ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

GHG Projections and Assessment of Policies and Measures in Austria

Reporting under Regulation (EU) 525/2013, 15 March 2015

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VORWORT

Der vorliegende Endbericht präsentiert die Projektionen der österreichischen Treibhausgasemissionen für die Jahre 2015, 2020, 2025, 2030 und 2035.

Die Projektionen 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 1. Mai 2014 bereits implementierten Maßnahmen inkludiert. Das WAM-Szenario baut auf den Maßnahmen in der Energiestrategie Österreich und den Maßnahmenverhandlungen zum Klimaschutzgesetz (KSG) auf. Es beinhaltet im Vergleich zu WEM jene zusätzlichen Maßnahmen im Planungsstadium, die nach ExpertInnenmeinung und nach Abstimmung mit dem Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) voraussichtlich umgesetzt und bis 2035 wirksam werden.

Die Emissionsszenarien in diesem Bericht basieren auf Wirtschaftsprognosen bis zum Jahr 2035 und berücksichtigen die Finanz- und Wirtschaftskrise 2008 mit all ihren Auswirkungen auf die zukünftige Entwicklung.

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 „Verordnung (EU) 525/2013 über ein System zur Überwachung der Treibhausgasemissionen sowie für die Berichterstattung über diese Emissionen und über andere klimaschutzrelevante Informationen auf Ebene der Mitgliedstaaten und der Union" und den UNFCCC-Leitlinien für nationale Klimaberichte (FCCC/CP/1999/7).

PREAMBLE

This report presents Austria's greenhouse gas emission projections for 2015, 2020, 2025, 2030 and 2035.

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 1 May 2014. The latter is based on measures specified in the Austrian Energy Strategy and negotiations leading up to the Austrian climate law. It contains, in addition to the WEM scenario, further planned policies and measures which, according to the view of experts and in agreement with the Austrian Ministry of Agriculture, Forestry, Environment and Water Management, are expected to be implemented and become effective by 2035.

Emission projections in this report are based on economic scenarios for the period up to 2035. The economic and financial crisis from 2008 with all its implications until now has been taken into account in these emission projections.

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

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

The report itself is in compliance with the requirements for reporting according to EU Regulation No 525/2013 of 21 May 2013 concerning a mechanism for monitoring and reporting greenhouse gas emissions, 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

Die Ergebnisse der fünf CRF-Sektoren[1] (aus methodischen Gründen ohne Landnutzung, Landnutzungsänderungen und Forstwirtschaft – LULUCF[2]) und der einzelnen Treibhausgase (THG) werden als CO_2-Äquivalent (CO_2e) angegeben. Sie werden getrennt nach den beiden Szenarien WEM (mit bestehenden Maßnahmen) und WAM (mit zusätzlichen Maßnahmen) dargestellt.

THG-Emissionen

Tabelle 1: Gesamtemissionen, im Szenario „mit bestehenden Maßnahmen“ (WEM).

	Trend der Inventur [kt CO_2e]			Emissionen „mit bestehenden Maßnahmen“ [kt CO_2e]				
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Gesamt (ohne LULUCF)	78.683	92.496	84.788	79.737	79.067	76.779	75.957	75.677
1. Energie	52.906	67.374	60.072	54.920	53.912	51.812	51.056	50.878
2. Prozessemissionen	13.593	15.611	15.870	16.429	16.916	16.924	16.983	16.836
3. Landwirtschaft	7.959	6.878	6.852	6.874	7.044	7.052	7.063	7.192
5. Abfall	4.226	2.632	1.993	1.515	1.195	992	856	771

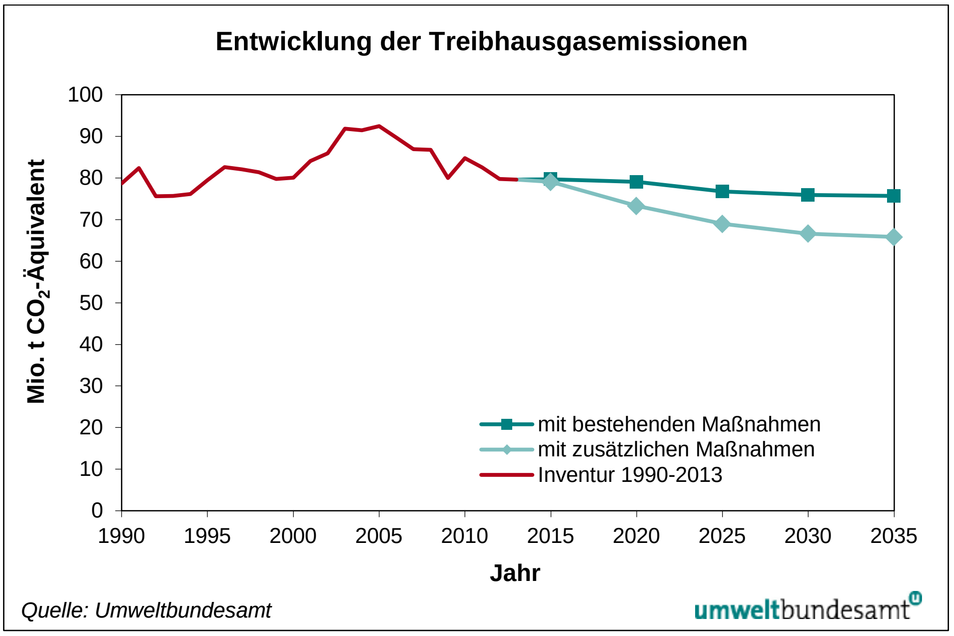
Tabelle 2: Gesamtemissionen, im Szenario „mit zusätzlichen Maßnahmen“ (WAM).

	Trend der Inventur [kt CO_2e]			Emissionen „mit zusätzlichen Maßnahmen“ [kt CO_2e]				
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Gesamt (ohne LULUCF)	78.683	92.496	84.788	79.066	73.293	68.998	66.619	65.804
1. Energie	52.906	67.374	60.072	54.405	48.440	44.726	42.964	42.389
2. Prozessemissionen	13.593	15.611	15.870	16.295	16.695	16.347	15.896	15.694
3. Landwirtschaft	7.959	6.878	6.852	6.852	6.965	6.950	6.935	6.982
5. Abfall	4.226	2.632	1.993	1.514	1.192	975	823	738

[1] „Common Reporting Format“ des Kyoto-Protokolls

[2] Land Use, Land-Use Change and Forestry

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



Szenario „mit bestehenden Maßnahmen“ (WEM)

Das WEM-Szenario (ohne LULUCF) zeigt einen Anstieg um 0,5 % zwischen 1990 und 2020 und eine Reduktion um 3,8 % im Zeitraum von 1990 bis 2035, d. h. von 78,7 Mio. t CO_2-Äquivalent (1990) auf 79,1 Mio. t CO_2-Äquivalent 2020 und 75,7 Mio. t CO_2-Äquivalent 2035. Das WAM-Szenario zeigt eine Abnahme von 6,9 % zwischen 1990 und 2020 und eine Abnahme von 16,4 % bis 2035, d. h. von 78,7 Mio. t CO_2-Äquivalent (1990) auf 73,3 Mio. t CO_2-Äquivalent 2020 und 65,8 Mio. t CO_2-Äquivalent 2035.

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

	Emissionstrend [kt CO_2e]			Emissionen mit bestehenden Maßnahmen [kt CO_2e]				
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
CO_2	62.217	79.596	72.691	67.940	67.252	65.534	65.156	64.870
CH_4	10.614	7.574	6.947	6.391	6.189	6.014	5.921	5.994
N_2O	4.197	3.500	3.251	3.271	3.324	3.294	3.275	3.244
F-Gase	1.656	1.825	1.900	2.135	2.302	1.938	1.606	1.568
Gesamt	**78.683**	**92.496**	**84.788**	**79.737**	**79.067**	**76.779**	**75.957**	**75.677**

Im WEM-Szenario werden für die Gesamt THG-Emissionen zwischen 2010 und 2035 eine Abnahme von 10,7 % oder 9,1 Mio. t CO_2-Äquivalent vorausgesagt. Diese Veränderung ist hauptsächlich auf folgende Projektionen zurückzuführen:

- Die Emissionen im Energiesektor werden um 15,3 % oder 9,2 Mio. t CO_2-Äquivalent sinken.
- Die Emissionen im Sektor Industrieprozesse werden mit 6,1 % oder 0,1 Mio. t CO_2-Äquivalent leicht steigen.
- Die Emissionen des Sektors Landwirtschaft werden sich um 5,0 % oder 0,3 Mio. t CO_2-Äquivalent erhöhen.
- Die Emissionen des Sektors Abfall werden um 61,3 % oder 1,2 Mio. t CO_2-Äquivalent sinken.

