% in 2007 to 2.3% in 2020. Once fully implemented, these measures will result in savings of 11.2 PJ fossil fuels by 2020, with an increase in biomass demand by 4.3 PJ.

04_ED public support for new buildings (”Neubau“)

This group of measures represents the effects of subsidised heating systems (renewable) and compulsory building regulations for the thermal insulation quality of new buildings. Policy instruments related to the allocation of financial subsidies (credit and cash) for improving the quality of thermal insulation of new buildings are: the Directive on Energy performance of buildings (Directive 2002/91/EC) and the Housing Support Scheme. For further information related to these policy instruments see also measure 01_ED.

Energy Supply related policies and measures (taken from NC 5):

Consumer awareness

Raising consumer awareness plays an essential role in reaching as many people as possible with these measures. A climate change initiative referred to as "klima:aktiv" (information available at: www.klimaaktiv.at) was therefore initiated by the Ministry of Environment in 2004. Several thematic programmes have been launched under klima:aktiv in the meantime, supporting inter alia:

- the mobilisation of woody biomass for energy purposes ("klima:aktiv" Energieholz (information available at: http://www.klimaaktiv.at/article/archive/25265/) 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 (information available at: http://www.klimaaktiv.at/article/archive/30056/).

The klima:aktiv initiative combines various market-based measures and encourages target-oriented implementation, e.g. by providing easy access for target groups and resources, enhanced transfer of know-how by providing support through vocational training and networking with important actors, the development of quality assurance standards as well as with target group specific information and marketing. The impacts of these programmes are implicitly included in the assumptions for the emission scenarios.

Promotion of renewable energy sources

CO_2 emissions from district heating also depend on annual climatic conditions and are consistent with temperature-induced heating energy demand during the winter season. The use of biomass in regional district heating systems has already gained a considerable share in Austria. In 1990 biomass (including the biogenic content share of waste) contributed 8% of the heat production in district heating systems, increasing to 41% in 2007. This was to a large extent due to existing public support schemes, granted both by the federal government and the provinces, and in many cases co-funded by the European Union.

Instruments to promote renewable energies and energy efficiency in Austria's energy supply include direct financial support for transformation plants (see measure 01_EN), feed-in tariffs for electricity production from renewables (see measure 02_EN) and public funding for research and development (R&D) projects and power plants for demonstration purposes (see measure 05_EN). The climate change initiative klima:aktiv, initiated by the Ministry of Environment, includes *inter alia* a programme on renewable energy, as mentioned in the above section on energy demand. On the level of the federal provinces, several measures are in place to further promote the use of renewable energies (e.g. solid, liquid and gaseous biomass in the residential sector or in public heat and power generation, photovoltaic plants). Other cross-sectoral policies also include energy related taxes.

01_EN Domestic environmental support scheme (UFI)

Information regarding the Domestic Environment Support Scheme (Federal Law Gazette No.185/1993 as amended) is also provided in the chapters on energy demand, industry (01_IND).

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, biomass-powered 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 27).

Table 27 The domestic environmental support scheme, 2004–2007: subsector "energy supply" (UMWELTBUNDESAMT 2009b).

2004–2007	Number of projects	Environment related investment costs [million €]	Subsidy [million €]	CO_2 reduction efficiency [t/a]
Biomass district heating systems	179	224	37	202 851
Biomass – CHP	36	212	42	602 729

The total environment related investment costs for 290 projects amounted to 536.13 million €, subsidised by 93.04 million €. In general, these projects were undertaken both within and outside the ETS sector.

02_EN Green Electricity Act

The Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources was implemented through the Green Electricity Act (Federal Law Gazette I No. 149/2002 as amended). The Act not only addresses the main issues raised by the Directive, but also harmonises the system for promoting electricity production from renewable energy sources by granting fixed feed-in tariffs for various forms of using biomass transformation and power production by wind, water, geothermal energy and photovoltaics. The objective of the Green Electricity Act currently in force is to raise the share of electricity from renewables in electricity consumption in the public grid to 10% by 2010. However, an amendment to the Green Electricity Act adopted by the Austrian government stipulates that the share of renewables in electricity consumption in the public grid should be raised to 15% by 2015. Among other amendments, the guaranteed feed-in time has been raised to 13 years in general and to 15 years for power plants based on biomass, respectively. Table 30 shows the evolution of Austrian green power outputs (in GWh) supported by fixed feed-in tariffs from 2002–2007.

Table 28: Subsidised renewable electricity (in GWh) (E-CONTROL 2008).

[GWh]	2002	2003	2004	2005	2006	2007	2008
Solid Biomass	95	99	313	553	1 096	1 631	2 400

With 2 400 GWh fed into the grid in 2008, it can be assumed that the objective for the year 2015 according to the Green Electricity Act 2008 (Federal Law Gazette I No.44/2008) will be reached and that the subsidies for green electricity will continue thereafter. Projections are therefore based on the assumption that the growth rates for individual renewable energy sources will remain at the same level until 2020.

03_EN European Emission Trading Scheme (ETS)

Information regarding the Emission Trading Scheme according to the Emission Trading Directive (2003/87/EC) is also provided in the chapter on industry (03_IND). The objective of emission trading is to put a price on fossil fuel emissions in the energy sector by limiting CO_2 emissions from power plants through a trading mechanism for emission allowances. Under this Directive, the use of biomass for energy purposes was promoted in the past as shown in Table 29 below.

Table 29: Energy related fuel use of installations covered by the ETS (in TJ/a).

[TJ/a]	2005		2006		2007		2008		2009	
Total	326 418	100%	310 913	100%	296 805	100%	299 677	100%	281 761	100%
Biomass	13 740	4,2%	16 061	5,2%	17 202	5,8%	16 965	5,7%	16 554	5,9%

05_EN Austrian Climate and Energy Fund (KLI.EN)

According to the ”Klima- und Energiefondsgesetz“ (Federal Law Gazette I No. 40/2007) the objective of the KLI.EN fund is to contribute to the achievement of Austria’s Kyoto Protocol target through the funding of climate and energy related projects. Funds are provided (2007: 50 million €, 2008: 150 million €) for a number of projects and programmes targeted at an increased use of renewable energies such as research on renewable energy, replacement of heating systems, etc. and support for companies, research institutions or municipalities as well as individuals, depending on the respective programme. 10 000 biomass heating systems were funded from the KLI.EN fund in 2008.

Policies and measures in the sector “Industry” (taken from NC 5)

Policies and measures in the manufacturing industry aim at decoupling emissions from production so as to achieve absolute reductions. To this end, the activities undertaken are aimed at:

- improvements in final energy efficiency and
- a shift from coal to gas or renewable sources.

01_IND Environmental support scheme for installations (UFI)

Information on the Domestic Environment Support Scheme (Federal Law Gazette No. 185/1993 as amended) is also provided in the chapters on energy demand, energy supply (01_EN) and cross-sectoral measures.

The main objective of this subsidy is to provide fiscal incentives for companies to implement measures in the field of energy efficiency, climate change mitigation and environmental protection. The following biomass related categories are of relevance for the industry sector: biomass-powered combined heat and power plants and power production from biomass and waste of biogenic origin.

Table 30: The domestic environmental support scheme 2004–2007: sector industry (UMWELTBUNDESAMT 2009b).

2004–2007	Number of projects	Environment related investment costs [million €]	Subsidy [million €]	CO_2 reduction efficiency [t/a]
Renewables	1 125	252	52	565 297

03_IND European Emission Trading Scheme (ETS)

Information on the Emission Trading Scheme (Directive 2003/87/EC) is also provided in the chapter on energy supply (03_EN). The objective of emission trading is to put a price on fossil fuel emissions in the industry sector by limiting CO_2 emissions of industrial installation through a trading mechanism for emission allowances. Under this Directive, the use of biomass to substitute process-related emissions stemming from fossil fuel use has been promoted.

Demand is expected to increase further with increases in allowance prices as a result of fewer allocated allowances in general and the tightening of free allocations (a 21% reduction in allowances allocated in 2020 overall compared to 2005).

Cross-cutting policies and measures (taken from NC 5)

The Domestic Environmental Support Scheme

Funding under the environmental support scheme between 2004 and 2007 was provided for 7 616 projects, of which 9% were related to climate change. These projects brought about an emission reduction of some 2.7 Tg CO_2 equivalents. Environment related investment costs for the years 2004–2007 amount to 1 464 million €. Table 31 lists biomass related projects for the period between 2004 and 2007 which were supported under this scheme:

Table 31: The domestic environmental support scheme 2004–2007: overview (UMWELTBUNDESAMT 2009b).

2004–2007 Sector	Number of projects	Environment related investment costs [million €]	Subsidy [million €]
Waste management	27	44	7
Energy supply	292	538	94
Industry	1 620	506	86
Agriculture	155	9	2
Energy demand (residential and commercial)	5 442	361	84
Transport	80	6	1
Total	**7 616**	**1 464**	**274**

In 2008, 2 609 projects were supported by 82.4 million €, of which 79.2 million € or 96.1% were of relevance for climate change mitigation measures. More than 80% of the emission reductions achieved can be attributed to the energy supply and industry sector. Two thirds of the projects (small-scale projects due to structural conditions) for which funds were provided were undertaken within the sub-sector "energy demand". Further information can be found on the webpage and in the annual reports of Kommunalkredit Public Consulting (http://www.public-consulting.at).

The Emission Trading Scheme

The emission trading scheme is based on the Austrian Emissions Allowance Trading Act (see Section 4.2.3 of the most recent Austrian National Communication). Emission trading currently covers greenhouse gas emitting installations in specific sectors (energy intensive installations in the industry and energy production sectors) as stipulated in the Austrian Emissions Allowance Trading Act. In 2007, these emitters were responsible for 36% of the total emissions (based on verified emissions) in Austria. Within the sectors concerned, about 80% of emissions were covered.

The objective of emission trading is to put a price on fossil fuel emissions in the industry and energy sector by limiting CO_2 emissions of industrial installations through a trading mechanism for emission allowances. Under this Directive, the use of biomass to substitute fossil fuel related emissions has been promoted. See also measure 03_EN and 03_IND.

Policies and measures for the domestic mobilisation of woody biomass (additional national policies and measures)

Austrian Rural Development Programme

According to the objectives of Regulation EC 1698/2005 and the National Strategy Plan (http://land.lebensministerium.at/article/articleview/44221/1/21437 (as notified to the European Commission on 8 August 2007) the Austrian Rural Development Programme 2007–2013 (http://land.lebensministerium.at/article/articleview/60417/1/21433) 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 (M122 of the Rural Development Programme 2007–2013),
- introduction of new technologies and innovations in the production process to improve the quality of forestry products (M123b&d),
- 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, (M124b),
- providing infrastructure, i.e. forest roads to improve forest management, and making provisions for the management of future extreme events resulting from climate change (M125),
- 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 (M 311a and M 321c).

Table 32: Overview of financial support made available for forest related measures (in million €).

Measure [million €]	Financial support available	Financial support made available (2007–2009)	Total investment volume triggered so far
M122	28.8	24.2	52
M123b&d	10	3.3	11
M124b	18.9	4.8	6.2
M125a	51.5	39.7	76
M311	78.9	26.2	87
M321c	146.5	31.1	86.6

Financial support amounting to 341 million € in total was made available to promote forest related measures during the programme period.

Government Programme

The Government Programme (http://www.bka.gv.at/DocView.axd?CobId=32965) of the current election period (2008–2013) includes a strong mandate to further mobilise domestic supply of woody biomass for energy purposes so as to increase energy security and self-sufficiency while reducing dependence on fuel imports. To support the aim of this Programme, the results of a "wood and biomass supply study", referred to under chapter 3.5, were published in a press release on 22 January 2009.

Austrian Forest Dialogue

The Federal Minister 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 Programme was developed (http://www.walddialog.at/filemanager/list/16026/), 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: G1 Increased utilisation of wood as a renewable raw material (material and energetic use) – the best possible substitution of fossil materials.

To put the Austrian Forest Programme into operation, a Work Programme (http://www.walddialog.at/filemanager/list/29043/) was developed with concrete measures to support the objectives of the Forest Programme.

The following mitigation measures have been identified to support the thematic issue of the "contribution of Austrian forests to climate change mitigation":

M 115.2 Organisation of information and awareness raising campaigns to support the increased demand in woody biomass (cross reference to the Biomass Action Plan);

M 115.3–115.9 Mobilisation of woody biomass production by taking into account market developments and environmental circumstances

M 32 Launching of the thematic window on "wood and timber for energy" ("klima:aktiv" Energieholz (information available at: http://www.klima-aktiv.at/article/archive/25265/)) for the mobilisation of woody biomass (referred to under "Energy supply related policies and measures")

M 321.1 Performing a "wood and biomass supply study", which forms the basis for establishing a reference level and has been included in this submission

M 321.2 Establishment of a "Task Force on Renewable Energy" to evaluate future supplies of domestic biomass (see below)

M 322.1–322.5 Information management and awareness raising, including the setting up of regional contracts and providing for transfer of know-how between forest holders and the forest sector overall.

Forest Cooperatives

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 (http://www.waldverband.at/), a dedicated organisation within the Austrian Chamber of Agriculture, which provides a platform for 8 regional 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 NFI 07/09 show that wood mobilisation initiatives on small scale forest holdings increased by more than 50% compared to the former NFI 2000/02. These initiatives are also closely linked to measures adopted under the Austrian Forest Dialogue.

Task Force "Renewable Energy"

In 2006 Task Force "Renewable Energy" (see M 321.2 of the Austrian Forest Dialogue) 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 (http://www.energiestrategie.at/images/stories/pdf/02_bmlfuw_09_erneuerbare2020.pdf) corroborates the findings of the wood and biomass supply study (which forms the basis for establishing the reference level.

Action Programme "Timber Flow"

In March 2009 the Action Programme "Timber Flow" ("Aktionsprogramm Holzfluss") (http://www.leader-austria.at/forstwirtschaft/downloads/copy_of_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 addition to the above, further policies and measures for the years after 2012 have been adopted and will further increase the demand for woody biomass. The following measures have been listed for information purposes only. They are not included in the results derived from the projections.

4.2.11 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 (P&M No.: 1-4_WASTE).

It has not been possible to quantify single measures implemented. Nevertheless, the progress achieved can be made visible by the indicator "annually deposited waste/CH_4 emissions" (see the following Figure 39 below).

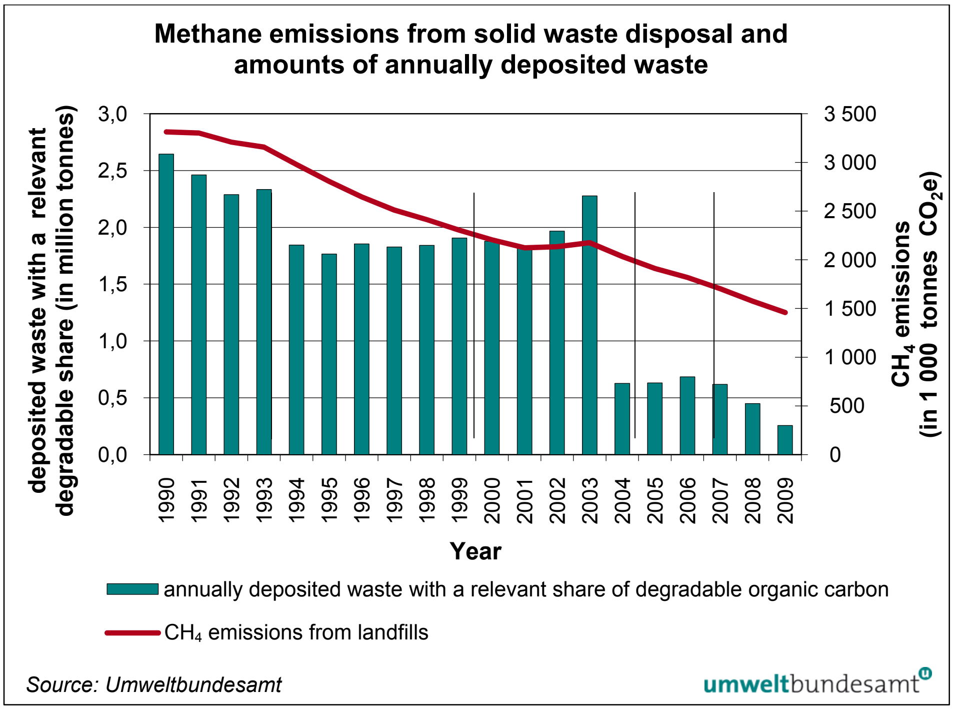

Figure 39: Methane emissions from landfills and annually deposited waste with relevant share of biogenic waste.