- Im Sektor 1.A.1 Energieversorgung wird eine Abnahme der Emissionen um 33,8 % oder 4,8 Mio. t CO_2-Äquivalent angenommen und
- im Sektor 1.A.2 Industrie wird eine Erhöhung um 3,5 % oder 0,4 Mio. t CO_2-Äquivalent projiziert.
- Für die Emissionen vom Sektor 1.A.3 Transport wird eine Zunahme um 1,0 % oder 0,2 Mio. t CO_2-Äquivalent zwischen 2010 und 2035 und
- für die Emissionen der Sektoren 1.A.4 Kleinverbrauch und 1.A.5 Sonstige (Militär) wird eine Abnahme um 44,4 % oder 5,1 Mio. t CO_2-Äquivalent erwartet.

Gemäß der WEM-Projektion wird Kohlenstoffdioxid weiterhin das wichtigste Treibhausgas in Österreich sein, sein Anteil an den Gesamtemissionen wird von 85,7 % im Jahr 2010 auf 85,1 % im Jahr 2020 leicht abnehmen und sich auf 85,7 % im Jahr 2035 erhöhen (siehe Tabelle 3). Zwischen 2010 und 2035 wird der Anteil am CO_2-Äquivalent für CH_4 und N_2O von 12,0 % und 12,2 % steigen, während für die Fluorierten Gase (HFKW, FKW, SF_6 und NF_3) der Anteil von 2,2 % auf 2,1 % fallen wird.

Szenario „mit zusätzlichen Maßnahmen" (WAM)

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

	Emissionstrend [kt CO_2e]			Emissionen mit zusätzlichen Maßnahmen [kt CO_2e]				
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
CO_2	62.217	79.596	72.691	67.315	61.602	58.203	56.783	56.078
CH_4	10.614	7.574	6.947	6.386	6.161	5.974	5.872	5.916
N_2O	4.197	3.500	3.251	3.253	3.239	3.170	3.096	3.011
F-Gase	1.656	1.825	1.900	2.112	2.291	1.652	868	799
Gesamt	**78.683**	**92.496**	**84.788**	**79.066**	**73.293**	**68.998**	**66.619**	**65.804**

Im WAM-Szenario wird für die THG-Emissionen eine Abnahme zwischen 2010 und 2035 von 22,4 % oder 19,0 Mio. t CO_2-Äquivalent erwartet. Diese Abnahme ist hauptsächlich auf folgende Projektionen zurückzuführen:

- Die Emissionen des Energie-Sektors werden um 29,4 % oder 17,7 Mio. t CO_2-Äquivalent abnehmen.
- Die Emissionen des Sektors Industrieprozesse werden um 1,1 % oder 0,2 Mio. t CO_2-Äquivalent zurückgehen.
- Die Emissionen des Abfall-Sektors reduzieren sich um 63,0 % oder 1,3 Mio. t CO_2-Äquivalent.
- Die Emissionen des Sektors Landwirtschaft werden sich um 1,9 % oder 0,1 Mio. t CO_2-Äquivalent erhöhen.
- Im 1.A.4 Kleinverbrauch und 1.A.5 Sonstige (Militär) wird eine Abnahme um 52 % oder 5,9 Mio. t CO_2-Äquivalent angenommen.
- Für die Emissionen des Sektors 1.A.1 Energieversorgung wird eine Abnahme um 33,5 % oder 4,7 Mio. t CO_2-Äquivalent und
- im Sektor 1.A.3 Transport um 29,9 % oder 6,7 Mio. t CO_2-Äquivalent projiziert.
- Für die Emissionen des Sektors 1.A.2 Industrie wird eine Abnahme um 3,4 % oder 0,4 Mio. t CO_2-Äquivalent berechnet.

Gemäß der WAM-Projektion wird Kohlenstoffdioxid weiterhin das wichtigste Treibhausgas in Österreich sein, sein Anteil an den Gesamtemissionen sinkt von 85,7 % im Jahr 2010 auf 84,0 % im Jahr 2020 und steigt wieder auf 85,2 % im Jahr 2035 (siehe Tabelle 4). Zwischen 2010 und 2035 wird der Anteil am CO_2-Äquivalent für CH_4 und N_2O von 12,0 % auf 13,6 % steigen, während für die Fluorierten Gase (HFKW, FKW, SF_6 und NF_3) der Anteil von 2,2 % auf 1,2 % fallen wird.

Eine Auswertung der Projektion für einzelne Sektoren wird in Kapitel 2 dargestellt, detaillierte Emissionstabellen der einzelnen Sektoren finden sich in Annex 1. Die spezifischen sektoralen Annahmen und Aktivitäten sind in den methodischen Kapiteln 3.1 bis 3.5 beschrieben.

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

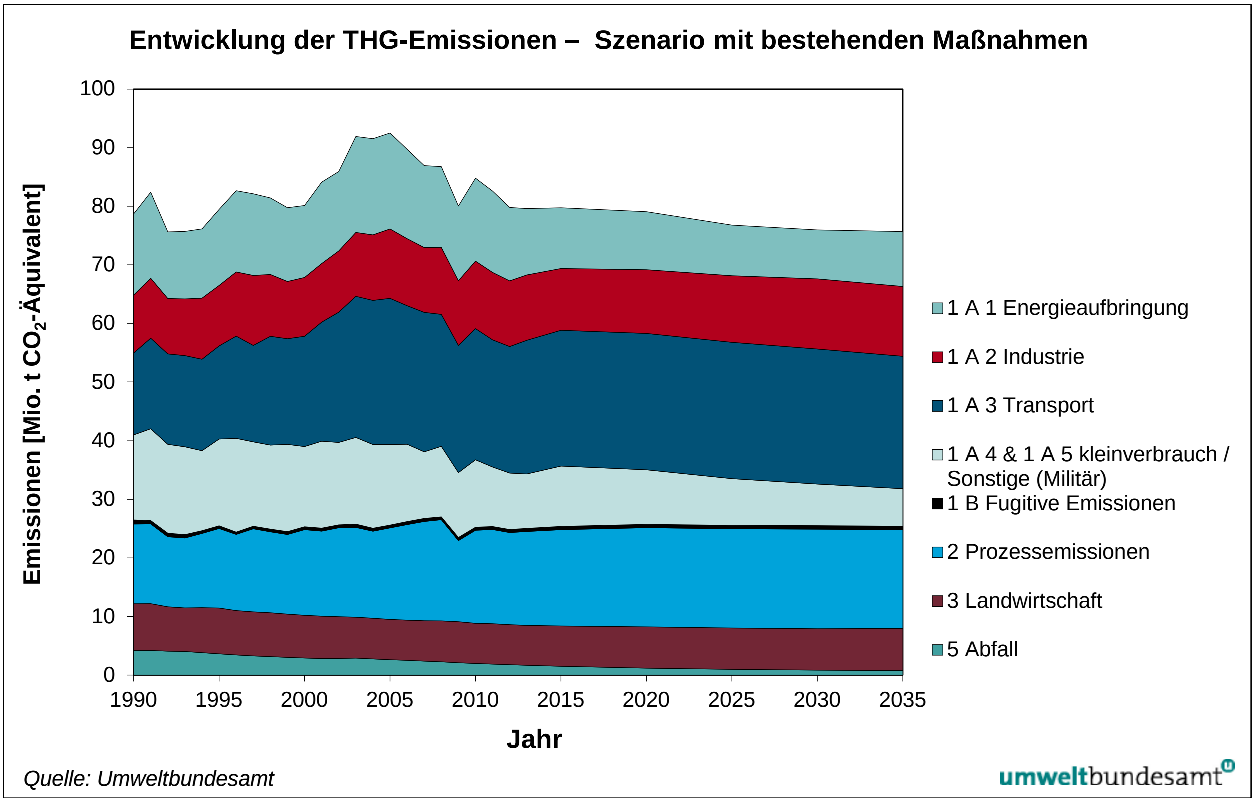


Abbildung 2: Entwicklung der THG-Emissionen nach Sektoren, Szenario mit bestehenden Maßnahmen (WEM).

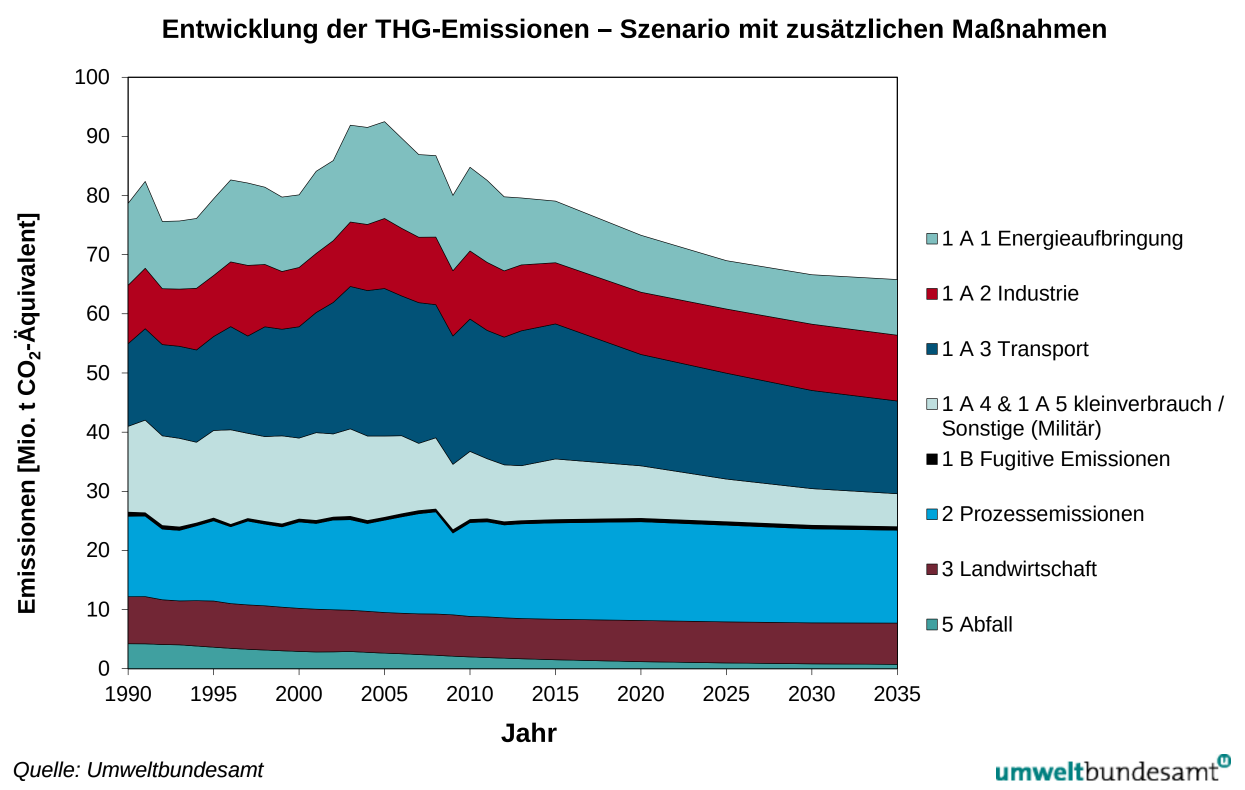


Abbildung 3: Entwicklung der THG-Emissionen nach Sektoren, Szenario mit zusätzlichen Maßnahmen (WAM).

EU ETS/Non-ETS Emissionen

Die Treibhausgas-Emissionen innerhalb des EU Emissionshandels (emission trading scheme, ETS) zeigen im Szenario „mit bestehenden Maßnahmen" einen sinkenden Trend bis 2035. Hauptverantwortlich dafür ist der Sektor Energie mit einem Rückgang von rd. 15 % im Zeitraum von 2013 bis 2035. Für die Emissionen des Sektors Prozessemissionen wird hingegen ein Anstieg projiziert (+ 10 %). Für 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 (WEM)

	mit bestehenden Maßnahmen [kt CO_2 Äquivalent]					
EU ETS THG-Emissionen	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Gesamt (ohne LULUCF)	29.905	28.223	28.111	27.465	27.944	28.808
1. Energie	16.422	14.397	13.966	12.945	13.025	13.988
2. Prozessemissionen	13.483	13.826	14.145	14.521	14.919	14.820
non-ETS THG-Emissionen	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Gesamt (ohne LULUCF)	49.694	51.514	50.956	49.314	48.013	46.869
1. Energie	38.672	40.523	39.946	38.867	38.031	36.890
2. Prozessemissionen	2.530	2.603	2.771	2.403	2.064	2.016
3. Landwirtschaft	6.807	6.874	7.044	7.052	7.063	7.192
5. Abfall	1.684	1.515	1.195	992	856	771

Die Reduktion aus Emissionen von ETS-Anlagen wird im WAM-Szenario aufgrund zusätzlicher Maßnahmen (mit rd. 7 %) höher als im WEM-Szenario (rd. 4 %) Es wird eine Abnahme der EU ETS-Emissionen im Sektor Energie um rd. 18 % und eine Zunahme im Sektor Prozessemissionen um rd. 7 % projiziert. Für die gesamten Emissionen, welche nicht dem Emissionshandel unterliegen (non-ETS) wird eine Reduktion von rd. 24 % vorausgesagt.

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

	mit zusätzlichen Maßnahmen [kt CO_2 Äquivalent]					
EU ETS THG-Emissionen	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Gesamt (ohne LULUCF)	29.905	27.987	27.548	26.519	27.064	27.961
1. Energie	16.422	14.272	13.609	12.286	12.490	13.508
2. Prozessemissionen	13.483	13.714	13.939	14.233	14.574	14.453
non-ETS THG-Emissionen	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Gesamt (ohne LULUCF)	49.694	51.079	45.744	42.480	39.554	37.843
1. Energie	38.672	40.132	34.831	32.441	30.474	28.881
2. Prozessemissionen	2.530	2.581	2.756	2.113	1.322	1.241
3. Landwirtschaft	6.807	6.852	6.965	6.950	6.935	6.982
5. Abfall	1.684	1.514	1.192	975	823	738

SUMMARY

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

Total GHG emissions

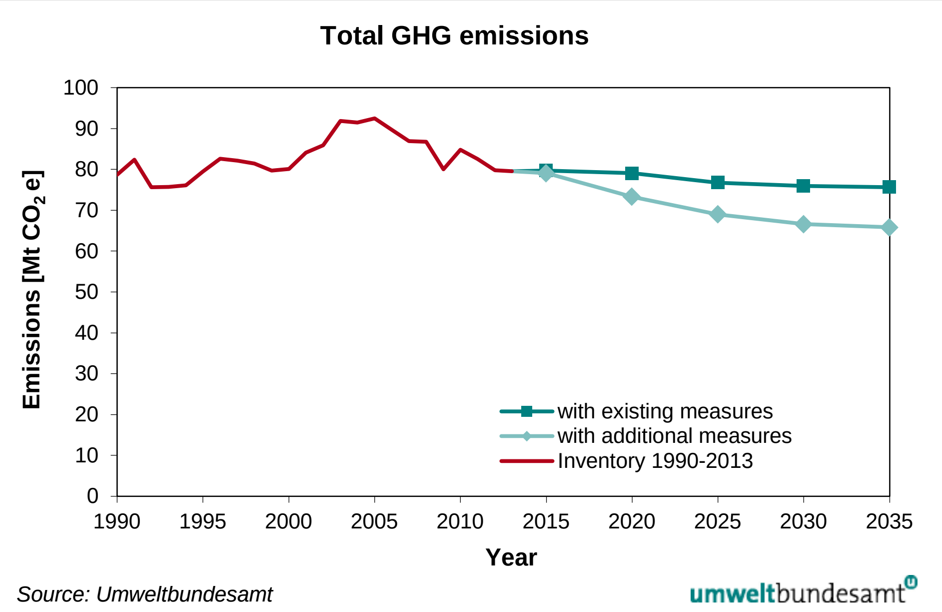
Table 1: Historical trends and projections (2015–2035): greenhouse gas emissions – scenario “with existing measures” (WEM).

	Inventory Trend [kt CO_2e]			Emissions “with existing measures” [kt CO_2e]				
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Total (without LULUCF)	78 683	92 496	84 788	79 737	79 067	76 779	75 957	75 677
1. Energy	52 906	67 374	60 072	54 920	53 912	51 812	51 056	50 878
2. Industrial Processes	13 593	15 611	15 870	16 429	16 916	16 924	16 983	16 836
3. Agriculture	7 959	6 878	6 852	6 874	7 044	7 052	7 063	7 192
5. Waste	4 226	2 632	1 993	1 515	1 195	992	856	771

Table 2: Historical trends and projections (2015–2035): greenhouse emissions – scenario “with additional measures” (WAM).

	Inventory Trend [kt CO_2e]			Emissions “with additional measures” [kt CO_2e]				
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Total (without LULUCF)	78 683	92 496	84 788	79 066	73 293	68 998	66 619	65 804
1. Energy	52 906	67 374	60 072	54 405	48 440	44 726	42 964	42 389
2. Industrial Processes	13 593	15 611	15 870	16 295	16 695	16 347	15 896	15 694
3. Agriculture	7 959	6 878	6 852	6 852	6 965	6 950	6 935	6 982
5. Waste	4 226	2 632	1 993	1 514	1 192	975	823	738

Figure 1: Past trend and scenarios (2014–2030): total GHG emissions (without LULUCF).