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.

01_WASTE Landfill Ordinance: deposition of untreated biodegradable waste (Federal Law Gazette No. 164/1996, Federal Law Gazette II No. 2008/39) (WEM+WAM)

According to this Ordinance, the deposition of untreated biodegradable waste has been forbidden since 2004. Methane emissions from landfills are thus expected to decrease continuously. 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.

As a consequence, it is expected that waste incineration and mechanical biological pre-treatment of waste will be increasingly applied.

02_WASTE Landfill Ordinance: collection and extraction of landfill gas (Federal Law Gazette No. 164/1996, Federal Law Gazette II No. 39/2008) (WEM+WAM)

A second important measure with respect to reductions of greenhouse gas emissions from landfills is the mandatory collection and extraction of landfill gas originating from (municipal) waste landfills according to section 22 of the Austrian Landfill Ordinance. This measure has been mandatory for new landfills since 01.01.1997 with a transition period for existing landfills until 01.01.2004. The collected landfill gas is intended for further use or treatment.

03_WASTE Remediation of Contaminated Sites Act (Federal Law Gazette No. 299/1989)

This measure has been excluded from the scenarios as it has lost its relevance for emission reductions in this sector.

04_WASTE Guideline for the Mechanical Biological Treatment of Waste (BMLFUW 2002) (WEM+WAM)

Mechanical biological treatment of biodegradable wastes prior to landfilling can reduce the gas formation potential. The Guideline for the Mechanical Biological Treatment of Wastes was prepared after expert consultations with the Environment Agency Austria (BMLFUW 2002). The purpose of this Guideline is to ensure consistent state-of-the-art process technology for mechanical biological treatment.

Currently no harmonised emission regulations are in force for mechanical biological treatment plants. A relevant ordinance on the mechanical-biological treatment of waste with legally binding emission thresholds is currently being prepared. This ordinance is expected to enter into force in 2012.

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 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 2nd February 2010. The scenario definition table lists the most important measures.

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.

5.2 Scenario "with existing measures"

Table 33: PAMs included in the scenario "with existing measures".

CRF	Policies & Measures
1.A.1 Energy industries	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: 03_EN: Emission Trading Directive (2003/87/EC) as amended (including National Allocation Plans) 02_EN: Amendment to the green electricity act 2008 (Federal Law Gazette I No. 114/2008) which promotes the use of renewable energy sources (RES) in power production 06_EN: Combined Heat and Power (CHP) Act (Federal Law Gazette I No. 45/2008) 05_EN: Austrian climate and energy fund (KLI.EN) 04_EN: EU Water Framework Directive (2000/60/EC) 01_EN: Domestic Environmental Support Scheme (UFI) 08_EN: Eco Design Directive as amended (2005/32/EC) **Status 2009 – Status 2011** Measure 08_EN has been considered in the scenario WEM (unlike before when it was included in the scenario WAM).
1.A.2 Manufacturing Industries and Construction	There are no sector specific measures. Energy related measures are defined in 1.A.1 and 1.A.3.

CRF	Policies & Measures
1.A.3 Transport, 1.A.4 & 1.A.5 Other Mobile Sources and Machinery	02_TRA: CO_2 Labelling and guidelines: Dir. 1999/94/EC 03_TRA: Toll for heavy duty vehicle "Bundesgesetz über die Mauteinhebung auf Bundesstraßen" (Federal Highways Toll Act, Federal Law Gazette I No. 109/2002); toll introduced on 1.1.2004 04_TRA: EU-Biofuels Directive: Dir. 2003/30/EC. Implemented through the legislative act entitled "Kraftstoffverordnung" (Fuel Ordinance), 4.11.2004 (Federal Law Gazette II No. 417/2004). 05_TRA: EURO classification (EURO 4, 5 & 6 for passenger cars, light duty vehicles and heavy duty vehicles), EURO 3 for Motorcycles, stage 3b for off-road machinery 06_TRA: Numerous measures related to infrastructure, public transport and mobility management. 07_TRA Klima:aktiv →mobility programme 08_TRA: Enhanced fuel efficiency of passenger cars **Status 2009 – Status 2011** Measure 08_TRA has been considered in the WEM (unlike before when it was included in the scenario WAM). Measure 01_TRA has expired and has therefore not been included anymore.
1.A.4 & 1.A.5 Other Sectors (Residential, Commercial, Agriculture and Other)	According to the specifications in CRF 1A1 all energy related measures are described in detail with the energy projections themselves. The following measures and regulations for this category have been implemented: 02_B increased building renovation 03_B increased replacement of heating systems 04_B public support for new buildings 06_B National energy efficiency action plan EEAP on small consumption for heating and hot water in the residential and commercial sector **Status 2009 – Status 2011** Measure 01_B is included with the measures 02-04_B in the new scenario WEM.
1.B Fugitive Emissions from fuels	No policies and measures.
2 Industrial Processes	07_IP, 08_IP, 09_IP Halocarbons and SF_6: The scenario includes the Austrian Ordinance on fluorinated gases (Federal Law Gazette II No. 447/2002) and its amendment 2007 (Federal Law Gazette II No. 139/2007), the EC Regulation on certain fluorinated greenhouse gases (842/2006/EC) and the EC Directive relating to emissions from air-conditioning systems in motor vehicles (2006/40/EC).

CRF	Policies & Measures
3 Solvent and Other Product Use	01_IP Solvent Ordinance 02_IP Ordinance for paint finishing systems 03_IP Federal Ozone Act 04_IP_ Ordinance on chlorinated hydrocarbons in industrial facilities and installations 05_IP Ordinance limiting emissions of volatile organic compounds (VOC) due to the use of organic solvents in certain activities and installations 06_IP Ordinance on the limitation of emissions during the use of solvents containing highly volatile halogenated hydrocarbons in industrial facilities and installations
4 Agriculture	The following policies and measures are considered implemented: 01_AGR Common Agricultural Policy (CAP) 2003 reform 02_AGR Austrian implementation of the CAP 03_AGR Funds transfer through "modulation" 04_AGR Land is maintained in good agricultural and ecological condition ("cross compliance") 05_AGR The programme for rural development is maintained in an unmodified way 06_AGR Implementation of the BiofuelsDirective in Austria 07_AGR Grassland maintenance 08_AGR Prices increase for crops
6 Waste	01_WASTE: Austrian Landfill Ordinance (deposition of untreated biodegradable waste) Federal Law Gazette No. 164/1996 of the year 1996 according to the Austrian Waste Management Act. 02_WASTE: Austrian Landfill Ordinance (collection and extraction of landfill gas) 03_WASTE: Remediation of Contaminated Sites Act Federal Law Gazette No. 299/1989 04_WASTE: The Guideline for the Mechanical Biological Treatment of Wastes

5.3 Scenario “with additional measures”

Table 34: PAMs included in the scenario “with additional measures“.

CRF	Measures
1.A.1 Energy industries	Measures are described under “energy projections”. For the scenario WAM the following additional measures have been consideredto be relevant for the whole energy industry sector: 07_EN: Directive 2006/32/EC on energy end-use efficiency and energy services and the corresponding first Austrian energy efficiency action plan 02_EN: Amendment to the Green Electricity Act 2008 (Federal Law Gazette I No. 114/2008): more stringent rules for the exploitation of hydropower

CRF	Measures
1.A.2 Manufacturing Industries and Construction	There are no sector-specific additional measures. Energy-related measures are defined in 1.A.1. and 1.A.3.
1.A.3 Transport, 1.A.4 & 1.A.5 Other Mobile Sources and Machinery	In this scenario further measures are considered (and estimated to have an additional effect). 09_TRA: Speed limits, traffic control systems and fuel saving driving style 10_TRA: Increased fuel tax 11_TRA: Modal shift in passenger transport 12_TRA: increased provision of feeder lines in freight transport 13_TRA: More efficient use of vehicles **Status 2009 – Status 2011** Measures 10-13_TRA have been added to the new scenario WAM.
1.A.4 & 1.A.5 Other Sectors (Residential, Commercial, Agriculture and Other)	In this scenario further measures are considered which have an effect on emissions from households. 05_RES additional measures to reduce energy consumption in the sectors residential and commercial 07_RES additional measures to reduce electric power consumption in the sector residential and commercial without energy use for heating and hot water
1.B Fugitive Emissions from fuels	There are no additional sector-specific measures
2 Industrial Processes	Further (voluntary) measures are taken into account, depending on their technical feasibility.
3 Solvent and Other Product Use	There are no sector-specific additional measures
4 Agriculture	The scenario “with existing measures" plus the following modifications are implemented: 09_AGR more premiums for organic farming 10_AGR payments for investments in emission reducing animal production technologies 11_AGR Setting aside additional land for short rotation forests 12_AGR Use of 7 000 000 m^3 slurry in 2015 and 800 000 m^3 slurry from 2020 onwards for biogas production
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. From today’s perspective there will be no further innovative developments in the next few years in terms of greenhouse gas emission minimisation.

6 CHANGES WITH RESPECT TO SUBMISSION 2009

Changes compared to the last GHG emission projections 2009 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 been applied consistently for the calculation of historical and forecast emissions.
2) Assumptions for activity forecasts have changed. These changes might 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.
4) Furthermore the projections have been extended to 2030.

The following table shows a comparison of the historical and forecast national emission totals.

Table 35: Comparison of projections 2009 and 2011 – national Totals (in Gg CO_2e).

Total – WEM	1990	2005	2010	2015	2020
Projections 2009	79 037	92 832	93 873	95 473	98 112
Projections 2011	78 171	92 916	85 237	86 096	87 330
Difference	– 866	84	– 8 636	– 9 377	– 10 782
Total – WAM					
Projections 2009	79 037	92 832	92 871	91 582	89 605
Projections 2011	78 171	92 916	84 449	80 298	78 751
Difference	– 866	84	– 8 422	– 11 284	– 10 854

The following tables present the changes of historical and forecast emissions by sector.

6.1.1 Energy Industries (1.A.1)

Table 36: Comparison of GHG projections 2009 and 2011 – Energy Industries (in Gg CO_2e).

1.A.1 – WEM	1990	2005	2010	2015	2020
Projections 2009	13 844	16 167	17 518	17 193	18 554
Projections 2011	13 842	16 184	12 605	10 671	10 910
Difference	– 2	17	– 4 913	– 6 522	– 7 644
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
Difference	– 2	17	– 4 765	– 5 158	– 4 549

The economic recession in the years 2008 and 2009 was not taken into account in the previous projections. Taking the recession into consideration has resulted in major changes for the years 2009 and 2010. Projections for the following years start from a significantly lower level.

Additionally, a new model has been used for the projection of the production of heat and power. Instead of the model Balmorel, a model based on TIMES has been used for this projection.

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

Table 37: Comparison of GHG projections 2009 and 2011 – Manufacturing Industries and Construction (in Gg CO_2e).

1.A.2 – WEM	1990	2005	2010	2015	2020
Projections 2009	12 773	15 832	15 767	17 011	18 045
Projections 2011	12 772	16 143	16 110	17 616	19 030
Difference	– 1	311	343	605	985
1.A.2 – WAM					
Projections 2009	12 773	15 832	15 767	17 011	18 045
Projections 2011	12 772	16 143	15 988	17 435	18 814
Difference	– 1	311	221	424	769

The economic recession of the years 2008 and 2009 was not taken into account in the previous projections. Taking the recession into consideration has resulted in major changes for the years 2009 and 2010. Projections for the following years start from a significantly lower level.

Additionally, a new macroeconomic model has been used for the projections for manufacturing industries. Instead of the model Prometheus, the DEIO model has been used for this projection. The data set for the previous projection was based on the year 2003.

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

Table 38: Comparison of GHG projections 2009 and 2011 – Transport (in Gg CO_2e).

1.A.3 – WEM	1990	2005	2010	2015	2020
Projections 2009	14 023	25 340	24 043	25 460	26 329
Projections 2011	14 010	24 981	23 308	24 850	24 872
Difference	– 13	– 359	– 735	– 611	– 1 457
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
Difference	– 13	– 359	– 567	– 3 510	– 4 297

The 2011 projections show lower emissions for both scenarios (WEM/WAM) than the projections 2009, one reason being that the economic downturn of the years 2008 and 2009 was not taken into account in the previous projections. However, taking the recession into consideration has resulted in major changes for the years 2009 and 2010. Projections for the following years start from a significantly lower level.

The scenario WAM 2011 is more optimistic than the scenario WAM in 2009, the first reason being that the measure 10_TRA (increased fuel tax) significantly reduces fuel exports and thus GHG emissions (for a description of this measure see chapter 4.2.3) and secondly because of an optimistic forecast for the development of electric cars up to 2020. Moreover, an increased use of biofuels has been assumed in the scenario WAM (as Austria already achieved (and exceeded) legally required biofuel substitution levels in 2009; for assumptions see chapter 3.1.3.2 or Annex 3).

6.1.4 Other Sectors (CRF Source Category 1.A.4 & 1.A.5)

Table 39: Comparison of GHG projections 2009 and 2011 – Other Energy Sectors (in Gg CO_2e).

1.A.4 & 1.A.5 – WEM	1990	2005	2010	2015	2020
Projections 2009	14 468	13 690	14 455	13 649	12 789
Projections 2011	14 468	14 435	12 089	11 174	10 241
Difference	0	745	– 2 366	– 2 475	– 2 548
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
Difference	0	745	– 2 377	– 2 280	– 1 734

The difference to the last projections (2009) is due to a different economic situation (taking into consideration the last economic crisis) und 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 40: Comparison of GHG projections 2009 and 2011 – Fugitive emissions (in Gg CO_2e).

1.B – WEM	1990	2005	2010	2015	2020
Projections 2009	487	876	959	977	975
Projections 2011	312	440	448	444	431
Difference	– 175	– 436	– 511	– 533	– 544
1.B – WAM					
Projections 2009	487	876	959	977	975
Projections 2011	312	440	448	444	431
Difference	– 175	– 436	– 511	– 533	– 544

The differences can be seen in the historical and forecast data; they are due to methodological improvements in the inventory, especially with regard to the use of country specific emission factors.

6.1.6 Industrial Processes (2)

Table 41:Comparison of GHG projections 2009 and 2011 – Industrial Processes (in Gg CO_2e).

2 – WEM	1990	2005	2010	2015	2020
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
- of which F-gases	*1 600*	*1 628*	*1 713*	*1 733*	*1 738*
Difference	0	322	– 0	493	779
- of which F-gases	*– 5*	*308*	*282*	*320*	*131*
2 – WAM					
Projections 2009	10 111	10 306	11 006	11 458	11 864
Projections 2011	10 111	10 628	10 974	11 598	12 148
Difference	0	322	– 32	140	284

The economic recession of the years 2008 and 2009 was not taken into account in the previous projections. Taking the recession into consideration has resulted in major changes for the years 2009 and 2010. Projections for the following years start from a significantly lower level.