Scenario "with existing measures" (WEM)

The "with existing measures" (WEM) scenario without LULUCF shows an increase of 0.5% from 1990 to 2020 and a decrease of 3.8% from 1990 to 2035, i.e. from 78.7 in 1990 to 79.1 Mt CO_2 equivalents in 2020 and 75.7 Mt CO_2 equivalents in 2035. The WAM scenario shows a decrease by 6.9% from 1990 to 2020 and a decrease by 16.4% until 2035, i.e. from 78.7 Mt CO_2 equivalents in 1990 to 73.3 Mt CO_2 equivalents in 2020 and 65.8 Mt CO_2 equivalents in 2035.

Table 3: Past trend and scenario (2015–2030): GHG emissions by gas (without LULUCF) – scenario "with existing measures" (WEM).

	Emission Trend [kt CO_2e]			Emissions "with existing measures" [kt CO_2e]				
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
CO_2	62 217	79 596	72 691	67 940	67 252	65 534	65 156	64 870
CH_4	10 614	7 574	6 947	6 391	6 189	6 014	5 921	5 994
N_2O	4 197	3 500	3 251	3 271	3 324	3 294	3 275	3 244
F-Gases	1 656	1 825	1 900	2 135	2 302	1 938	1 606	1 568
Total	**78 683**	**92 496**	**84 788**	**79 737**	**79 067**	**76 779**	**75 957**	**75 677**

The WEM scenario predicts a decrease in total GHG emissions by 10.7% or 9.1 Mt CO_2 equivalents between 2010 and 2035. This change is mainly driven by the decrease in the Energy sector of 15.3% or 9.2 Mt CO_2 equivalents. A slight increase in emissions from the Industrial Processes sector is expected (about 6.1% or 0.1 Mt CO_2 equivalents). Emissions from the Agriculture sector are forecast to increase by 5.0% or 0.3 Mt CO_2 equivalents. Emissions in the Waste sector in the scenario are forecast to decrease by 61.3% or 1.2 Mt CO_2 equivalents. In the Energy sector emissions from the sub-sector 1.A.1 Energy industries are forecast to decrease by 33.8% or 4.8 Mt CO_2 equivalents and in 1.A.2 Manufacturing industries and construction emissions are forecast to increase by 3.4% or 0.4 Mt CO_2 equivalents. Emissions from the sub-sector 1.A.3 Transport are forecast to increase by 1,0% or 0.2 Mt between 2010 and 2035, and emissions from the sub-sector 1.A.4 and 1.A.5 'Other sectors' are forecast to decrease by 44.4% or 5.1 Mt CO_2 equivalents.

According to the WEM scenario the most important GHG in Austria will still be CO_2, but with a decreasing share in the national total emissions from 85.7% in 2010 to 85.1% 2020 and an increase to 85.7% in 2030. Between 2010 and 2035 total CO_2 equivalent CH_4 emissions and N_2O emissions are forecast to increase from 12.0% to 12.2%, whereas the percentage of emissions of fluorinated gases (HFC, PFC and SF_6) is expected to decrease slightly from 2.2% 2010 to 2.1% until 2035.

Scenario "with additional measures" (WAM)

In the scenario "with additional measures" total GHG emissions are forecast to decrease between 2010 and 2035 by 22.4% or 19.0 Mt CO_2 equivalents. This decrease is mainly driven by the expected decrease of emissions from the Energy sector by 29.4% or 17.7 Mt CO_2 equivalents. Emissions are forecast to decrease in the Waste sector by 63.0% or 1.3 Mt CO_2 equivalents. Emissions from the Industrial Processes sector are forecast to decrease by 1.2% or 0.2 Mt 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 52% or 5.9 Mt CO_2 equivalents. Emissions are also forecast to decrease in the sub-sector 1.A.1 Energy industries (by 33.5% 4.7 Mt CO_2 equivalents) and in the sub-sector 1.A.3 Transport by 29.9% or 6.7 Mt CO_2 equivalents. Emissions from the sub-sector 1.A.2 Manufacturing industries and construction are forecast to decrease by 3.4% or 0.4 Mt CO_2 equivalents.

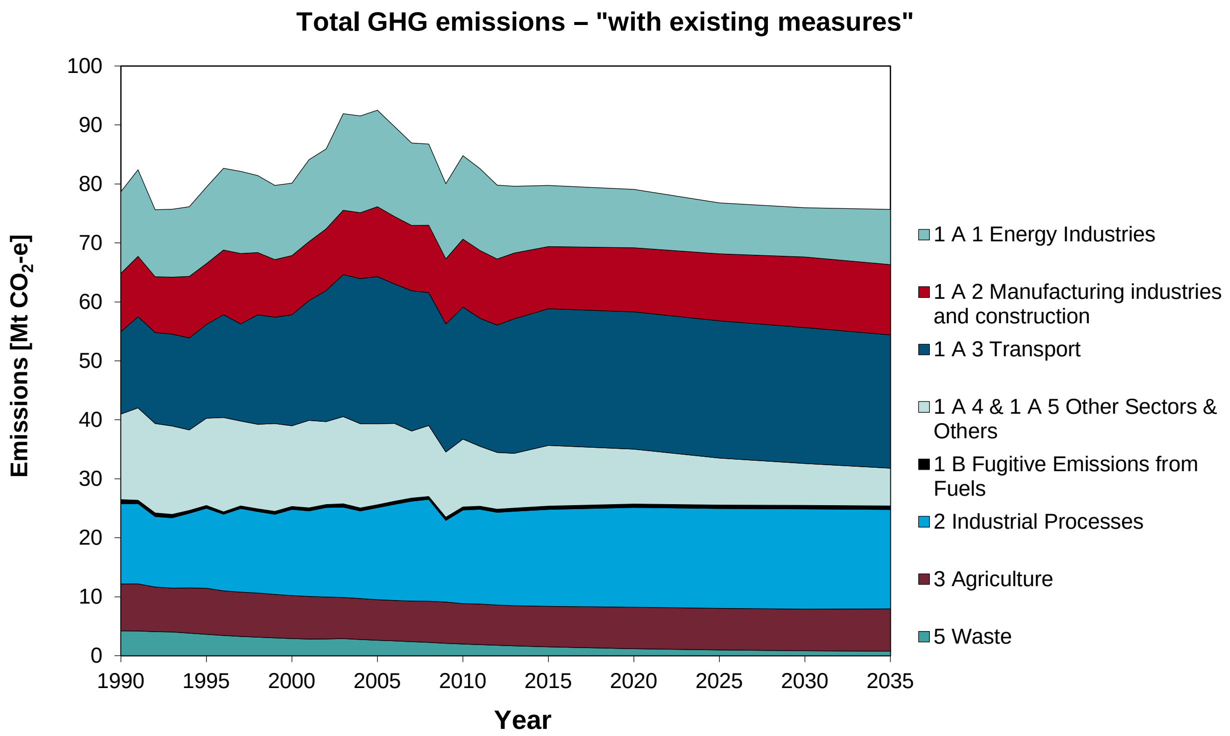
Table 4: Past trend and scenario (2015–2030): GHG emissions by gas (without LULUCF) – scenario "with additional measures" (WAM).

	Emission Trend [kt CO_2e]			Emissions "with additional measures" [kt CO_2e]				
	1990	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
CO_2	62 217	79 596	72 691	67 315	61 602	58 203	56 783	56 078
CH_4	10 614	7 574	6 947	6 386	6 161	5 974	5 872	5 916
N_2O	4 197	3 500	3 251	3 253	3 239	3 170	3 096	3 011
F-Gases	1 656	1 825	1 900	2 112	2 291	1 652	868	799
Total	**78 683**	**92 496**	**84 788**	**79 066**	**73 293**	**68 998**	**66 619**	**65 804**

According to the WAM scenario, the most important GHG in 2035 in Austria will still be CO_2, with a decreasing share in the national total emissions (from 85.7% in 2010 to 84.0% in 2020 and an increase to 85.2% in 2035). Between 2010 and 2035 CH_4 emissions and N_2O emissions are forecast to increase in total from 12.0% and 13.6%. Emissions of fluorinated gases (HFC, PFC and SF_6) are forecast to decrease from 2.2% to 1.2% in 2035.