Additionally, a new macroeconomic model has been used for projections for the manufacturing industries. Instead of the Prometheus model the DEIO model has been used for this projection. The data set for the previous projections was based on the year 2003.

The differences in F-gas emissions are due to updates of chapter 2.F of the National Inventory on Greenhouse Gases, which are based on an extensive survey of the F-gas sector in Austria, which has in turn served as the basis for a new study on projections of F-gas use in Austria (GSCHREY 2010).

6.1.7 Solvents and other product use (3)

Table 42: Comparison of GHG projections 2009 and 2011 – Solvents and other product use in Gg CO_2 eq.

3 – WEM	1990	2005	2010	2015	2020
Projections 2009	512	394	412	419	426
Projections 2011	512	385	321	343	367
Difference	0	– 9	– 91	– 76	– 59
3 – WAM					
Projections 2009	512	394	412	419	426
Projections 2011	512	385	321	343	367
Difference	0	– 9	– 91	– 76	– 59

The model revision included an update of activity data by using the struc-tural 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.

6.1.8 Agriculture (4)

Table 43: Comparison of GHG projections 2009 and 2011 – Agriculture (in Gg CO_2e).

4 – WEM	1990	2005	2010	2015	2020
Projections 2009	9 171	7 848	7 797	7 811	7 893
Projections 2011	8 558	7 399	7 534	7 625	7 693
Difference	– 613	– 449	– 263	– 186	– 200
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
Difference	– 613	– 449	– 195	– 167	– 210

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.

6.1.9 Waste (CRF Source Category 6)

Table 44: Comparison of GHG projections 2009 and 2011 – Waste (in Gg CO_2e).

6 – WEM	1990	2005	2010	2015	2020
Projections 2009	3 649	2 378	1 915	1 495	1 237
Projections 2011	3 586	2 322	1 815	1 423	1 144
Difference	– 62	– 56	– 99	– 72	– 93
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
Difference	– 62	– 56	– 99	– 72	– 93

The revisions with respect to the projections 2009 are due to:

- CRF 6A: Recalculations in the GHG inventory: Methodological changes in the calculation of emissions from Solid Waste Disposal (e.g. the period of half lives considered in the IPCC FOD modell)
- CRF 6B: Recalculations in the GHG inventory because updated parameters have become available (updates of denitrification rate, the level of connection to sewage treatment plants and FAO statistics on protein consumption)
- CRF 6C: No recalculations have been carried out for historical and projected data.
- CRF 6D: Recalculations in the GHG inventory because updated activity data have become available (as described in UMWELTBUNDESAMT 2010a, Table 266) and different assumptions have been made for the future development of biogenic and green waste (CRF 6D) and waste amounts undergoing mechanical-biological treatment.

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

PAM .... Policies and Measures

SVO .... Straight Vegetable Oil

Tg .... terragramme

UFI .... Umweltförderung im Inland (domestic environmental support scheme)

UNFCCC .... United 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 .... hydroflurocarbons

PFC .... perfluorocarbons

SF_6 .... sulphur hexafluoride

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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 45: CO_2 emissions in 2008 and projections 2010–2030, scenario “with existing measures”.

CO_2 [Gg]	2008	2010	2015	2020	2025	2030
Total excluding LULUCF	**73 630**	**72 792**	**73 997**	**75 505**	**77 432**	**79 316**
Total including LULUCF	**55 995**	**67 970**	**70 456**	**73 634**	**75 560**	**77 445**
1. Energy	**63 474**	**63 431**	**63 719**	**64 524**	**65 828**	**67 097**
A. Fuel Combustion Activities	63 261	63 227	63 534	64 358	65 677	66 961
1. Energy Industries	13 423	12 507	10 581	10 833	11 930	12 767
a. Public Electricity and Heat production	10 089	9 096	6 975	7 194	8 303	9 176
b. Petroleum Refining	2 806	2 833	2 833	2 833	2 833	2 833
c. Manufacture of Solid Fuels and Other Energy Industries	528	579	773	806	795	758
2. Manufacturing Industries and Construction	15 997	15 953	17 452	18 854	20 312	22 004
a. Iron and Steel	6 240	6 106	6 259	6 523	6 764	7 003
b. Non-Ferrous Metals	300	262	260	270	274	284
c. Chemicals	1 361	1 378	1 616	1 800	2 020	2 279
d. Pulp, Paper and Print	2 140	2 188	2 377	2 509	2 623	2 791
e. Food Processing, Beverages and Tobacco	882	909	1 058	1 221	1 417	1 648
f. Other	5 073	5 110	5 882	6 531	7 215	8 000
3. Transport	22 255	23 075	24 675	24 741	24 572	24 410
a. Civil Aviation	70	68	73	78	83	89
b. Road Transportation	21 411	22 359	23 827	23 735	23 359	22 924
c. Railways	165	155	160	160	165	169
d. Navigation	35	35	35	35	35	35
e. Other Transportation	574	458	579	733	930	1 193
4. Other Sectors	11 542	11 645	10 778	9 876	8 807	7 720
a. Commercial/Institutional	2 956	3 100	2 930	2 732	2 470	2 212
b. Residential	7 622	7 524	6 757	6 023	5 180	4 332
c. Agriculture/Forestry/Fisheries	964	1 022	1 092	1 122	1 157	1 176
5. Other	45	46	49	53	56	60
a. Stationary	NO	0	0	0	0	0
b. Mobile	45	46	49	53	56	60
B. Fugitive Emissions from Fuels	212	204	184	167	151	136
1. Solid Fuels	0	0	0	0	0	0
2. Oil and Natural Gas	212	204	184	167	151	136
2. Industrial Processes	**9 912**	**9 190**	**10 088**	**10 770**	**11 377**	**11 978**
A. Mineral Products	3 531	3 299	3 899	4 299	4 675	5 068
B. Chemical Industry	593	573	727	762	767	753
C. Metal Production	5 788	5 318	5 461	5 709	5 934	6 158
3. Solvent and Other Product Use	**232**	**159**	**178**	**199**	**215**	**229**
5. Land Use, Land-Use Change and Forestry	**– 17 635**	**– 4 821**	**– 3 541**	**– 1 871**	**– 1 871**	**– 1 871**
6. Waste	**12**	**12**	**12**	**12**	**12**	**12**
C. Waste Incineration	12	12	12	12	12	12

Table 46: CH_4 emissions in 2008 and projections 2010–2030, scenario "with existing measures".

CH_4 [Gg]	2008	2010	2015	2020	2025	2030
Total excluding LULUCF	**272.2**	**261.3**	**245.4**	**234.7**	**227.1**	**222.3**
Total including LULUCF	**272.2**	**261.3**	**245.4**	**234.7**	**227.2**	**222.3**
1. Energy	**24.1**	**21.9**	**21.3**	**20.6**	**19.8**	**19.1**
A. Fuel Combustion Activities	12.0	10.2	8.9	8.0	7.5	7.2
1. Energy Industries	0.3	0.3	0.4	0.3	0.3	0.4
2. Manufacturing Industries and Construction	0.6	0.6	0.7	0.8	0.8	0.9
3. Transport	0.9	0.7	0.5	0.5	0.4	0.4
4. Other Sectors	10.2	8.6	7.3	6.5	5.9	5.5
B. Fugitive Emissions from Fuels	12.1	11.6	12.4	12.6	12.3	12.0
1. Solid Fuels	0.0	0.0	0.0	0.0	0.0	0.0
2. Oil and Natural Gas	12.1	11.6	12.4	12.6	12.3	12.0
2. Industrial Processes	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**
B. Chemical Industry	0.9	0.9	0.9	0.9	0.9	0.9
4. Agriculture	**169.0**	**170.5**	**174.2**	**177.1**	**179.2**	**181.1**
A. Enteric Fermentation	153.5	155.2	158.7	161.5	163.6	165.7
1. Cattle	143.8	145.9	149.4	152.3	154.6	156.8
3. Sheep	2.7	2.5	2.4	2.4	2.4	2.4
4. Goats	0.3	0.3	0.3	0.3	0.3	0.3
6. Horses	1.6	1.6	1.6	1.6	1.6	1.5
7. Mules and Asses	IE	IE	IE	IE	IE	IE
8. Swine	4.6	4.4	4.4	4.4	4.3	4.2
9. Poultry	0.3	0.2	0.2	0.2	0.2	0.2
10. Other	0.3	0.3	0.3	0.3	0.3	0.3
B. Manure Management	15.0	14.9	15.1	15.2	15.2	15.1
1. Cattle	10.3	10.4	10.6	10.8	10.9	10.9
3. Sheep	0.1	0.1	0.1	0.1	0.1	0.1
4. Goats	0.0	0.0	0.0	0.0	0.0	0.0
6. Horses	0.1	0.1	0.1	0.1	0.1	0.1
7. Mules and Asses	IE	IE	IE	IE	IE	IE
8. Swine	3.5	3.4	3.4	3.3	3.2	3.2
9. Poultry	1.0	0.9	0.9	0.9	0.9	0.9
D. Agricultural Soils	0.4	0.4	0.3	0.3	0.3	0.3
F. Field Burning of Agricultural Residues	0.1	0.0	0.0	0.0	0.0	0.0
6. Waste	**78.2**	**68.0**	**49.1**	**36.0**	**27.3**	**21.1**
A. Solid Waste Disposal on Land	74.2	64.2	45.3	32.7	24.0	17.8
B. Waste Water Handling	1.5	1.2	1.1	0.9	1.0	1.0
C. Waste Incineration	0.0	0.0	0.0	0.0	0.0	0.0
D. Other	2.5	2.6	2.7	2.4	2.4	2.3

Table 47: N_2O emissions in 2008 and projections 2010–2030, scenario "with existing measures".

N_2O [Gg]	2008	2010	2015	2020	2025	2030
Total excluding LULUCF	**18.33**	**16.92**	**16.81**	**16.65**	**16.49**	**16.31**
Total including LULUCF	**18.48**	**17.07**	**16.97**	**16.80**	**16.64**	**16.47**
1. Energy	**2.41**	**2.16**	**1.90**	**1.70**	**1.68**	**1.70**
A. Fuel Combustion Activities	2.41	2.16	1.90	1.70	1.68	1.70
1. Energy Industries	0.32	0.29	0.26	0.22	0.22	0.22
2. Manufacturing Industries and Construction	0.49	0.47	0.48	0.51	0.56	0.62
3. Transport	0.84	0.70	0.53	0.39	0.33	0.31
4. Other Sectors	0.75	0.70	0.62	0.57	0.56	0.55
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial Processes	**1.05**	**0.27**	**0.36**	**0.37**	**0.38**	**0.37**
B. Chemical Industry	1.05	0.27	0.36	0.37	0.38	0.37
3. Solvent and Other Product Use	**0.51**	**0.52**	**0.53**	**0.54**	**0.55**	**0.56**
4. Agriculture	**13.17**	**12.75**	**12.80**	**12.82**	**12.66**	**12.45**
A. Enteric Fermentation	0.00	0.00	0.00	0.00	0.00	0.00
B. Manure Management	2.94	2.98	3.04	3.08	3.11	3.14
D. Agricultural Soils	10.23	9.78	9.76	9.73	9.55	9.31
1. Direct Soil Emissions	6.06	5.79	5.77	5.75	5.67	5.52
2. Pasture, Range and Paddock Manure (3)	0.30	0.30	0.30	0.30	0.30	0.30
3. Indirect Emissions	3.87	3.69	3.69	3.69	3.58	3.49
6. Waste	**1.19**	**1.21**	**1.23**	**1.21**	**1.22**	**1.23**
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste Water Handling	0.84	0.84	0.86	0.89	0.90	0.92
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.35	0.36	0.37	0.32	0.32	0.31

Table 48: HFC, PFC and SF_6 emissions in 2008 and projections 2010–2030, scenario "with existing measures".

	2008	2010	2015	2020	2025	2030
HFC [Gg CO_2e]						
Total (without LULUCF)	**1 058**	**1 091**	**1 152**	**1 153**	**1 194**	**1 209**
2. Industrial Processes	**1 058**	**1 091**	**1 152**	**1 153**	**1 194**	**1 209**
F. Consumption of Halocarbons and SF_6	1 058	1 091	1 152	1 153	1 194	1 209
PFC [Gg CO_2e]						
Total (without LULUCF)	**174**	**285**	**300**	**315**	**330**	**345**
2. Industrial Processes	**174**	**285**	**300**	**315**	**330**	**345**
F. Consumption of Halocarbons and SF_6	174	285	300	315	330	345
SF_6 [Gg CO_2e]						
Total (without LULUCF)	**381**	**337**	**282**	**270**	**262**	**251**
2. Industrial Processes	**381**	**337**	**282**	**270**	**262**	**251**
F. Consumption of Halocarbons and SF_6	381	337	282	270	262	251

Emission Projections – scenario "with additional measures"

Table 49: CO_2 emissions in 2008 and projections 2010–2030, scenario "with additional measures".

CO_2 [Gg]	2008	2010	2015	2020	2025	2030
Total excluding LULUCF	73 630	72 200	68 684	67 926	66 002	67 323
Total including LULUCF	55 995	67 378	65 142	66 055	64 130	65 452
1. Energy	63 474	62 825	58 508	57 069	54 576	55 235
A. Fuel Combustion Activities	63 261	62 621	58 324	56 902	54 425	55 099
1. Energy Industries	13 423	11 903	9 984	9 351	9 937	11 159
a. Public Electricity and Heat production	10 089	8 490	6 528	5 863	6 476	7 648
b. Petroleum Refining	2 806	2 833	2 833	2 833	2 833	2 833
c. Manufacture of Solid Fuels and Other Energy Industries	528	581	623	655	628	678
2. Manufacturing Industries and Construction	15 997	15 974	17 420	18 798	20 218	21 896
a. Iron and Steel	6 240	6 116	6 258	6 504	6 730	6 964
b. Non-Ferrous Metals	300	262	260	270	274	284
c. Chemicals	1 361	1 385	1 609	1 791	2 007	2 268
d. Pulp, Paper and Print	2 140	2 188	2 377	2 510	2 622	2 793
e. Food Processing, Beverages and Tobacco	882	911	1 060	1 224	1 417	1 648
f. Other	5 073	5 112	5 857	6 499	7 168	7 940
3. Transport	22 255	23 082	20 525	19 811	16 888	16 024
a. Civil Aviation	70	68	73	78	83	89
b. Road Transportation	21 411	22 365	19 670	18 786	15 652	14 511
c. Railways	165	155	167	179	187	195
d. Navigation	35	35	35	35	35	35
e. Other Transportation	574	458	579	733	930	1 193
4. Other Sectors	11 542	11 615	10 345	8 890	7 326	5 960
a. Commercial/Institutional	2 956	3 090	2 795	2 437	2 040	1 690
b. Residential	7 622	7 503	6 476	5 345	4 142	3 112
c. Agriculture/Forestry/Fisheries	964	1 022	1 074	1 108	1 144	1 158
5. Other	45	46	49	53	56	60
a. Stationary	0	0	0	0	0	0
b. Mobile	45	46	49	53	56	60
B. Fugitive Emissions from Fuels	212	204	184	167	151	136
1. Solid Fuels	0	0	0	0	0	0
2. Oil and Natural Gas	212	204	184	167	151	136
2. Industrial Processes	9 912	9 204	9 985	10 646	11 199	11 847
A. Mineral Products	3 531	3 302	3 903	4 296	4 641	5 019
B. Chemical Industry	593	574	621	659	655	706
C. Metal Production	5 788	5 328	5 461	5 691	5 903	6 122
3. Solvent and Other Product Use	232	159	178	199	215	229
5. Land Use, Land-Use Change and Forestry	– 17 635	– 4 821	– 3 541	– 1 871	– 1 871	– 1 871
6. Waste	12	12	12	12	12	12
C. Waste Incineration	12	12	12	12	12	12

Table 50: CH_4 emissions in 2008 and projections 2010–2030, scenario "with additional measures".

CH_4 [Gg]	2008	2010	2015	2020	2025	2030
Total excluding LULUCF	**272.2**	**261.3**	**243.6**	**231.4**	**224.7**	**220.5**
Total including LULUCF	**272.2**	**261.3**	**243.7**	**231.4**	**224.7**	**220.5**
1. Energy	**24.1**	**21.9**	**21.2**	**20.6**	**19.6**	**18.8**
A. Fuel Combustion Activities	12.0	10.2	8.9	8.0	7.4	6.8
1. Energy Industries	0.3	0.3	0.4	0.4	0.4	0.4
2. Manufacturing Industries and Construction	0.6	0.6	0.7	0.8	0.9	0.9
3. Transport	0.9	0.7	0.5	0.4	0.3	0.3
4. Other Sectors	10.2	8.6	7.3	6.4	5.8	5.3
B. Fugitive Emissions from Fuels	12.1	11.6	12.4	12.6	12.3	12.0
1. Solid Fuels	0.0	0.0	0.0	0.0	0.0	0.0
2. Oil and Natural Gas	12.1	11.6	12.4	12.6	12.3	12.0
2. Industrial Processes	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**
B. Chemical Industry	0.9	0.9	0.9	0.9	0.9	0.9
4. Agriculture	**169.0**	**170.5**	**172.5**	**173.9**	**176.8**	**179.6**
A. Enteric Fermentation	153.5	155.2	157.5	159.0	161.9	164.8
1. Cattle	143.8	145.9	148.2	149.9	152.9	155.9
3. Sheep	2.7	2.5	2.4	2.4	2.4	2.3
4. Goats	0.3	0.3	0.3	0.3	0.3	0.3
6. Horses	1.6	1.6	1.6	1.5	1.5	1.5
7. Mules and Asses	IE	IE	IE	IE	IE	IE
8. Swine	4.6	4.4	4.4	4.4	4.3	4.2
9. Poultry	0.3	0.2	0.2	0.2	0.2	0.2
10. Other	0.3	0.3	0.3	0.3	0.3	0.3
B. Manure Management	15.0	14.9	14.6	14.5	14.5	14.5
1. Cattle	10.3	10.4	10.3	10.3	10.4	10.5
3. Sheep	0.1	0.1	0.1	0.1	0.1	0.1
4. Goats	0.0	0.0	0.0	0.0	0.0	0.0
6. Horses	0.1	0.1	0.1	0.1	0.1	0.1
7. Mules and Asses	IE	IE	IE	IE	IE	IE
8. Swine	3.5	3.4	3.3	3.2	3.1	3.1
9. Poultry	1.0	0.9	0.9	0.9	0.8	0.8
D. Agricultural Soils	0.4	0.4	0.4	0.4	0.3	0.3
F. Field Burning of Agricultural Residues	0.1	0.0	0.0	0.0	0.0	0.0
6. Waste	**78.2**	**68.0**	**49.1**	**36.0**	**27.3**	**21.1**
A. Solid Waste Disposal on Land	74.2	64.2	45.3	32.7	24.0	17.8
B. Waste Water Handling	1.5	1.2	1.1	0.9	1.0	1.0
C. Waste Incineration	0.0	0.0	0.0	0.0	0.0	0.0
D. Other	2.5	2.6	2.7	2.4	2.4	2.3

Table 51: N_2O emissions in 2008 and projections 2010–2030, scenario "with additional measures".

N_2O [Gg]	2008	2010	2015	2020	2025	2030
Total excluding LULUCF	**18.33**	**16.91**	**16.76**	**16.65**	**16.47**	**16.28**
Total including LULUCF	**18.48**	**17.07**	**16.92**	**16.81**	**16.63**	**16.44**
1. Energy	**2.41**	**2.16**	**1.85**	**1.70**	**1.65**	**1.61**
A. Fuel Combustion Activities	2.41	2.16	1.85	1.70	1.65	1.61
1. Energy Industries	0.32	0.28	0.26	0.26	0.26	0.21
2. Manufacturing Industries and Construction	0.49	0.47	0.48	0.52	0.57	0.63
3. Transport	0.84	0.71	0.48	0.35	0.27	0.23
4. Other Sectors	0.75	0.70	0.62	0.57	0.55	0.53
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial Processes	**1.05**	**0.27**	**0.30**	**0.32**	**0.32**	**0.34**
B. Chemical Industry	1.05	0.27	0.30	0.32	0.32	0.34
3. Solvent and Other Product Use	**0.51**	**0.52**	**0.53**	**0.54**	**0.55**	**0.56**
4. Agriculture	**13.17**	**12.75**	**12.86**	**12.88**	**12.73**	**12.54**
A. Enteric Fermentation	0.00	0.00	0.00	0.00	0.00	0.00
B. Manure Management	2.94	2.98	3.00	3.01	3.06	3.10
D. Agricultural Soils	10.23	9.78	9.86	9.86	9.68	9.44
1. Direct Soil Emissions	6.06	5.79	5.84	5.84	5.76	5.61
2. Pasture, Range and Paddock Manure (3)	0.30	0.30	0.30	0.29	0.30	0.30
3. Indirect Emissions	3.87	3.69	3.72	3.72	3.62	3.53
6. Waste	**1.19**	**1.21**	**1.23**	**1.21**	**1.22**	**1.23**
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste Water Handling	0.84	0.84	0.86	0.89	0.90	0.92
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.35	0.36	0.37	0.32	0.32	0.31

Table 52: HFC, PFC and SF_6 emissions in 2008 and projections 2010–203, scenario "with additional measures".

HFC, PFC & SF_6 [Gg CO_2e]	2008	2010	2015	2020	2025	2030
HFC						
Total (without LULUCF)	**1 058**	**1 055**	**1 003**	**582**	**444**	**171**
2. Industrial Processes	**1 058**	**1 055**	**1 003**	**582**	**444**	**171**
F. Consumption of Halocarbons and SF_6	1 058	1 055	1 003	582	444	171
PFC						
Total (without LULUCF)	**174**	**272**	**180**	**126**	**47**	**0**
2. Industrial Processes	**174**	**272**	**180**	**126**	**47**	**0**
F. Consumption of Halocarbons and SF_6	174	272	180	126	47	0
SF_6						
Total (without LULUCF)	**381**	**337**	**267**	**255**	**237**	**222**
2. Industrial Processes	**381**	**337**	**267**	**255**	**237**	**222**
F. Consumption of Halocarbons and SF_6	381	337	267	255	237	222

Indicators for projections to monitor and evaluate progress (according to Annex III of Commission Decision 2005/166/EC)

Table 53: 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 €]**	**260.2**	**241.9**	**222.3**	**205.6**	**188.7**
Total CO_2 emissions [kt]	72 792	73 997	75 505	77 432	79 316
GDP [billion €] (EC 2008)	279.8	305.9	339.7	376.7	420.4
TRANSPORT C0 **Passenger Car CO_2 [Gg/Mvkm]**	**0.135**	**0.125**	**0.108**	**0.088**	**0.067**
CO_2 emissions from passenger cars [kt]	10 938	11 085	10 622	9 696	8 602
Number of kilometres by passenger cars,[Mkm]	81 030	88 745	97 916	110 580	127 530
TRANSPORT D0 **Freight Transport CO_2 [Gg/Mtkm]**	**0.076**	**0.072**	**0.067**	**0.063**	**0.061**
CO_2 emissions from freight transport (all modes) [kt]	10 994	12 325	12 707	13 265	13 930
Freight transport (all modes) [Mtkm]	145 379	170 035	189 194	209 732	229 427
INDUSTRY A1 **Energy related CO_2 intensity of industry [t/million €]**	**282.4**	**282.6**	**274.9**	**267.1**	**259.2**
CO_2 emissions from fossil fuel combustion in industry [kt]	15 953	17 452	18 854	20 312	22 004
Gross value-added total industry [billion €] (EC 2000)	56.5	61.8	68.6	76.0	84.9
HOUSEHOLDS A.1 **Specific CO_2 emissions of households [t/dwelling]**	**2.05**	**1.75**	**1.49**	**1.23**	**0.98**
CO_2 emissions from fossil fuel consumption households [kt]	7 524	6 757	6 023	5 180	4 332
Stock of permanently occupied dwellings [1 000]	3 662	3 851	4 042	4 227	4 401
SERVICES A0 **CO_2 intensity of the Service Sector [t/million €]**	**37.8**	**32.5**	**27.0**	**21.3**	**16.2**
CO_2 emissions from fossil fuel consumption in services [kt]	3 100	2 930	2 732	2 470	2 212
Gross value-added services [billion €] (EC 2000)	82.0	90.0	101.2	116.2	136.6
TRANSFORMATION B0 **Specific CO_2 emissions from public and autoproducer power plants [t/TJ]**	**34.5**	**24.9**	**24.8**	**27.6**	**29.4**
CO_2 emissions from public and autoproducer thermal power stations (without heat-only plants) [kt]	8 290	6 102	6 371	7 527	8 451
All products – output of public and autoproducer thermal power stations [PJ]	240.5	245.2	256.9	272.9	287.1
AGRICULTURE **Specific N_2O emissions from fertiliser and manure use [kg/kg]**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**
N_2O emissions from synthetic fertiliser and manure use [kt]	4.2	4.1	4.1	4.0	3.9
Use of synthetic fertiliser and manure [kt nitrogen]	211.5	210.8	209.5	205.6	198.1
AGRICULTURE **Specific CH_4 emissions from cattle production, [kg/head]**	72.4	73.8	74.8	76.1	77.5
CH_4 emissions from cattle [kt]	145.9	149.4	152.3	154.6	156.8
Cattle population [1 000 head]	2 013	2 025	2 037	2 030	2 024
WASTE **Specific CH_4 emissions from landfills [kt/kt]**	**NA**	**NA**	**NA**	**NA**	**NA**
CH_4 emissions from landfills [kt]	64.23	45.32	32.70	23.98	17.82
Municipal solid waste going to landfills [kt]*	0	0	0	0	0

** MSW no longer landfilled in Austria, only sorting residues; NA=not applicable*

Table 54: 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 €]**	**258.1**	**224.5**	**200.0**	**175.2**	**160.1**
Total CO_2 emissions [kt]	72 200	68 684	67 926	66 002	67 323
GDP [billion €] (EC 2008)	279.8	305.9	339.7	376.7	420.4
TRANSPORT C0 **Passenger Car CO_2 [Gg/Mvkm])**	**0.135**	**0.120**	**0.100**	**0.075**	**0.052**
CO_2 emissions from passenger cars [kt]	10 938	9 452	8 206	6 129	4 677
Number of kilometres by passenger cars [Mkm]	81 031	78 846	82 125	81 181	89 617
TRANSPORT D0 **Freight Transport CO_2 [Gg/Mtkm]**	**0.076**	**0.074**	**0.067**	**0.065**	**0.062**
CO_2 emissions from freight transport (all modes) [kt]	11 000	9 782	10 108	9 047	9 353
Freight transport (all modes) [Mtkm]	145 379	132 502	150 383	139 180	151 706
INDUSTRY A1 **Energy related CO_2 intensity of industry [t/million €]**	**282.8**	**282.0**	**274.1**	**265.9**	**258.0**
CO_2 emissions from fossil fuel combustion in industry [kt]	15 974	17 420	18 798	20 218	21 896
Gross value-added total industry [billion €] (EC 2000)	56.5	61.8	68.6	76.0	84.9
HOUSEHOLDS A.1 **Specific CO_2 emissions from households [t/dwelling]**	**2.05**	**1.68**	**1.32**	**0.98**	**0.71**
CO_2 emissions from fossil fuel consumption households [kt]	7 503	6 476	5 345	4 142	3 112
Stock of permanently occupied dwellings [1 000]	3 662	3 851	4 042	4 227	4 401
SERVICES A0 **CO_2 intensity of the Service Sector [t/million €]**	**37.6**	**31.6**	**25.0**	**18.7**	**13.7**
CO_2 emissions from fossil fuel consumption in services [kt]	3 090	2 795	2 437	2 040	1 690
Gross value-added services [billion €] (EC 2000)	82.1	88.5	97.4	108.9	123.7
TRANSFORMATION B0 **Specific CO_2 emissions from public and autoproducer power plants [t/TJ]**	**32.3**	**23.5**	**20.3**	**21.8**	**24.8**
CO_2 emissions from public and autoproducer thermal power stations (without heat only plants) [kt]	7 687	5 655	5 039	5 701	6 925
All products – output of public and autoproducer thermal power stations [PJ]	237.8	240.7	248.7	262.0	279.6
AGRICULTURE **Specific N_2O emissions from fertiliser and manure use [kg/kg]**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**
N_2O emissions from synthetic fertiliser and manure use [kt]	4.2	4.2	4.2	4.1	4.0
Use of synthetic fertiliser and manure,[kt nitrogen]	211.5	213.5	213.4	209.2	201.6
AGRICULTURE **Specific CH_4 emissions from cattle production [kg/head]**	**72.4**	**73.8**	**74.9**	**76.2**	**77.5**
CH_4 emissions from cattle [kt]	145.9	148.2	149.9	152.9	155.9
Cattle population [1 000 head]	2 013	2 007	2 001	2 006	2 011
WASTE **Specific CH_4 emissions from landfills [kt/kt]**	**NA**	**NA**	**NA**	**NA**	**NA**
CH_4 emissions from landfills [kt]	64.23	45.32	32.70	23.98	17.82
Municipal solid waste going to landfills [kt]*	0	0	0	0	0

** 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 55: 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 €]	279.78	305.92	339.70	376.66	420.41
1b. Gross Domestic Product growth rate	Annual growth rate [%]	2.0	2.0	2.3	2.1	2.3
2a. Population	[1 000 people]	8 388	8 556	8 726	8 877	9 021
3. International coal	[€ per GJ]	5.71	7.18	8.61	10.40	12.56
4. International oil	[€ per GJ]	10.41	13.09	15.70	18.97	22.91
5. International gas	[€ per GJ]	8.33	10.47	12.56	15.17	18.33
Assumptions for weather parameters						
18a. Heating Degree Days	Annual HDD	3 227	3 134	3 086	3 039	2 992
Assumptions for the Industry Sector						
19. Gross value-added total industry, billion € (EC 2000)	Value [€]	56.49	61.76	68.58	76.05	84.88
21. Growth of the industrial sector in GDP	growth rate per year [%]					
Metals		1.56	1.56	1.56	1.56	1.56
Mineral industries		– 0.20	– 0.20	– 0.20	– 0.20	– 0.20
Paper and print		2.17	2.17	2.17	2.17	2.17
Chemistry		2.08	2.08	2.08	2.08	2.08
Others		0.04	0.04	0.04	0.04	0.04
Assumptions for Buildings						
31a. Number of dwellings	(1 000)	3 662	3 851	4 042	4 227	4 401

Table 56: Parameters for projections – Energy sector: inland consumption, electricity generation, scenario „with existing measures".