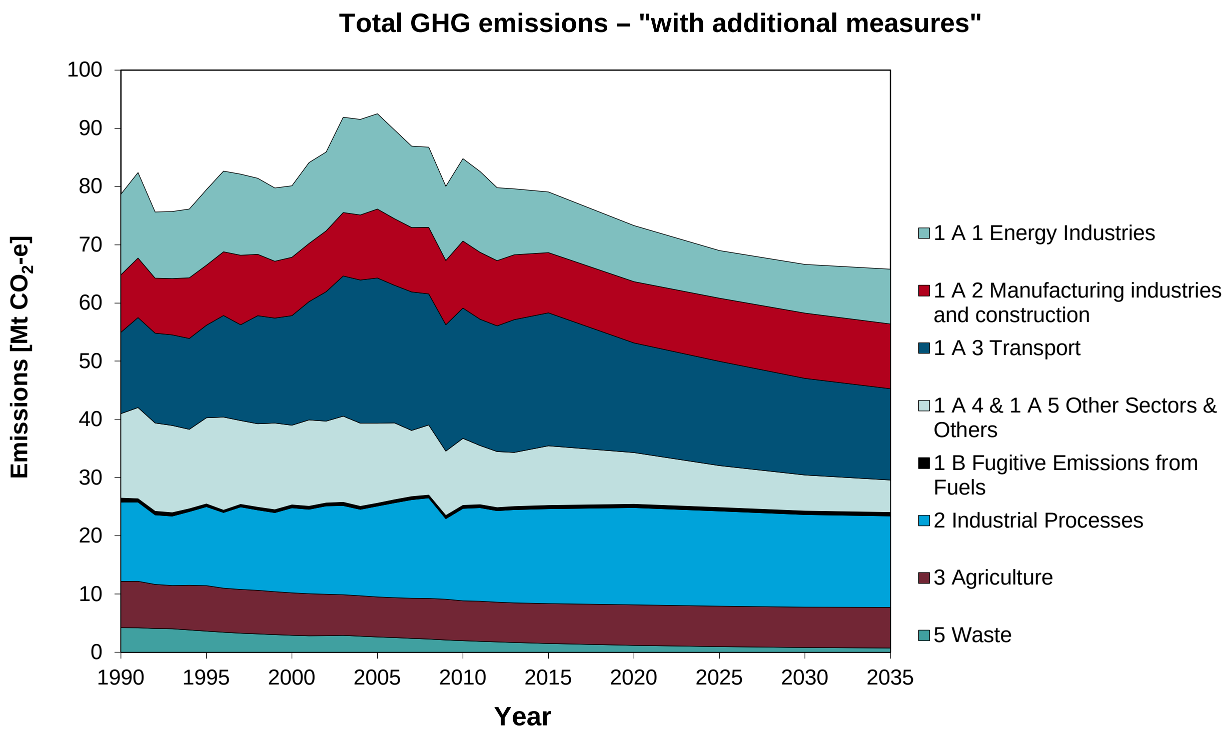
An analysis of the past trend and scenarios by sector is presented in chapter 2 'Sectoral Scenario Results'. Tables with detailed emissions by sub-sector and gas are included in Annex 1. The specific sectoral assumptions and activities are described in the methodical sub-chapters 3.1 to 3.5.

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



Source: Umweltbundesamt

Figure 2: Past trend and scenario (2014–2030): total GHG emissions by sector – "with existing measures" (WEM).



Source: Umweltbundesamt

Figure 3: Past trend and scenario (2014–2030): total GHG emissions by sector – "with additional measures" (WAM).

EU ETS/Non-ETS emissions

The GHG emissions covered by the EU emissions trading scheme (ETS) show (in the scenario "with existing measures") a downward trend until 2035. The driving force is the Energy sector with a projected decrease by about 15% from 2013 to 2035. However, for the Industrial Processes sector an increase is projected (+ 10%). 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 (WEM).

	with existing measures [kt CO_2e]					
EU ETS GHG emissions	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Total (without LULUCF)	29 905	28 223	28 111	27 465	27 944	28 808
1. Energy	16 422	14 397	13 966	12 945	13 025	13 988
2. Industrial Processes	13 483	13 826	14 145	14 521	14 919	14 820
Non ETS GHG emissions	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Total (without LULUCF)	49 694	51 514	50 956	49 314	48 013	46 869
1. Energy	38 672	40 523	39 946	38 867	38 031	36 890
2. Industrial Processes	2 530	2 603	2 771	2 403	2 064	2 016
3. Agriculture	6 807	6 874	7 044	7 052	7 063	7 192
5. Waste	1 684	1 515	1 195	992	856	771

Due to additional measures, the decrease in EU ETS emissions from 2005 to 2035 is expected to be more substantial in the WAM scenario (about 7%) than in the WEM scenario (4%). More specifically, the projected decrease in EU ETS GHG emission in the Energy sector will be about 18% and the increase in the Industrial Processes sector 7%. Total non-ETS GHG emissions in the WAM scenario are expected to decrease by 24% over the same period.

Table 6: EU ETS and non-ETS GHG emissions, with additional measures (WAM).

	with additional measures [kt CO_2e]					
EU ETS GHG emissions	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Total (without LULUCF)	29 905	27 987	27 548	26 519	27 064	27 961
1. Energy	16 422	14 272	13 609	12 286	12 490	13 508
2. Industrial Processes	13 483	13 714	13 939	14 233	14 574	14 453
Non ETS GHG emissions	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Total (without LULUCF)	49 694	51 079	45 744	42 480	39 554	37 843
1. Energy	38 672	40 132	34 831	32 441	30 474	28 881
2. Industrial Processes	2 530	2 581	2 756	2 113	1 322	1 241
3. Agriculture	6 807	6 852	6 965	6 950	6 935	6 982
5. Waste	1 684	1 514	1 192	975	823	738

1 GENERAL APPROACH

1.1 Guidelines and Provisions

The following regulations and guidelines were taken into account:

- **EU Monitoring Mechanism (Regulation (EU) No 525/2013** on the mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and EU level relevant to climate change and repealing Decision No 2080/2004/EC of the European Parliament and the Council of 21 May 2013.
  - Article 12 – National and Union systems for policies and measures and projections: will be implemented by 9 July 2015
  - Article 13 – Reporting on polices and measures
  - Article 14 – Reporting on projections
- **Commission Implementing Regulation (EU) No 749/2014** of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council.
  - Article 22 – Reporting on polices and measures
  - Article 23 – Reporting on projections
- The **Guidelines for the preparation of National Communications** by parties included in Annex I to the Convention (FCCC/CP/1999/7).
- Annotated Outline for Fifth National Communications of Annex I Parties under the UNFCCC, including Reporting Elements under the Kyoto Protocol
- 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.
- Guidance and recommendations for reporting on GHG projections in 2015 (European Commission, draft from 30 April 2014)
- Recommended parameters for reporting on GHG projections in 2015 (European Commission, final after consultation, 17 June 2014)

1.2 Description of General Methodology

1.2.1 Database and Historical Emission Data

The Projections for Greenhouse Gases are consistent with the historical emission data of the Austrian Emission Inventory (from today's perspective submission is expected in June 2015) up to the data year 2013. Because of switching to the IPCC Guidelines 2006, which implicated methodical changes and using new GWPs for CH_4, N_2O and F-Gases according to Decision 4/CMP.7 (based on 4th Assessment Report of IPCC), the latest inventory had to be used for projections up to 2035. Unfortunately, due to problems with the UNFCCC CRF-Reporter Software which caused a delay in the inventory reporting cycle for the submissions 2015, the inventory for the sector LULUCF was not finished on the date when the submission of the projections was due (15th of March). Therefore the latest available inventory for this sector was used as a basis. Nevertheless an update of the LULUCF projections is scheduled for around June 2015.

1.2.2 Emission projections

Emission projections are generally calculated by applying the same methodologies as those used for the national GHG inventory. These are described in Austria's National Inventory Report 2015 (UMWELTBUNDESAMT 2015a).

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

Emission factors and underlying parameters are described in the methodological sub-chapters 3 of this report.

1.2.3 Underlying Models and Measures

The emission projections are based on the following sectoral forecasts:

- Energy Forecast, based on the National Energy Balance of Statistik Austria and a macro-economic model DEIO of the Austrian Institute of Economic Research (WIFO 2013), supported by calculations with bottom-up models:
  - TIMES (Austrian Energy Agency, AEA 2015): electricity demand, public electrical power and district heating supply
  - INVERT/EE-Lab (Energy Economics Group of the Technical University of Vienna, TU WIEN 2015): domestic heating and hot water supply
  - NEMO & GEORG (Technical University of Graz, TU GRAZ 2015): energy demand and emissions of transport (incl. off-road)
- Forecasts of emissions from industrial processes and solvent emissions are based on expert judgements of the Umweltbundesamt.
- The estimations of emissions for fluorinated gases are based on a study published in 2010 (GSCHREY 2010), in which the whole chapter on fluorinated gases was updated.
- The agricultural scenarios are based on the PASMA model of the Austrian Institute of Economic Research (WIFO & BOKU 2015)
- Waste scenarios are generally based on Umweltbundesamt expert judgements of waste amounts expected to be pre-treated in mechanical-biological treatment plants (before being landfilled). Furthermore, the population scenarios of ÖROK 2010 and a national study on the N_2O reduction potential of wastewater treatment plants (BMLFUW 2015) are considered.