	2010	2015	2020	2025	2030
6. Total gross inland consumption [PJ]	**1 399**	**1 437**	**1 478**	**1 524**	**1 579**
6a. Oil (fossil)	550	560	553	540	528
6b. Gas (fossil)	336	338	363	404	445
6c. Solid fuels	124	113	114	113	113
6d. Renewables	350	373	389	401	413
6e. Nuclear (IEA definition for energy calc.)	0	0	0	0	0
6f. Net Electricity import (–/+)	0	0	0	0	7
6g. Other[1)]	39	54	59	66	73
Total gross electricity generation by fuel type [GWhe]	66 815	68 103	71 369	75 819	79 747
7. Oil (fossil)	1 345	1 247	1 150	1 084	1 019
8. Gas (fossil)	12 994	10 467	11 291	14 654	17 852
9. Solid fuels	3 724	3 266	3 237	3 194	3 288
10. Renewable	46 184	49 751	51 499	52 246	52 441
11. Nuclear (IEA definition for energy calc.)	0	0	0	0	0
12. Other[2)]	2 569	3 373	4 192	4 640	5 148

[1)] waste (total), heat (total), hydrogen

[2)] waste (total) and unspecified autoproducers

Table 57: Parameters for projections – Energy sector: inland consumption, electricity generation, scenario "with additional measures".

		2010	2015	2020	2025	2030
6. Total gross inland consumption	PJ	1 308	1 299	1 325	1 321	1 371
6a. Oil (fossil)	PJ	549	495	467	412	386
6b. Gas (fossil)	PJ	337	325	332	360	422
6c. Solid fuels	PJ	350	380	416	427	426
6d. Renewables	PJ	32	45	47	49	52
6e. Nuclear (IEA definition for energy	PJ	0	0	0	0	0
6f. Net Electricity import (–/+)	PJ	0	0	0	0	0
6g. Other[1)]	PJ	39	56	64	74	86
Total gross electricity generation by	GWh	66 042	66 872	69 083	72 782	77 663
7. Oil (fossil)	GWh	1 345	1 247	1 150	1 084	1 019
8. Gas (fossil)	GWh	12 994	9 236	7 505	9 874	16 402
9. Solid fuels	GWh	2 951	3 266	3 237	3 194	2 246
10. Renewable	GWh	46 184	49 751	53 404	54 462	53 447
11. Nuclear (IEA definition for energy	GWh	0	0	0	0	0
12. Other[2)]	GWh	2 569	3 373	3 788	4 167	4 550

[1)] waste (total), heat (total), hydrogen

[2)] waste (total) and unspecified autoproducers

Table 58: Parameters for projections – energy demand by sector, scenario „with existing measures“.

	2010	2015	2020	2025	2030
Total Energy Demand [PJ]	**2 015**	**2 061**	**2 113**	**2 183**	**2 257**
13. Energy Industries	948	947	965	1 005	1 045
13a. Oil (fossil)	380	380	383	386	394
13b. Gas (fossil)	130	115	121	150	176
13c. Solid fuels	151	145	148	151	153
13d. Renewables	219	234	238	241	245
13e. Nuclear	0	0	0	0	0
13e. Other[1)]	68	74	75	77	77
14. Industry	284	314	340	371	403
14a. Oil (fossil)	12	13	14	15	17
14b. Gas (fossil)	102	118	134	150	164
14c. Solid fuels	17	15	13	11	11
14d. Renewables	43	48	47	51	55
14e. Electricity	89	95	104	113	121
14f. Heat (from CHP)	7	9	9	11	12
14g. Other	13	17	18	21	23
15. Commercial (Tertiary)	121	118	119	119	121
15a. Oil (fossil)	17	16	14	12	10
15b. Gas (fossil)	32	30	29	27	25
15c. Solid fuels	0	0	0	0	0
15d. Renewables	3	4	6	9	11
15e. Electricity	43	40	41	43	46
15f. Heat	27	27	28	28	29
16. Residential	0	0	0	0	0
16a. Oil (fossil)	264	252	242	232	222
16b. Gas (fossil)	59	52	45	36	28
16c. Solid fuels	51	48	45	42	39
16d. Renewables	3	2	2	1	1
16e. Electricity	59	55	53	52	50
16f. Heat	58	57	56	55	54
17. Transport	35	38	41	45	50
7a. Gasoline	0	0	0	0	0
of which biofuels	398	430	447	456	467
17b. Diesel	68	75	76	70	62
of which biofuels	2	5	6	6	6
17c. Jet Kerosine	285	306	315	319	324
17d. Other liquid fuels	21	23	32	33	35
17e. Gas (fossil)	28	30	32	34	36
17f. Renewables	0	0	0	0	0
17g. Other[2)]	9	11	14	18	24

[1)] *waste (total) + electricity demand of sector + transportation losses*

[2)] *electricity, coal and hydrogen*

Table 59: Parameters for projections – energy demand by sector, scenario "with additional measures".

	2010	2015	2020	2025	2030
Total Energy Demand [PJ]	**2 005**	**1 985**	**2 017**	**2 027**	**2 087**
13. Energy Industries	946	935	946	976	1 016
13a. Oil (fossil)	380	374	373	375	382
13b. Gas (fossil)	130	104	98	114	161
13c. Solid fuels	144	145	148	151	144
13d. Renewables	225	239	252	260	252
13e. Nuclear	0	0	0	0	0
13e. Other[1)]	67	74	75	76	76
14. Industry	275	305	334	363	393
14a. Oil (fossil)	12	13	14	15	17
14b. Gas (fossil)	102	118	134	149	164
14c. Solid fuels	17	15	13	11	11
14d. Renewables	37	43	47	51	55
14e. Electricity	87	92	98	105	112
14f. Heat (from CHP)	7	8	9	10	11
14g. Other	13	17	19	21	23
15. Commercial (Tertiary)	121	116	114	110	108
15a. Oil (fossil)	17	15	12	9	7
15b. Gas (fossil)	32	29	26	23	20
15c. Solid fuels	0	0	0	0	0
15d. Renewables	3	6	10	13	15
15e. Electricity	42	39	37	36	37
15f. Heat	26	27	28	28	29
16. Residential	0	0	0	0	0
16a. Oil (fossil)	264	249	235	219	206
16b. Gas (fossil)	59	50	40	28	18
16c. Solid fuels	51	46	41	35	31
16d. Renewables	3	2	1	1	0
16e. Electricity	59	56	54	52	49
16f. Heat	58	57	57	56	56
17. Transport	35	38	42	46	52
17a. Gasoline	0	0	0	0	0
of which biofuels	398	380	389	359	364
17b. Diesel	68	66	60	45	33
of which biofuels	2	6	6	6	5
17c. Jet Kerosine	285	264	269	241	240
17d. Other liquid fuels	21	25	36	34	36
17e. Gas (fossil)	28	29	32	34	36
17f. Renewables	0	0	0	0	0
17g. Other[2)]	9	12	15	20	26

[1)] *waste (total) + electricity demand of sector + transportation losses*

[2)] *electricity, coal and hydrogen*

Table 60: 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	81 030	88 745	97 916	110 580	127 530
24b. Total kilometres driven by passenger cars,	Mkm	69 289	76 957	85 604	96 098	108 489
25a. Growth of freight tonne kilometres	Mtkm	145 379	170 035	189 194	209 732	229 427
25b. Freight transport (all modes)	Mtkm	15 507	18 180	21 354	24 961	28 563
Assumptions for buildings (residential and commercial or tertiary sector)						
26. Gross value-added – services (Ec 2000)	Value [billion €]	82.0	90.0	101.2	116.2	136.6
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	310.5	306.0	301.4	297.7	293.9
35. Swine	1 000 heads	2 964.7	2 944.8	2 924.9	2 857.3	2 789.8
36. Poultry	1 000 heads	12 551.4	12 456.3	12 361.1	12 028.1	11 695.1
37. Other (goats, horses, …)	1 000 heads	186.3	185.5	184.6	183.7	182.9
39. Fertiliser Used (Synthetic & Manure)	kt Nitrogen	211.5	210.8	209.5	205.6	198.1

Table 61: 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	81 031	78 846	82 125	81 181	89 617
24b. Total kilometres driven by passenger cars	Mkm	69 289	68 327	71 471	70 751	77 491
25a. Growth of freight tonne kilometres	Mtkm	145 379	132 502	150 383	139 180	151 706
25b. Freight transport (all modes)	Mtkm	15 507	14 563	17 280	16 885	19 017
Assumptions for buildings (residential and commercial or tertiary sector)						
26. Gross value-added – services (Ec 2000)	Value [billion €]	82.1	88.5	97.4	108.9	123.7
Assumptions in the agriculture sector						
33. Total cattle	1 000 heads	2 013.3	2 007.4	2 001.5	2 006.1	2 010.8
33a. Dairy cattle	1 000 heads	532.7	539.1	545.4	543.6	541.9
33b. Non-dairy cattle	1 000 heads	1 480.5	1 468.3	1 456.1	1 462.5	1 468.9
34. Sheep	1 000 heads	310.5	304.6	299.8	296.1	292.4
35. Swine	1 000 heads	2 964.7	2 927.7	2 904.9	2 850.4	2 795.9
36. Poultry	1 000 heads	12 551.4	12 443.2	12 345.9	12 005.3	11 664.7
37. Other (goats, horses, …)	1 000 heads	186.3	183.8	182.7	181.2	179.7
39. Fertiliser Used (Synthetic & Manure)	kt Nitrogen	211.5	213.5	213.4	209.2	201.6

Policies and Measures

Table 62: Policies & Measures I.

P&M-No	Status of policy, measure or group	Scenario	Name of policy or measure (or group)	Common and coordinated policy and measure (CCPM)
01_IP	implemented	WEM	Solvent Ordinance Federal Law Gazette II No. 398/2005 , amendment of Federal Law Gazette No. 872/1995 ; amendment of Federal Law Gazette No. 492/1991	Council Directive 2004/42/CE of the European Parliament and of the Council of 21 April 2004 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 and amending Directive 1999/13/EC
02_IP	implemented	WEM	Ordinance for paint finishing system (surface technology systems) Federal Law Gazette No. 873/1995; amendment of Federal Law Gazette No. 27/1990	
03_IP	implemented	WEM	Federal Ozone Act: Federal Law Gazette No. 309/1994; amendment of Federal Law Gazette No. 210/1992	
04_IP	implemented	WEM	Ordinance on chlorinated hydrocarbons in industrial facilities and installations : Federal Law Gazette No. 865/1994	
05_IP	implemented	WEM	Ordinance limiting emissions of volatile organic compounds (VOC) due to the use of organic solvents in certain activities and installations; Federal Law Gazette II No. 301/2002 , amended by Federal Law Gazette II No. 42/2005	Council Directive 1999/13/EC of March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activi-ties and installations
06_IP	implemented	WEM	Ordinance on the limitation of emissions during the use of solvents containing highly volatile halogenated hydrocarbons in industrial facilities and installations: Federal Law Gazette II No. 411/2005	
01_EN	implemented	WEM	Domestic environmental support scheme (UFI)	
02_EN	implemented	WEM+ WAM	Green Electricity Act (Federal Law Gazette I No. 149/2002 amended by Federal Law Gazette I No. 114/2008)	Energy supply: Electricity production from renewable energy sources (Directive 2001/77/EC)
03_EN	implemented	WEM	Emission Trading System (ETS)	Cross-cutting: EU ETS directive 2003/87/EC as amended by Directive 2008/101/EC and Directive 2009/29/EC
04_EN	expired	WEM	EU Water Framework Directive (2000/60/EC)	Cross-cutting: EU ETS Directive 2003/87/EC as amended by Directive 2008/101/EC and Directive 2009/29/EC
05_EN	implemented	WEM	Austrian Climate and Energy Fund (KLI.EN)	Energy supply: Electricity production from renewable energy sources (Directive 2001/77/EC)

P&M-No	Status of policy, measure or group	Scenario	Name of policy or measure (or group)	Common and coordinated policy and measure (CCPM)
06_EN	implemented	WEM	Support for combined heat and power (CHP) Federal Law Gazette I No. 45/2008	Energy supply: Promotion of cogeneration (Directive 2004/8/EC)
07_EN	planned	WAM	Directive 2006/32/EC on energy end-use efficiency and energy services and the corresponding first Austrian energy efficiency action plan	Energy consumption: End-use efficiency and energy services (Directive 2006/32/EC)
08_EN	planned	WAM	Eco Design Directive (2005/32/EC)	Energy consumption: Ecodesign requirements for energy-using products (Directive 2005/32/EC) and its implementing regulations
01_WASTE	implemented	WEM+ WAM	Landfill Ordinance: deposition of untreated biodegradable waste, Federal Law Gazette No. 164/1996, Federal Law Gazette No. II 2008/39	Waste: Landfill Directive (Directive 1999/31/EC)
02_WASTE	implemented	WEM+ WAM	Landfill Ordinance: collection and extraction of landfill gas Federal Law Gazette No. 164/1996, Federal Law Gazette No. II 2008/39	Waste: Landfill Directive (Directive 1999/31/EC)
03_WASTE	expired	WEM+ WAM	Remediation of Contaminated Sites Act Federal Law Gazette No. 299/1989	Non CCPM National Policy
04_WASTE	implemented	WEM+ WAM	Guideline for the Mechanical Biological Treatment of Waste (BMLFUW 2002), a relevant Ordinance is in preparation	Waste: Landfill Directive (Directive 1999/31/EC)
01_IND	implemented		Environmental support scheme for installations (UFI)	Non CCPM National Policy
02_IND	implemented	WEM+ WAM	Green Electricity Act (Federal Law Gazette I No. 149/2002 amended by Federal Law Gazette. I No. 114/2008)	Non CCPM National Policy
03_IND	implemented	WEM	Emission Trading System (ETS)	Cross-cutting: Kyoto Protocol project mechanisms (Directive 2004/101/EC)
07_IP	implemented	WEM	Austrian F-Gas Ordinance Federal Law Gazette II No. 447/2002 and its amendment 2007 Federal Law Gazette II No139/2007)	Industrial Process: F-Gas Regulation (Regulation No. 842/2006)
08_IP	adopted	WEM	EU F-Gas Regulation 842/2006/EC	Industrial Process: F-gas Regulation (Regulation No. 842/2006)
09_IP	adopted	WEM	HFC emissions from air conditioning in motor vehicles Dir. 2006/40/EC	Industrial Process: HFC emissions from air conditioning in motor vehicles (Directive 2006/40/EC)
01_TRA	expired	WEM	ACEA – voluntary agreement on CO_2 emissions from newly registered vehicles 1998: (ACEA, KAMA, JAMA1) [COM(98) 495 final.); (Basis: Strategy [COM (95) 689])	Transport: Voluntary agreement with car manufacturers to reduce specific CO_2 emissions (ACEA, KAMA, JAMA)
02_TRA	implemented	WEM+ WAM	CO_2 labelling and other measures to reduce emissions from passenger cars	Transport: Labelling of new passenger cars (Directive 1999/94/EC)
03_TRA	implemented	WEM+ WAM	Mileage based toll for lorries	Transport: Eurovignette Directive (2006/38/EC)

P&M-No	Status of policy, measure or group	Scenario	Name of policy or measure (or group)	Common and coordinated policy and measure (CCPM)
04_TRA	implemented	WEM+ WAM	Promotion of biofuels and wider use of electric vehicles, tax exeption and reductions for pure biofuels and fuels blended with biofuels, Federal Law Gazette II No. 417/2004	Transport: Biofuels Directive (Directive 2003/30/EC)
05_TRA	implemented	WEM+ WAM	Euro classification	Transport: Regulation EURO 5 and 6 2007/715/EC
06_TRA	adopted	WEM+ WAM	Measures concerning infrastructure, public transport and mobility management	Transport: Shifting the balance between modes of transport, in particular towards rail (2001/12/EC, 2001/13/EC, 2001/14/EC of 15/03/01 Regulation 881/2004 of 29/04/2004, 2001/49/EC, 2001/50/EC, 2001/51/EC of 29/04/2004)
07_TRA	implemented	WEM+ WAM	klima:aktiv-->mobility programme	Transport: Shifting the balance between modes of transport, in particular towards rail (2001/12/EC, 2001/13/EC, 2001/14/EC of 15/03/01 Regulation 881/2004 of 29/04/2004, 2001/49/EC, 2001/50/EC, 2001/51/EC of 29/04/2004)
08_TRA	implemented	WEM	enhanced fuel efficiency of cars	Transport: Voluntary agreement with car manufacturers to reduce specific CO_2 emissions (ACEA, KAMA, JAMA)
09_TRA	planned	WAM	speed limits, traffic control systems and supporting measures	Non CCPM National Policy
01_B	expired	WEM	measure group: stepping up the use of renewable energy in the sector residential and commercial	Energy consumption: Energy performance of buildings (Directive 2002/91/EC)
02_B	implemented	WEM	measure group: stepping up building renovation	Energy consumption: Energy performance of buildings (Directive 2002/91/EC)
03_B	implemented	WEM	measure group: stepping up the replacement of heating systems	Energy consumption: Energy performance of buildings (Directive 2002/91/EC)
04_B	implemented	WEM	measure group: public support for new buildings	Energy consumption: Energy performance of buildings (Directive 2002/91/EC)
05_B	planned	WAM	measure group: additional measures to reduce energy consumption in the sectors residential and commercial	Non CCPM National Policy
06_B	implemented	WEM	National energy efficiency action plan (EEAP) in the residential and commercial sector for heating and hot water	Energy consumption: End-use efficiency and energy services (Directive 2006/32/EC)
07_B	planned	WAM	measure group: additional measures to reduce electric power consumption in the sector residential and commercial for heating and hot water	Energy consumption: Ecodesign requirements for energy-using products (Directive 2005/32/EC) and its implementing regulations.
01_AGR	implemented	WEM	Implementation of the Common Agricultural Policy (CAP) 2003 reform	Agriculture: Common rules for direct support schemes under CAP (Regulation (EC) No. 1782/2003)

P&M-No	Status of policy, measure or group	Scenario	Name of policy or measure (or group)	Common and coordinated policy and measure (CCPM)
02_AGR	implemented	WEM	Austrian implementation of the CAP	Agriculture: Common rules for direct support schemes under CAP (Regulation (EC) No. 1782/2003)
03_AGR	implemented	WEM	Funds from "modulation"	Agriculture: Common rules for direct support schemes under CAP (Regulation (EC) No. 1782/2003)
04_AGR	implemented	WEM	Land is maintained in good agricultural and ecological condition ("cross compliance")	Agriculture: Common rules for direct support schemes under CAP (Regulation (EC) No. 1782/2003)
05_AGR	implemented	WEM	The programme for rural development is maintained in an unmodified way	Agriculture: Support for rural development (Regulation (EC) No. 1783/2003 amending a number of other Regulations)
06_AGR	implemented	WEM	Implementation of the Biofuels Directive in Austria	Agriculture: Common rules for direct support schemes under CAP (Regulation (EC) No. 1782/2003)
07_AGR	implemented	WEM	Grassland maintenance	Agriculture: Common rules for direct support schemes under CAP (Regulation (EC) No. 1782/2003)
08_AGR	planned	WAM	Price increase for crops	Agriculture: Agricultural production methods compatible with environment (Regulation (EEC) No. 2078/92)
09_AGR	planned	WAM	25% more organic farming within the given budget of the programme for rural development (additional premiums are offset by an equivalent reduction of premiums for "Grundförderung" i.e. basic subsidies)	Agriculture: Support for rural development (Regulation (EC) No. 1783/2003 amending a number of other Regulations)
10_AGR	adopted	WAM	Payments for investments in emission reducing animal production technologies (funded by the programme for rural development) e. g. slurry and manure store facilities, slurry hose techniques	Agriculture: Support for rural development (Regulation (EC) No. 1783/2003 amending a number of other Regulations)
11_AGR	implemented	WAM	Setting aside additional land for short rotation forests	Agriculture: Support for rural development (Regulation (EC) No. 1783/2003 amending a number of other Regulations)
12_AGR	expired	WAM	Use of slurry for biogas production	Energy supply: Internal electricity market (Directive 2003/54/EC) including provision of the third package
13_AGR	expired	WAM	Use of 13 500 hectares of set aside land for biogas production from silage maize (from 2008 on)	Energy supply: Internal electricity market (Directive 2003/54/EC) including provision of the third package
14_AGR	implemented	WAM	Use of 10 000 ha silage of grassland and alfalfa (from 2008 onwards)	Energy supply: Internal electricity market Directive 2003/54/EC) including provision of the third package
10_TRA	planned		Increased fuel tax	Transport: Shifting the balance between modes of transport, in particular towards rail (2001/12/EC, 2001/13/EC, 2001/14/EC of 15/03/01 Regulation 881/2004 of 29/04/2004, 2001/49/EC, 2001/50/EC, 2001/51/EC of 29/04/2004)

IP = Industrial processes, EN = EnergySupply, IND = Industry, TRA = Transport, RES = Residential, AGR = Agriculture

P&M-No	Status of policy, measure or group	Scenario	Name of policy or measure (or group)	Common and coordinated policy and measure (CCPM)
11_TRA	adopted		Modal Shift in passenger transport (group of measures)	Transport: Shifting the balance between modes of transport, in particular towards rail (2001/12/EC, 2001/13/EC, 2001/14/EC of 15/03/01 Regulation 881/2004 of 29/04/2004, 2001/49/EC, 2001/50/EC, 2001/51/EC of 29/04/2004)
12_TRA	implemented		Promotion of feeder lines in freight transport	Transport: Biofuels Directive (Directive 2003/30/EC)
13_TRA	planned		More efficient vehicle use (group of measures)	Transport: Shifting the balance between modes of transport, in particular towards rail (2001/12/EC, 2001/13/EC, 2001/14/EC of 15/03/01 Regulation 881/2004 of 29/04/2004, 2001/49/EC, 2001/50/EC, 2001/51/EC of 29/04/2004)

IP = Industrial processes, EN = EnergySupply, IND = Industry, TRA = Transport, RES = Residential, AGR = Agriculture

Table 63: Policies & Measures II.

P&M-No	Objective of measure(s)	Type of instruments
01_IP	limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products in order to combat acidification and ground-level ozone	Reg
02_IP	limitation of emissions of volatile organic compounds due to the use of organic solvents by activities such as surface coating, painting or varnishing of different materials and products along the entire chain in the painting process in order to combat acidification and ground-level ozone	Reg
03_IP	establishes a reduction in emissions of ozone precursors NOx and NMVOC by various measures	Reg
04_IP	for limitation of emissions of chlorinated organic solvents from industrial facilities and installations using chlorinated hydrocarbons	Reg
05_IP	limitation of VOCs	Reg
06_IP	limitation of VOC emissions during the use of solvents containing highly volatile halogenated hydrocarbons in industrial facilities and installations	Reg
01_EN	GHG-relevant are funded projects for energy efficiency and renewables	Fi
02_EN	The “Green Electricity Act” promotes power production from renewable energy sources. Power plants based on renewable energy sources are granted a fixed feed-in tariff at least for the first ten years of operation. The objective of the Green Electricity Act currently in force is to raise the share of electricity from RES in electricity consumption in the public grid to 10% by 2010, a target which is not likely to be achieved.	Reg
03_EN	However, an amendment to the Green Electricity Act which has been adopted by the Austrian government but not yet approved by the European Commission intends to raise the share of all power plants based on RES and supported under the Green Electricity Act in electricity consumption through thepublic grid to 15% by 2015. Among other amendments the feed-in time was raised to 13 years in general and 15 years for power plants based on biomass, respectively.	Ec
04_EN	The objective is to limit CO_2 emissions from large power plants and industrial plants through a trading mechanism for emission certificates.	Reg
05_EN	The improvement of water bodies has a negative effect on the production of electricity from hydro power plants.	Ec
06_EN	The objective is to meet the target specified under the Kyoto Protocol for Austria. One energy related measure is to allocate subsidies to PV plants < 5 kW. (PV= Photovoltaics)	Ec
07_EN	The objective is to expand the Austrian CHP facilities.	Ec, Reg, Inf, Rew
08_EN	energy savings target of 9% by 2016	Reg
01_WASTE	minimum ecodesign requirements for specific energy-using products	Reg
02_WASTE	reduction of the deposition of untreated deposited waste	Reg
03_WASTE	mandatory collection and extraction of landfill gas originating from mass (municipal) waste landfills	Fis
04_WASTE	higher costs for the deposition of wastes on landfills without gas collection	P
01_IND	reduction of the gas formation potential of deposited waste and re-sorting of feedstock	Fis
02_IND	GHG-relevant are funded projects for energy efficiency and renewables	Ec, Fis
03_IND	Subsidies and funds for electricity from renewable energy sources (RES)	Ec, Reg
07_IP	limit CO_2 emissions from large power plants and industrial plants through a trading mechanism for emission certificates	Reg
08_IP	reducing and phasing out the use of HFCs, PFCs and SF6 in all relevant applications on the basis of the Federal Chemicals Act	Reg
09_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

P&M-No	Objective of measure(s)	Type of instruments
01_TRA	Raising the market share of advanced engine technologies with low fuel consumption	Reg, Inf
02_TRA	Raising the market share of advanced engine technologies with low fuel consumption	Vo
03_TRA	Internalisation of external costs for road transport	Vo, Reg
04_TRA	Minimum shares for transport fuels from renewable energy sources	Trh
05_TRA	drowtown of the emission limits	Ec, Inf
06_TRA	Increase the share of public transport in passenger transport	Ec, Inf, Ed
07_TRA	The programme klima:aktiv mobil provides financial support and consultation for mobility management	Vo
08_TRA	Raising the market share of advanced engine technologies with low fuel consumption	Reg
09_TRA	Indirect fuel efficiency of cars	Ec, Reg, Inf, Ed
01_B	reduce GHGs by stepping up the use of renewables (biomass, solar heat, heat pumps)	Ec, Reg, Inf, Ed
02_B	improve thermal building envelopes (house front, windows, top and bottom floor ceiling) and the overall renovation rate	Ec, Reg, Inf
03_B	give financial support and make people aware of the fact that old, inefficient heating systems should be replaced	Ec, Reg, Inf, Ed
04_B	grant financial subsidies (credit, cash) for better thermal insulation of new buildings	Ec, Reg
05_B	further reduction of GHGs by compulsory exchange of heating systems older than 30 years; new heating systems with fossil fuels have to use condensing boiler technology, further increase in renovation rates	Reg, Inf
06_B	further improvement of energy efficiency	Reg, Inf
07_B	reduction of electric energy consumption	Ec, Reg
01_AGR	reduction of environmental pollution from agricultural activity	Ec, Reg, Inf
02_AGR	incentives for livestock holders in less favoured regions	Ec, Fis, Reg
03_AGR	big farms losing their benefits to the environmental programme	Ec, Reg
04_AGR	decoupling of the production and maintenance of unproductive argricultural areas	Ec, Vo, Reg
05_AGR	support of environmental measures in the agricultural sector	Ec, Vo, Reg
06_AGR	promoting the production of biomass for liquid energy purposes	Ec, Reg
07_AGR	grassland maintenance	Reg
08_AGR	price development based on biofuel demand	Ec, Vo
09_AGR	Increase in organically farmed area	Ec, Vo
10_AGR	new installations and improvement of livestock stables and manure storage	Ec, Vo
11_AGR	Increase in short rotation areas	Ec, Vo
12_AGR	support of manure fermentation	Ec, Vo
13_AGR	support of agricultural crops via the Green Electricity Act	Ec, Vo

IP = Industrial processes, EN = EnergySupply, IND = Industry, TRA = Transport, RES = Residential, AGR = Agriculture

P&M-No	Objective of measure(s)	Type of instruments
14_AGR	support of agricultural crops via the Green Electricity Act	Ec, Vo
10_TRA	reducing individual motorised transport and moving towards public transport	Ec, Fi
11_TRA	improvements of public transport systems to make public transport more attractive and supporting the modal shift from individual motorised transport to public transport	Vo, Inf, Ed, P
12_TRA	improvement of rail infrastructure at company sites to shift transport from road to rail.	Ec, Fi
13_TRA	Speed limits, measures to increase biofuels and electro mobility to make vehicle use in individual motorised transport more efficient.	Vo, Reg, Res

Ec = Economic, Fi = Fiscal, Vo = Voluntary, Reg =regulatory, Inf = Information, Ed = Education, Res = Research, P = Planning, O = Other

Table 64: Policies & Measures III.

P&M-No	**GHG affected**	**Ex-ante (Projected) Estimate of GHG emission reduction effect or sequestration effect in Gg CO_2e per year for the year(s) indicated**			**Indicators used to monitor progress of implementation**
		2010	**2015**	**2020**	
01_IP	CO_2	NE	NE	NE	no indicator
02_IP	CO_2	NE	NE	NE	no indicator
03_IP	CO_2	NE	NE	NE	no indicator
04_IP	CO_2	NE	NE	NE	no indicator
05_IP	CO_2	NE	NE	NE	no indicator
06_IP	CO_2	NE	NE	NE	no indicator
01_EN	CO_2, CH_4, N_2O	– 39.00	NE	NE	total for the years 2008–2012 for non-ETS sector: 195 Gg CO2e
02_EN	CO_2	– 2.24	– 3.29	– 3.97	yearly reduction by subsidised green electricity plants; indicators are the share of electricity from RES in electricity consumption in the public grid and the yearly installed capacity of renewable energy plants
03_EN	CO_2	NE	NE	NE	ETS cannot be estimated
04_EN	CO_2	0.00	– 160.00	– 300.00	a 400 GWh reduction of electricity produced by fossil fuels by 2015 and a 750 reduction by 2020
05_EN	CO_2	– 1.46	– 3.08	– 3.08	programme from 2008–2010, a 3.66 GWh reduction of electricity produced by fossil fuels is expected by 2010 and a 7.71 GWh reduction by 2015 and 2020 respectively
06_EN	CO_2	NE	NE	NE	no indicator
07_EN	CO_2	NE	NE	NE	annual final domestic energy consumption of all energy users within the scope of the directive
08_EN	CO_2	NE	NE	NE	no indicator
01_WASTE	CH_4	NE	NE	NE	amount waste landfilled
02_WASTE	CH_4	NE	NE	NE	amount gas collected
03_WASTE	CH_4	NE	NE	NE	amount gas collected
04_WASTE	CH_4	NE	NE	NE	reduction of gas formation potential
01_IND	CO_2, CH_4, N_2O	NE	NE	NE	no indicator
02_IND	CO_2	IE	IE	IE	no indicator
03_IND	CO_2	NE	NE	NE	no indicator
07_IP	HFC, PFC, SF_6	– 30.00	– 18.00	– 17.00	no indicator
08_IP	HFC, PFC, SF_6	– 14.00	– 3.00	– 2.00	no indicator
09_IP	HFC	– 10.00	– 17.00	– 6.00	no indicator
01_TRA	CO_2, N_2O	NE	NE	NE	no indicator
02_TRA	CO_2	NE	NE	NE	no indicator
03_TRA	CO_2	NE	NE	NE	no indicator