Two scenarios were modelled: "with existing measures" includes all measures implemented by 1 May 2014; "with additional measures" includes planned policies and measures with a realistic chance of being adopted and implemented in time to influence the emissions. All additional measures have been defined at expert level in consultation with the Federal Ministry of Agriculture, Forestry, Environment and Water Management. Information on national policies and measures included in the scenarios can be found in chapter 5.

1.2.4 General Key Underlying Assumptions

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

The same general key factors are used for both scenarios.

Table 7: Key input parameters of emission projections (UMWELTBUNDESAMT 2015b)

Year	2010	2015	2020	2025	2030	2035
GDP [billion € 2010]	285	306	330	355	383	408
Population [1 000]	8 382	8 555	8 733	8 889	9 034	9 162
Stock of dwellings [1 000]	3 638	3 818	3 957	4 069	4 166	4 246
Heating degree days	3 252	3 228	3 204	3 161	3 118	3 065
Exchange rate [US$/€]	1.33	1.30	1.30	1.30	1.30	1.30
International coal price [US$10/t]	99.2	105	109	113	116	136
International oil price [US$10/bbl]	78.1	106	118	127	135	137
International natural gas price [US$10/GJ]	7.1	9.3	10.4	11.3	11.9	12.5
CO_2 certificate price [€/t CO_2]	13	15	20	25	30	57

Other underlying assumptions are included in the sectoral methodology chapters 3 and in the Annexes.

1.3 Sensitivity of Underlying Assumptions

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

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

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

- WEMsens1 and
- WEMsens2.

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

Table 8: Basic parameters for sensitivity analysis modelling (UMWELTBUNDESAMT 2015b)

Parameter WEMsens1	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
GDP [bn. € 2010]	285	312	353	399	452	511
International coal prices [US$10/t]	99.2	105	112	121	131	142
International oil price [US$/bbl]	78.1	124	163	215	284	368
International oil price [US$10/bbl]	78.1	111	130	153	180	212
International natural gas price [US$10/GJ]	7.1	9.6	11.5	13.6	16.1	19.1
CO_2 certificate price [€/t CO_2]	13	17	30	35	40	76
Parameter WEMsens2	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
GDP [bn € 2010]	285	302	314	327	340	354
International coal prices [US$10/t]	99.2	104	107	109	110	112
International oil price [US$/bbl]	78.1	112	136	159	184	212
International oil price [US$10/bbl]	78.1	100	108	113	117	122
International natural gas price [US$10/GJ]	7.1	9.0	9.9	10.1	10.2	10.5
CO_2 certificate price [€/t CO_2]	13	13	15	17	20	38

The following charts show the trend analysis of national total GHG emissions and the two sensitivity analyses. Additionally, the results were also presented separately for ETS (Directive 2003/87/EC) and ESD (decision No 406/2009/EC). Detailed conclusions and the effect of sensitivity analysis can be found in chapter 3.1.

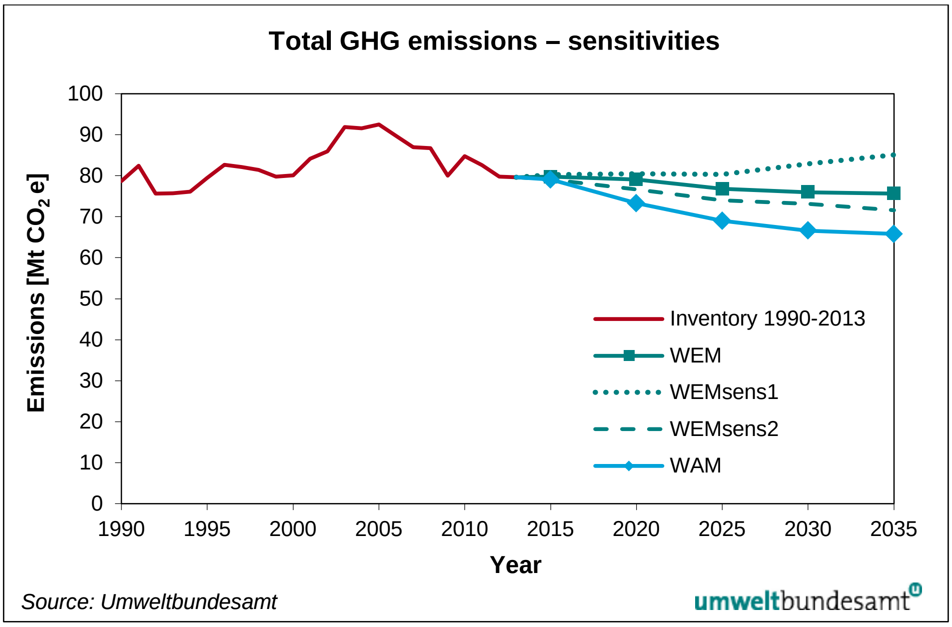


Figure 4: Trend and projections (2014–2035): total GHG emissions for the different scenarios and sensitivities

Figure 5: Trend and projections (2014–2035): total ETS GHG emissions for the different scenarios and sensitivities

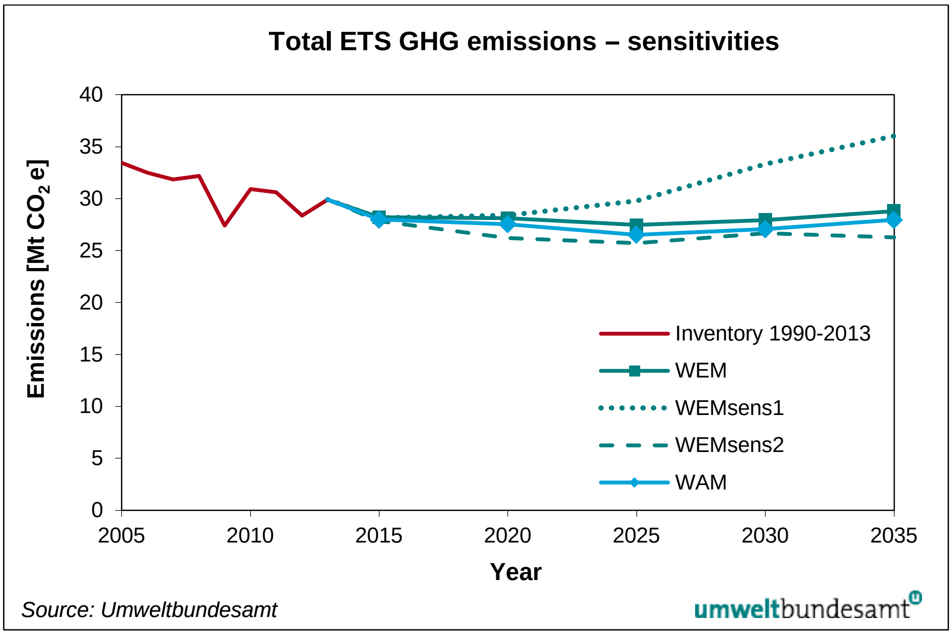
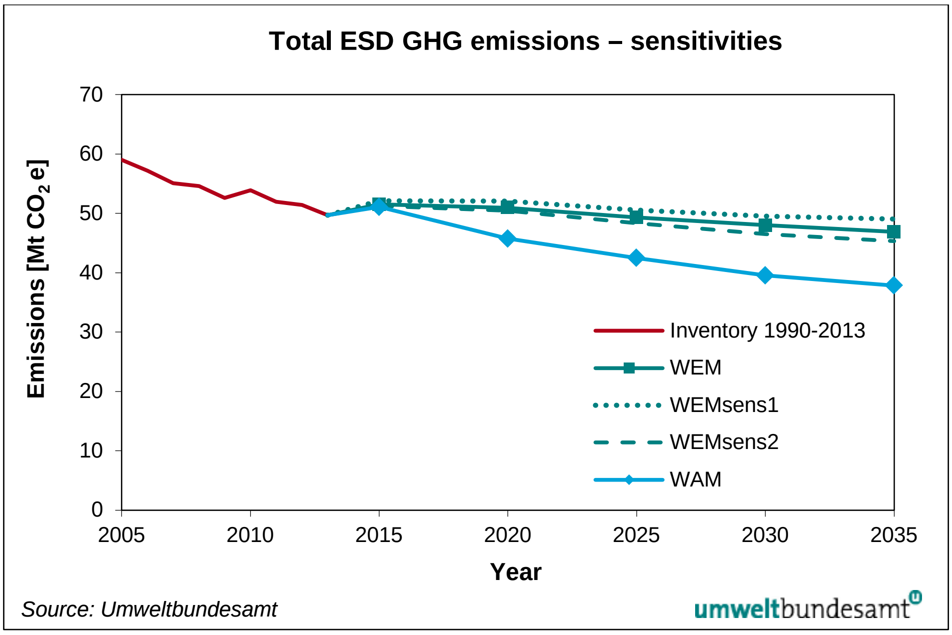


Figure 6: Trend and projections (2014–2035): total ESD GHG emissions for the different scenarios and sensitivities



1.4 Quality Assurance & Control

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

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

An output data check has been carried out which involved a detailed comparison of the results of the sectors and the checking of the plausibility of emission trends.