P&M-No	GHG affected	Ex-ante (Projected) Estimate of GHG emission reduction effect or sequestration effect in Gg CO_2e per year for the year(s) indicated			Indicators used to monitor progress of implementation
		2010	2015	2020	
04_TRA	CO_2	– 1 653	– 2 110	– 2 766	no indicator
05_TRA	CO_2, CH_4, N_2O	NE	NE	NE	no indicator
06_TRA	CO_2, CH_4, N_2O	NE	NE	NE	no indicator
07_TRA	CO_2, CH_4, N_2O	– 250	– 250	– 250	no indicator
08_TRA	CO_2, N_2O	– 160	– 833	– 1 715	no indicator
09_TRA	CO_2, N_2O	0.0	– 433	– 390	no indicator
01_B	CO_2				statistics of yearly sold facilities (for log wood, pellets, wood chips, heat pumps, solar heat) number of facilities subsidised by local authorities
02_B	CO_2	– 129	– 388	– 660	statistics of implemented thermal renovations from local authorities, census of renovation measures in households (every two years), modelled average heating demand (HWB)
03_B	CO_2	– 96	– 290	– 670	statistics of actual replacements of heating systems by subsidies, new sales volumes of individual heating systems
04_B	CO_2	– 94	– 212	– 330	subsidies spent on new (low-energy) buildings in €
05_B	CO_2	– 31	– 407	– 953	no indicator
06_B	CO_2	NE	NE	NE	electric energy consumption
07_B	CO_2	NE	NE	NE	electric energy consumption
01_AGR	CO_2, CH_4, N_2O	NE	NE	NE	The agricultural set-aside area is an instrument to influence the market supply. In 2005 it was dropped
02_AGR	CH_4, N_2O	NE	NE	NE	Young beef units are a main target of support for farmers under conditions
03_AGR	CO_2	NE	NE	NE	big farms losing their benefits to environmental programme
04_AGR	CO_2, N_2O	NE	NE	NE	decoupling of the production and maintenance of unproductive agricultural areas
05_AGR	CO_2, CH_4, N_2O	NE	NE	NE	support of environmental measures in agricultural
06_AGR	CO_2, N_2O	NE	NE	NE	promoting production of biomass for energy purpose
07_AGR	CO_2, N_2O	NE	NE	NE	grassland will be maintained as a sustainable resource for the production of biomass on steep hills and mountains

P&M-No	GHG affected	Ex-ante (Projected) Estimate of GHG emission reduction effect or sequestration effect in Gg CO_2e per year for the year(s) indicated			Indicators used to monitor progress of implementation
		2010	2015	2020	
08_AGR	CO_2, N_2O	NE	NE	NE	price for energy crops based on development of biofuel demand
09_AGR	CO_2, CH_4, N_2O	NE	NE	NE	the development of organic farming is a main goal for GHG emission reductions – mainly N_2O
10_AGR	CH_4, N_2O	NE	NE	NE	Investments and support for new installations of livestock stables and manure storage cause reductions of CH_4 and N_2O emissions.
11_AGR	CO_2	NE	NE	NE	Short rotation areas with quick-growing trees should be increased
12_AGR	CH_4, N_2O	NE	NE	NE	Application of manure as a basis for fermentation to bio-gas is intended
13_AGR	CO_2, CH_4, N_2O	NE	NE	NE	Support of agricultural crops for fermentation is intro-duced
14_AGR	CH_4, N_2O	NE	NE	NE	Support of agricultural crops for fermentation is intro-duced
10_TRA	CH_4, N_2O	NE	– 3 101	– 2 979	no indicator
11_TRA	CH_4, N_2O	NE	– 302	– 805	no indicator
12_TRA	CH_4, N_2O	NE	– 101	– 124	no indicator
13_TRA	CH_4, N_2O	NE	– 761	–1 176	no indicator

IP = Industrial processes, EN = EnergySupply, IND = Industry, TRA = Transport, RES = Residential, AGR = Agriculture

ANNEX 2: ADDITIONAL KEY INPUT PARAMETERS FOR SECTORAL FORECASTS

Residential, Commercial & Other Sectors

Table 65: Assumptions for energy prices – scenarios WEM & WAM.

residential sector [cent/kWh]	2010	2015	2020	2025	2030
coal	3.68	3.59	3.98	4.25	4.54
wood log and wood briquettes	3.56	3.64	3.75	3.88	4.02
wood chips	3.08	3.15	3.24	3.36	3.48
wood pellets	4.46	4.56	4.7	4.86	5.03
natural gas	7.09	7.32	7.68	8.1	8.56
heating and Other Gas Oil (HEL 2007)	7.88	8.23	8.77	9.41	10.1
distr. heat Vienna	4.15	4.25	4.41	4.59	4.78
distr. heat Other	5.37	5.5	5.7	5.93	6.18
distr. heat biomass	4.77	4.89	5.06	5.27	5.49
commercial sector [cent/kWh]	**2010**	**2015**	**2020**	**2025**	**2030**
coal	3.07	2.99	3.32	3.54	3.78
wood log and wood briquettes	2.97	3.03	3.13	3.23	3.35
wood chips	2.57	2.63	2.7	2.8	2.9
wood pellets	3.72	3.8	3.92	4.05	4.19
natural gas	5.91	6.1	6.4	6.75	7.13
heating and Other Gas Oil (HEL 2007)	6.57	6.86	7.31	7.84	8.42
distr. heat Vienna	3.46	3.54	3.68	3.83	3.98
distr. heat Other	4.48	4.58	4.75	4.94	5.15
distr. heat biomass	3.98	4.08	4.22	4.39	4.58

Table 66: Assumptions on subsidy rates – scenario "with existing measures".

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
solarthermie	20–25	20–25	20–25	20–25	20–25
renovation measures (insulation and window)	5–15	5–15	5–15	5–15	5–15

Table 67: Assumptions on subsidy rates – scenario "with additional measures".

subsidy rates [%]	2010	2015	2020	2025	2030
wood log and wood briquettes	35	35	35	35	35
wood chips	38	38	38	38	38
wood pellets	38	38	38	38	38
distr. heat Vienna	15	15	15	15	15
distr. heat Other	15	15	15	15	15
distr. heat biomass	23	23	23	23	23
solarthermie	33–38	33–38	33–38	33–38	33–38
renovation measures (insulation and window)	40	40	40	40	40

Table 68: Assumptions for the number and size of buildings, and the number of permanently occupied dwellings – scenarios WEM & WAM.

Number of buildings		**2010**	**2015**	**2020**	**2025**	**2030**
residential buildings with one or two apartments	number	1 480 340	1 528 027	1 569 913	1 601 558	1 626 402
residential buildings with more than two apartments	number	196 468	202 839	208 437	212 671	215 999
commercial buildings	number	149 790	162 400	176 118	184 171	192 606
Size of buidlings		**2010**	**2015**	**2020**	**2025**	**2030**
residential buildings with one or two apartments	million m² gross floor area	250	258	265	271	275
residential buildings with more than two apartments	million m² gross floor area	162	168	174	178	181
commercial buildings	million m³ gross floor volume	164	177	191	200	209
Number of permanently occupied dwellings		**2010**	**2015**	**2020**	**2025**	**2030**
residential buildings with one or two apartments	number in 1 000	1 747	1 801	1 848	1 883	1 910
residential buildings with more than two apartments	number in 1 000	1 915	2 050	2 194	2 344	2 491

Agriculture

Table 69: Assumptions for macro-economic variables in the European Union (Sources: OECD-FAO 2010; UMWELTBUNDESAMT 2011).

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
real GDP	%	1.0	1.8	2.3	2.2	2.2	2.2	2.2	1.7	1.7	1.7
price deflator	%	0.5	0.6	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Population	%	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
GDP deflator	%	0.5	0.6	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0
world oil price	USD/ barrel	80.0	82.7	85.7	88.8	92.1	95.4	98.9	102.5	106.2	110.1

Prices have been derived from OECD-FAO outlooks on agricultural markets (see OECD-FAO, 2010). Projections of the EU Commission (CEC 2010) show very similar assumptions about future developments of key economic indicators.

ANNEX 3: ADDITIONAL KEY OUTPUT PARAMETERS FOR SECTORAL FORECASTS

Energy Industries

Scenario „with existing measures"

Table 70: Projected fuel input into power and heat plants – scenario "with existing measures".

Energy [TJ]	2010	2015	2020	2025	2030
Bituminous Coal and Anthracite	24 515	14 136	13 859	13 610	10 515
Residual Fuel Oil	13 077	11 319	9 602	8 704	7 865
Natural gas	112 441	93 420	102 687	127 327	153 465
Waste	21 449	29 808	29 984	30 164	30 348
Biomass	71 549	72 643	58 100	56 608	57 522
Hydropower	141 202	146 927	152 652	152 441	152 332
Wind power	7 489	12 660	18 679	21 685	22 696
Photovoltaics	196	590	985	1 379	1 773
Geothermal	524	1 193	1 863	1 863	1 863

Scenario "with additional measures"

Table 71: Projected fuel input into power and heat plants – scenario "with additional measures".

Energy [TJ]	2010	2015	2020	2025	2030
Bituminous Coal and Anthracite	18 005	14 136	13 859	13 610	1 745
Residual Fuel Oil	13 077	11 319	9 602	8 704	7 865
Natural gas	112 441	85 350	78 654	94 364	140 613
Waste	21 449	29 808	29 984	30 164	30 348
Biomass	71 532	72 643	71 263	73 050	61 931
Hydropower	141 202	146 927	152 652	152 441	152 332
Wind power	7 489	12 660	18 679	21 685	22 696
Photovoltaics	196	590	985	1 379	1 773
Geothermal	524	1 193	1 863	1 863	1 863

Manufacturing Industries and Construction

Scenario „with existing measures“

Table 72: Final energy demand of industry – scenario “with existing measures”.

Energy [TJ]	2010	2015	2020	2025	2030
Coal without coke	6 925	4 525	2 412	0	0
Coke	7 084	7 275	7 275	7 275	7 275
Light Fuel Oil	3 075	3 636	4 383	5 282	6 365
Heavy Fuel Oil	6 744	6 687	6 806	6 948	7 126
Other petr. Products	2 480	2 659	2 950	3 259	3 578
Natural gas	101 959	118 265	133 670	149 826	164 300
Derived gas	2 660	2 779	3 075	3 407	3 641
Waste	12 655	16 574	18 480	20 579	22 879
Biomass	37 019	42 859	47 252	51 390	54 658
Electricity	89 492	95 487	104 036	112 847	121 366
Heat	7 493	8 511	9 463	10 517	11 735

Scenario “with additional measures”

Table 73: Final energy demand of industry – scenario “with additional measures”.

Energy [TJ]	2010	2015	2020	2025	2030
Coal without coke	6 872	4 449	2 357	0	0
Coke	7 084	7 275	7 275	7 275	7 275
Light Fuel Oil	3 063	3 625	4 352	5 218	6 279
Heavy Fuel Oil	6 701	6 613	6 684	6 774	6 928
Other Petr. Products	2 465	2 626	2 893	3 169	3 469
Natural gas	102 558	118 847	134 123	149 712	164 002
Derived gas	2 660	2 771	3 053	3 369	3 596
Waste	12 670	16 687	18 662	20 794	23 160
Biomass	37 029	42 930	47 362	51 464	54 756
Electricity	86 898	91 652	98 005	104 920	112 166
Heat	7 454	8 424	9 314	10 291	11 465

Transport

Table 74: Energy consumption of mobile sources by fuel – scenario "with existing measures".

[TJ]	gasoline fossil	diesel fossil	bioethanol	biodiesel	vegetable oil	natural gas
1990	106 533	88 904	0	0	0	0
2005	86 512	262 469	0	3 395	0	0
2010	66 102	264 782	2 337	19 970	728	242
2015	69 917	283 144	5 077	21 696	891	570
2020	70 281	282 878	5 697	31 139	1 061	1 070
2025	64 177	285 794	5 931	32 141	1 233	1 679
2030	56 462	289 368	5 555	33 176	1 409	2 533

Table 76: continuation.

[TJ]	biogas	H2	coal	electricity rail	electricity passenger cars	aviation jet fuel
1990	0	0	69	7 295	0	13 163
2005	0	0	5	7 965	1	28 403
2010	61	0	5	7 393	2	27 900
2015	142	9	4	8 043	31	29 815
2020	268	34	4	8 748	624	31 863
2025	420	69	3	9 457	3 681	34 050
2030	633	97	3	10 230	9 940	36 388

Table 75: Energy consumption of mobile sources by fuel – scenario "with additional measures".

[TJ]	gasoline fossil	diesel fossil	bioethanol	biodiesel	vegetable oil	natural gas
1990	106 533	88 904	0	0	0	0
2005	86 512	262 469	0	3 395	0	0
2010	66 058	264 935	2 386	19 827	713	237
2015	59 643	236 576	5 605	24 176	950	1 093
2020	53 591	231 592	6 098	34 691	1 157	2 101
2025	38 718	205 847	5 799	32 786	1 209	2 962
2030	27 682	202 464	5 349	34 410	1 369	4 430

Table 77: continuation.

[TJ]	biogas	H2	coal	electricity rail	electricity passenger cars	aviation jet fuel
1990	0	0	69	7 295	0	13 163
2005	0	0	5	7 965	1	28 403
2010	59	0	6	7 393	4	27 900
2015	386	10	6	8 676	229	29 815
2020	741	37	6	10 270	1 922	31 863
2025	1 045	68	5	11 391	6 964	34 050
2030	1 563	94	5	12 655	15 843	36 388

Residential, Commercial & Other Sectors

Table 76: Heating demand, renovation rates and boiler exchange rates – scenario „with existing measures".

Heating demand (average)		2010	2015	2020	2025	2030
residential buildings with one or two apartments	[kWh/m².a]	176	159	147	135	125
residential buildings with more than two apartments	[kWh/m².a]	114	105	98	92	87
commercial buildings	kWh/m³.a	152	138	125	114	106
renovation rate	**[%]**					
residential buildings with one or two apartments		0.73	1.03	1.20	1.29	1.26
residential buildings with more than two apartments		0.73	1.00	1.21	1.28	1.25
commercial buildings		1.02	1.35	1.68	1.89	2.05
boiler exchange rate in residential buildings		1.70	2.68	3.63	4.12	4.05

Table 77: Heating demand, renovation rates and boiler exchange rates – scenario "with additional measures".

Heating demand (average)		**2010**	**2015**	**2020**	**2025**	**2030**
residential buildings with one or two apartments	[kWh/m².a]	176	158	141	125	112
residential buildings with more than two apartments	[kWh/m².a]	114	104	95	87	83
commercial buildings	kWh/m³.a	153	137	124	112	102
renovation rate	**[%]**					
residential buildings with one or two apartments		0.77	1.28	1.79	1.65	1.61
residential buildings with more than two apartments		0.81	1.29	1.76	1.63	1.60
commercial buildings		1.02	1.35	1.68	1.89	2.05
boiler exchange rate in residential buildings		1.70	2.57	3.54	4.17	4.07

Fugitive Emissions from Fuels

Table 78: Historical and forecast activities (2010–2030) for calculation of fugitive emissions.

	2008	**2010**	**2015**	**2020**	**2025**	**2030**
Gas pipeline length [km]	6 545	6 800	7 438	8 075	8 075	8 075
Gas distribution network [km]	28 348	28 554	29 069	29 585	30 100	30 615
Natural gas production [million m³]	1 534	1 473	1 332	1 204	1 088	984
Natural gas final consumption [PJ]	189	194	203	197	182	169
Refinery crude oil input [PJ]	375	344	331	327	323	324
Natural gas storage capacities [million m³]	2 949	3 583	5 168	5 700	5 700	5 700

Industrial Processes

Halocarbons and SF_6

Table 79: Emissions (annual consumption) of halocarbons and SF_6 – scenario „with existing measures“.

[Gg CO_2e]	1990	2008	2010	2015	2020	2025	2030
HFC	26.32	1 058.1	1 091.3	1 151.7	1 153.1	1 194.0	1 208.6
PFC	29.05	173.5	285.0	300.0	315.0	330	345
SF_6	240.94	381.1	336.9	282.2	270.2	261.5	250.6

Table 80: Emissions (annual consumption) of halocarbons and SF_6 – scenario “with additional measures”.

[Gg CO_2e]	1990	2008	2010	2015	2020	2025	2030
HFC	26.32	1 058.1	1 055.0	1 003.3	581.9	443.9	171.4
PFC	29.05	173.5	272.0	180.0	126.0	46.7	0.0
SF_6	240.94	381.1	336.9	267.2	255.2	236.5	222.3

Agriculture

Table 81: Livestock population 2008 and forecast (2010–2030), total cattle, dairy cows, suckling cows – scenario „with existing measures“ (Source: SINABELL et al. 2011a).

Cattle [heads] – Scenario “with existing measures”						
Year	TOTAL Cattle		Dairy		Suckling Cows	
	Conv.	Org.	Conv.	Org.	Conv.	Org.
2008	1 644 439	352 770	445 123	85 107	185 711	80 741
2010	1 658 811	354 463	447 226	85 509	181 830	79 053
2015	1 671 865	353 104	456 475	84 744	179 451	80 116
2020	1 684 920	351 746	465 724	83 979	177 072	81 179
2025	1 677 472	352 759	462 082	84 759	180 029	81 020
2030	1 670 025	353 771	458 440	85 538	182 986	80 862

Table 82: Livestock population 2008 and forecast (2010– 2030), total cattle, dairy cows, suckling cows – scenario "with additional measures" (Source: SINABELL *et al. 2011a).*

Cattle [heads] – Scenario "with additional measures"						
Year	**TOTAL Cattle**		**Dairy**		**Suckling Cows**	
	Conv.	**Org.**	**Conv.**	**Org.**	**Conv.**	**Org.**
2008	1 644 439	352 770	445 123	85 107	185 711	80 741
2010	1 658 811	354 463	447 226	85 509	181 830	79 053
2015	1 666 205	341 178	457 002	82 056	176 618	77 396
2020	1 673 599	327 892	466 777	78 603	171 406	75 738
2025	1 670 255	335 867	462 612	81 023	176 478	77 080
2030	1 666 910	343 843	458 447	83 442	181 549	78 423

Table 83: Livestock population 2008 and forecast (2010–2030), young cattle and breeding heifers – scenario "with existing measures" (Source: SINABELL et al. *2011a).*

Cattle [heads] – Scenario "with existing measures"				
Year	**Young Cattle < 1 yr**		**Breeding Heifers 1–2 yr**	
	Conv.	**Org.**	**Conv.**	**Org.**
2008	537 371	99 098	169 524	31 263
2010	535 330	98 722	230 796	42 562
2015	547 605	98 986	202 942	36 942
2020	559 880	99 250	175 089	31 322
2025	554 338	99 553	174 383	31 321
2030	548 797	99 855	173 678	31 319

Table 84: Livestock population 2008 and forecast (2010–2030), young cattle and breeding heifers – scenario "with additional measures" *(Source: SINABELL et al. 2011a).*

Population size [heads] – Scenario "with additional measures"				
Year	**Young Cattle < 1 yr**		**Breeding Heifers 1–2 yr**	
	Conv.	**Org.**	**Conv.**	**Org.**
2008	537 371	99 098	169 524	31 263
2010	535 330	98 722	230 796	42 562
2015	545 308	94 722	202 849	35 700
2020	555 286	90 722	174 902	28 837
2025	551 486	93 434	174 084	29 615
2030	547 687	96 146	173 265	30 393

Table 85: Livestock population 2008 and forecast (2010–2030),fattening heifers and other cattle – scenario "with existing measures" (Source: SINABELL et al. 2011a).

	Population size [heads] – Scenario "with existing measures"			
Year	**Fattening Heifers, Bulls, Oxen 1–2 yr**		**Other Cattle > 2 yr**	
	Conv.	**Org.**	**Conv.**	**Org.**
2008	194 575	35 882	112 135	20 679
2010	143 773	26 514	119 856	22 103
2015	169 515	31 316	115 877	21 000
2020	195 256	36 119	111 899	19 897
2025	194 829	36 024	111 811	20 083
2030	194 401	35 928	111 723	20 268

Table 86: Livestock population 2008 and forecast (2010–2030), fattening heifers and other cattle – scenario "with additional measures" (Source: SINABELL et al. 2011a).

	Population size [heads] – Scenario "with additional measures"			
Year	**Fattening Heifers, Bulls, Oxen 1–2 yr**		**Other Cattle > 2 yr**	
	Conv.	**Org.**	**Conv.**	**Org.**
2008	194 575	35 882	112 135	20 679
2010	143 773	26 514	119 856	22 103
2015	168 683	30 537	115 746	20 768
2020	193 593	34 560	111 635	19 433
2025	193 794	34 979	111 802	19 736
2030	193 994	35 399	111 968	20 040

Table 87: Livestock population 2008 and forecast (2010– 2030), swine, sheep, goats – scenario "with existing measures" (Source: SINABELL et al. 2011a).

	Population size [heads] – Scenario "with existing measures"					
Year	**TOTAL Swine**	**Young & Fattening Pigs > 20 kg**	**Breeding Sows > 50 kg**	**Piglets < 20 kg**	**Sheep**	**Goats**
2008	3 064 231	2 023 536	297 830	742 865	333 181	62 490
2010	2 964 685	1 932 458	289 186	743 041	310 492	58 973
2015	2 944 776	1 914 242	287 457	743 076	305 954	58 270
2020	2 924 866	1 896 026	285 728	743 112	301 416	57 566
2025	2 857 332	1 842 469	279 993	734 871	297 661	57 732
2030	2 789 799	1 788 911	274 257	726 630	293 906	57 898

Table 88: Livestock population 2008 and forecast (2010–2030), swine, sheep, goats – scenario "with additional measures" (Source: SINABELL et al. 2011a).

	Population size [heads] – Scenario "with additional measures"					
Year	**TOTAL Swine**	**Young & Fattening Pigs > 20 kg**	**Breeding Sows > 50 kg**	**Piglets < 20 kg**	**Sheep**	**Goats**
2008	3 064 231	2 023 536	297 830	742 865	333 181	62 490
2010	2 964 685	1 932 458	289 186	743 041	310 492	58 973
2015	2 927 671	1 904 465	286 187	737 019	304 566	57 409
2020	2 904 911	1 884 620	284 247	736 044	299 797	56 562
2025	2 850 421	1 835 074	280 144	735 203	296 097	56 212
2030	2 795 931	1 785 528	276 042	734 361	292 397	55 861

Table 89: Livestock population 2008 and forecast (2010–2030), poultry, horses, other – scenario "with existing measures" (Source: SINABELL et al. 2011a).

	Population size [heads] – Scenario "with existing measures"				
Year	**TOTAL Poultry**	**Chicken**	**Other Poultry**	**Horses**	**Other**
2008	13 027 145	12 354 358	672 787	87 072	41 190
2010	12 551 420	11 881 720	669 700	86 401	40 974
2015	12 456 275	11 787 193	669 083	86 267	40 931
2020	12 361 130	11 692 665	668 465	86 133	40 888
2025	12 028 123	11 361 819	666 304	85 664	40 342
2030	11 695 116	11 030 972	664 143	85 194	39 797

Table 90: Livestock population 2008 and forecast (2010– 2030), poultry, horses, other – scenario "with additional measures" (Source: SINABELL et al. 2011a).

	Population size [heads] – Scenario "with additional measures"				
Year	**TOTAL Poultry**	**Chicken**	**Other Poultry**	**Horses**	**Other**
2008	13 027 145	12 354 358	672 787	87 072	41 190
2010	12 551 420	11 881 720	669 700	86 401	40 974
2015	12 443 220	11 772 909	670 311	86 038	40 387
2020	12 345 900	11 676 001	669 898	85 866	40 253
2025	12 005 277	11 336 823	668 454	85 262	39 718
2030	11 664 654	10 997 644	667 010	84 659	39 183

Table 91: Milk production 2008 and forecast (2010–2030) (Source: SINABELL et al. 2011a).

Ø milk yield per dairy cow (kg/year)					
2008	**2010**	**2015**	**2020**	**2025**	**2030**
6 059	6 258	6 820	7 209	7 685	8 161

Table 92: Mineral fertiliser use 2008 and forecast (2010–2030) – scenario "with existing measures" (Source: SINABELL et al. 2011a).

Mineral fertiliser use (t/year) – Scenario "with existing measures"						
	2008	**2010**	**2015**	**2020**	**2025**	**2030**
TOTAL	118 850	104 095	101 143	98 192	89 675	81 157
Of which urea	10 534	9 226	8 965	8 703	7 948	7 193

Table 93: Mineral fertiliser use 2008 and forecast (2010–2030) – scenario "with additional measures" (Source: SINABELL et al. 2011a).

Mineral fertilizer use (t/year) – Scenario "with additional measures"						
	2008	**2010**	**2015**	**2020**	**2025**	**2030**
TOTAL	118 850	104 095	104 764	103 680	94 523	85 366
Of which urea	10 534	9 226	9 285	9 189	8 378	7 566

Table 94: Sewage sludge application 2008 and forecast (2010–2030) – scenario "with existing measures" (Source: SINABELL et al. 2011a).

Sewage sludge application (t/year) – Scenario "with existing measures"					
2008	**2010**	**2015**	**2020**	**2025**	**2030**
1 531	1 341	1 303	1 265	1 155	1 045

Table 95: Sewage sludge application 2008 and forecast (2010–2030) – scenario "with additional measures" (Source: SINABELL et al. 2011a).

Sewage sludge application (t/year) – Scenario "with additional measures"					
2008	**2010**	**2015**	**2020**	**2025**	**2030**
1 531	1 341	1 350	1 336	1 218	1 100

Table 96: Crop yields 2008 and forecast (2010–2030) – scenario "with existing measures" (Source: SINABELL et al. 2011a).

Harvest [1 000 t] – Scenario "with existing measures"						
Year	**Cereals (Total)**	**Maize (Corn)**	**Silo-Green Maize**	**Sugar Beet**	**Rape**	**Sunflower**
2008	5 717	2 449	3 949	3 091	175	80
2010	4 776	1 941	3 557	3 138	171	67
2015	5 229	2 268	3 855	3 167	176	72
2020	5 243	2 285	3 866	3 181	176	72
2025	5 207	2 308	3 791	3 175	179	71
2030	5 171	2 331	3 717	3 169	181	70

Table 97: Crop yields 2008 and forecast (2010– 2030) – scenario "with additional measures" (Source: SINABELL et al. 2011a).

Harvest [1 000 t] – Scenario "with additional measures"						
Year	**Cereals (Total)**	**Maize (Corn)**	**Silo-Green Maize**	**Sugar Beet**	**Rape**	**Sunflower**
2008	5 717	2 449	3 949	3 091	175	80
2010	4 776	1 941	3 557	3 138	171	67
2015	5 287	2 299	3 846	3 186	177	72
2020	5 309	2 321	3 856	3 203	178	72
2025	5 279	2 346	3 792	3 197	180	71
2030	5 250	2 371	3 728	3 191	182	70

Table 98: Crop yields of legumes 2008 and forecast (2010–2030) – scenario "with existing measures" (Source: SINABELL et al. 2011a).

Harvest [1 000 t] – Scenario "with existing measures"				
Year	**Peas**	**Soja Beans**	**Horse/Field Beans**	**Clover Hey, Lucerne, …**
2008	45	54	8	650
2010	31	95	11	682
2015	32	91	8	590
2020	30	100	8	597
2025	30	104	8	587
2030	30	108	7	573

Table 99: Crop yields of legumes 2008 and forecast (2010–2030) – scenario "with additional measures" (Source: SINABELL et al. 2011a).

	Harvest [1 000 t] – Scenario "with additional measures"			
Year	**Peas**	**Soja Beans**	**Horse/Field Beans**	**Clover Hey, Lucerne, …**
2008	45	54	8	650
2010	31	95	11	682
2015	33	92	8	605
2020	31	101	8	614
2025	31	106	8	606
2030	31	110	8	594

Table 100: Land use 2008 and forecast (2010–2030) – scenario "with existing measures" (Source: SINABELL et al. 2011a).

	Areas [1 000 ha] – Scenario "with existing measures"			
Year	**Cereals**	**Cropland**	**Grassland**	**Grassland (extensive)**
2008	833	1 369	1 792	722
2010	802	1 360	1 731	722
2015	788	1 293	1 475	551
2020	781	1 280	1 422	523
2025	757	1 243	1 268	436
2030	733	1 206	1 113	350

Table 101: Land use 2008 and forecast (2010–2030) – scenario "with additional measures" (Source: SINABELL et al. 2011a).

	Areas [1 000 ha] – Scenario "with additional measures"			
Year	**Cereals**	**Cropland**	**Grassland**	**Grassland (extensive)**
2008	833	1 369	1 792	722
2010	802	1 360	1 731	722
2015	797	1 311	1 761	727
2020	791	1 301	1 756	727
2025	768	1 265	1 591	628
2030	744	1 230	1 425	529

Table 102: Area legume production 2008 and forecast (2010–2030) – scenario "with existing measures" (Source: SINABELL et al. 2011a).

	Areas [ha] – Scenario "with existing measures"			
Year	**Peas**	**Soja Beans**	**Horse/Field Beans**	**Clover Hey, Lucerne, …**
2008	22 306	18 419	3 695	98 966
2010	13 562	34 378	4 154	105 500
2015	14 604	32 091	3 346	91 241
2020	13 321	34 369	3 288	89 953
2025	12 949	35 065	3 120	86 371
2030	12 576	35 760	2 953	82 790

Table 103: Area legume production 2008 and forecast (2010–2030) – scenario "with additional measures" (Source: SINABELL et al. 2011a).

	Areas [ha] – Scenario "with additional measures"			
Year	**Peas**	**Soja Beans**	**Horse/Field Beans**	**Clover Hey, Lucerne, …**
2008	22 306	18 419	3 695	98 966
2010	13 562	34 378	4 154	105 500
2015	14 747	32 536	3 478	93 475
2020	13 487	34 889	3 442	92 559
2025	13 228	35 515	3 293	89 171
2030	12 970	36 140	3 144	85 782

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The report "GHG projections and assessment of policies and measures in Austria" presents information on projections, policies and measures according to reporting obligations as defined in Decision 280/2004/EC. It includes projections of the greenhouse gases (GHGs) CO_2, CH_4, N_2O, HFC, PFC and SF_6 for the years 2010, 2015, 2020, 2025 and 2030 and describes policies and measures to reduce greenhouse gas emissions by source.
The results include two different scenarios: the scenario "with existing measures, WEM" takes into account climate change mitigation measures that were implemented under the Austrian Climate Strategies 2002 and 2007 before 2nd February 2010. The scenario "with additional measures, WAM" also includes planned policies and measures.
The wem scenario without LULUCF shows an increase of greenhouse gases by 11.7 percent from 1990 to 2020 and by 16.2 percent from 1990 to 2030. The wam scenario shows an increase of 0.9 percent from 1990 up to 2020 and a decrease of 1.0 percent to 2030.

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