The specific responsibilities for this report have been as follows:

- Coordination & General chapters ... Andreas Zechmeister
- Energy Industries & Manufacturing Industries .... Michael Gössl, Thomas Krutzler, Herbert Wiesenberger
- Transport .... Gudrun Stranner
- Other Energy Sectors..................... Wolfgang Schieder, Alexander Storch
- Fugitive Emissions .... Stephan Poupa
- Industrial Processes .... Herbert Wiesenberger, Maria Purzner, Lorenz Moosmann
- Agriculture .... Michael Anderl, Simone Haider, Gerhard Zethner
- Waste .... Katja Pazdernik, Christoph Lampert, Stephan Poupa
- LULUCF.. Peter Weiss, Carmen Schmid
- Policies and Measures .... Elisabeth Kampel

1.5 Uncertainty of emission projections

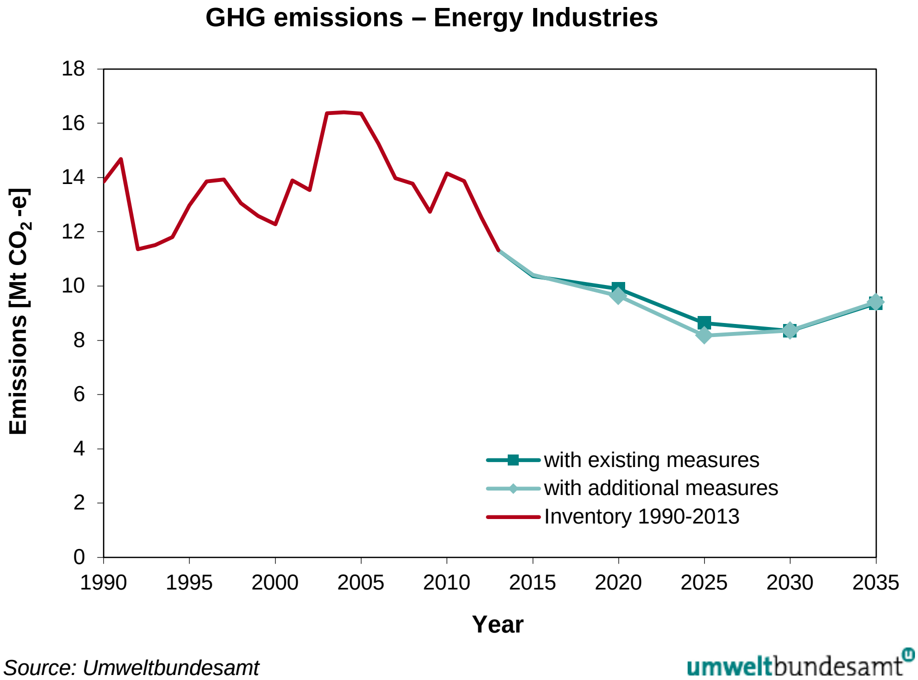
The variations in the chosen input parameters in the Sensitivity Analysis can be seen as an indicator of the overall uncertainty caused by changing the input data. The methodological chapter 3 additionally includes qualitative discussions of uncertainties in specific sectors.

2 SECTORAL SCENARIO RESULTS

2.1 Energy (CRF Category 1)

2.1.1 Energy industries (1.A.1)

Figure 7: Past trend and scenarios (2014–2035): GHG emissions from 1.A.1 – Energy Industries.



Source: Umweltbundesamt

In the Energy Industries sector GHG emissions will continue to decrease due to fuel shifts from oil and coal to renewables. The installed capacities of hydro power, solar and wind plants are expected to increase significantly. After 2017 the first biomass plants will be decommissioned unless more subsidies are made available than foreseen in the WEM scenario. After 2030 the rise in overall electricity demand is expected to outpace growth in renewable generation. Therefore, emissions are expected to increase again.

The major driving force behind the emissions in this sector is electricity demand, especially after 2020. Whereas demand in the year 2020 in the WEM scenario is expected to be about as high as in 2012, it is expected to rise almost 2% per year on average thereafter. In the WAM scenario, a slightly falling demand until 2020 is expected to be followed by a rise almost as steep as in the WEM scenario.

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

Emissions from oil and gas exploration and storage are expected to be quite stable.

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

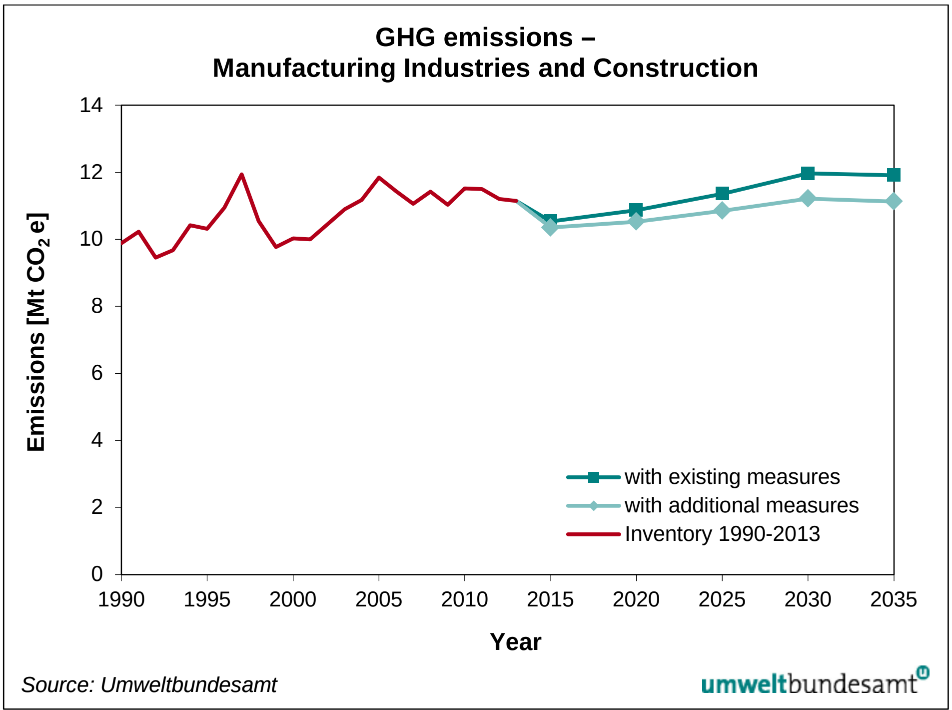


Figure 8: Past trend and scenarios (2014–2035) GHG emissions from 1.A.2 – Manufacturing Industries and Construction.

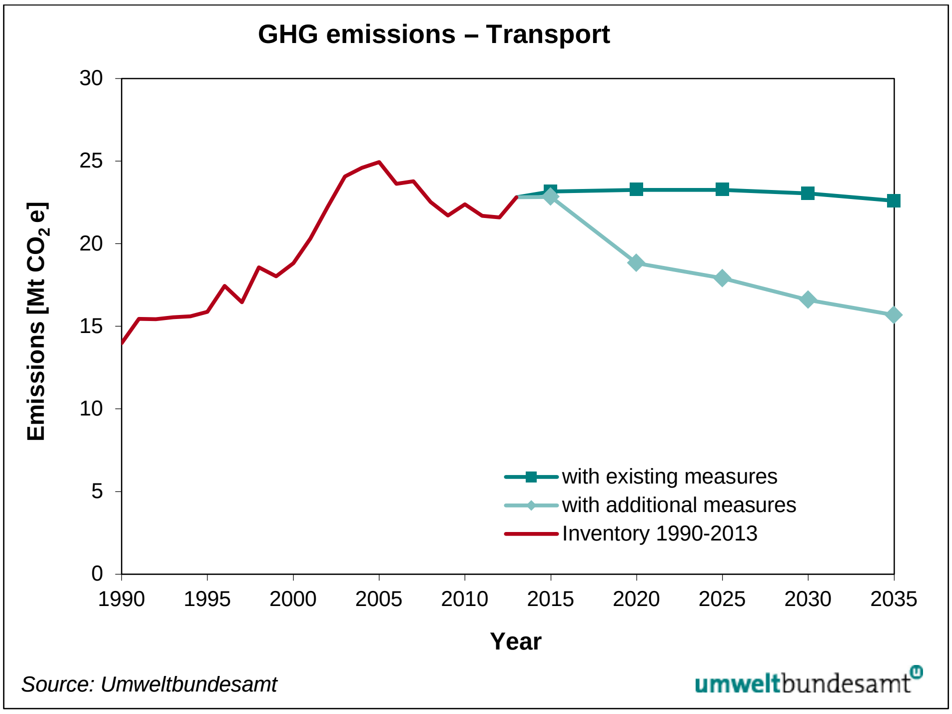
The Industry sector is one of the main sources of greenhouse gases in Austria, mainly due to the CO_2 emissions in this sector. Major sub-groups contributing to these emissions are: the production of iron and steel, the production of non-metallic minerals, the pulp and paper industry and the chemicals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

During the period between 1990 and 2005 the Industry sector was responsible for an emission increase by more than 20%. Since 2005 emissions have slightly decreased. For the period from 2013 to 2030 a slight increase of CO_2 emissions (as a result of higher sectoral GDP projections) is expected.

After 2030 a higher CO_2 price and a lower economic growth rate are assumed as the main reasons for the stabilisation of emissions.

2.1.3 Transport (1.A.3)

Figure 9: Past trend and scenarios (2014–2035) GHG emissions from 1.A.3 – Transport.



The Transport sector is one of the main sources of greenhouse gases in Austria. While emissions from gasoline vehicles are declining steadily, emissions from diesel are increasing constantly. Up to 30% of the GHG emissions in this sector are caused by fuel exports due to persistently low fuel prices in Austria compared to the neighbouring countries (BMWFW 2015).

GHG emissions saw a steep increase in recent years and reached their peak in 2005. Then the implementation of the EU Biofuels Directive (2003/30/EC) and declining fuel exports changed this trend. In addition, the economic downturn resulted in further emission reductions, especially in 2008 and 2009, but emissions are now expected to rise again because of an increase in economic and transport activities from 2010 onwards. Up to 2015, the implemented measures (WEM scenario) are not expected to change this trend. From 2015 onwards, an increased use of biofuels in the Transport sector, plus higher fuel efficiency standards of the fleet – in addition to electro-mobility initiatives – are expected to help stabilise the increasing trend and keep emissions at a constant level.

In the WAM scenario the two-stage increase of the Austrian fuel tax (MöSt) in 2016 and 2019 as well as the implementation of the Energy Efficiency Directive (2012/27/EC) are the main measures through which the estimated reduction of GHG emissions up to 2020 is expected to be achieved.

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

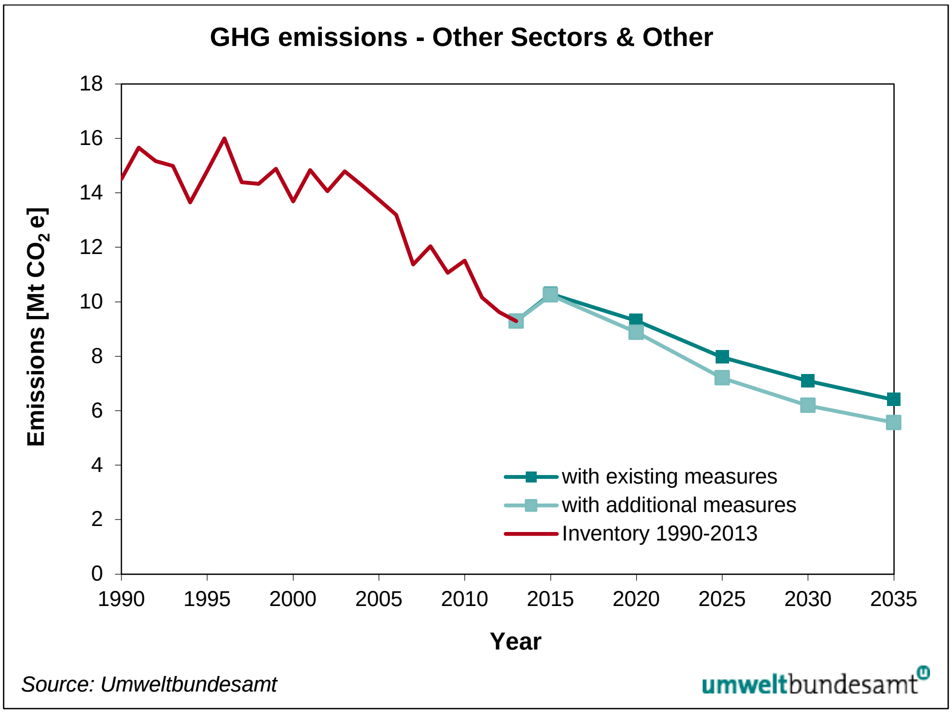


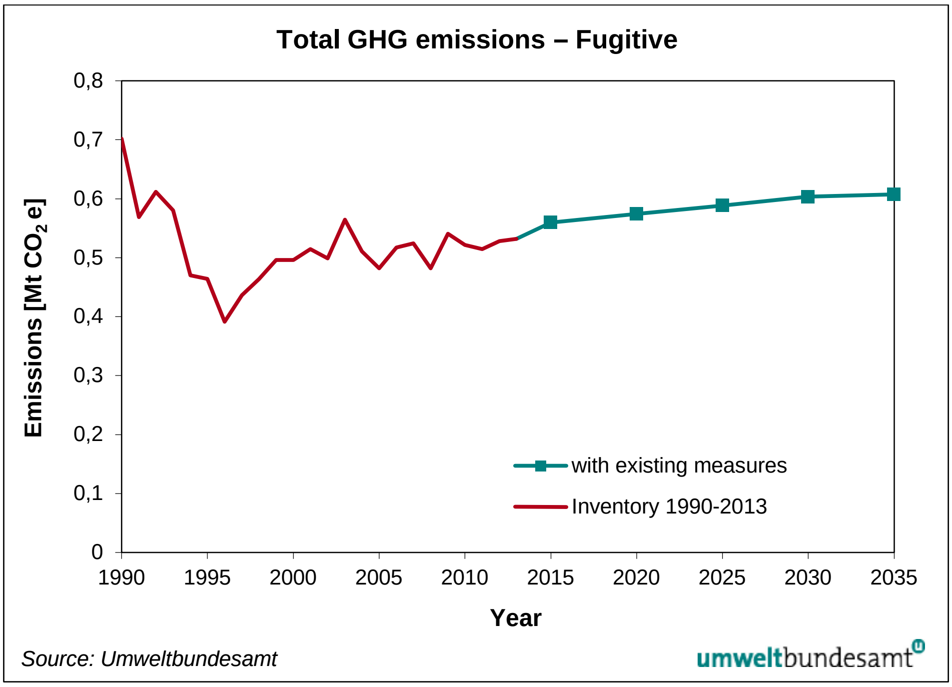
Figure 10: Past trend and scenarios (2014–2035) GHG emissions from 1.A.4 – Other sectors (includes Residential, Commercial/Institutional and Agriculture/Forestry/Fishing) and 1.A.5 – Other (military transport).

The "1.A.4 other sectors" account for a considerable amount of the total greenhouse gas emissions in Austria. Despite growing numbers of households and occupied living space, the total GHG emissions in this sector are expected to see substantial reductions by 2035 in the scenario "with existing measures" and even more reductions in the scenario "with additional measures".

The driving force behind these reductions is the shift from fossil fuels to renewables like biomass, solar heat and heating pumps as well as a slight transfer of emissions to other sectors (district heat). Furthermore, a slight reduction of total energy consumption (incl. electricity) together with increased insulation in new buildings (or better insulation through renovation measures), as well as an improved efficiency of primary heating systems in buildings are all expected to lead to a considerable reduction of GHG emissions between now and 2035.

2.1.5 Fugitive emissions (1.B)

Figure 11: Past trend and scenarios (2014–2035) GHG emissions from 1.B – Fugitive emissions.



Between 1990 and 2013 fugitive emissions from coal mining, fossil fuel exploration, refining, transport, production and distribution decreased by 24%. The main driving force behind this decrease was the closure of coal mines. The increase since 1996 was due to the extension of the natural gas distribution network and the increasing emissions from natural gas and oil extraction. It is expected that total emissions will slightly increase due to an increase in natural gas exploration and an expansion of the gas distribution and pipeline network.

2.2 Industrial Processes (CRF Category 2)

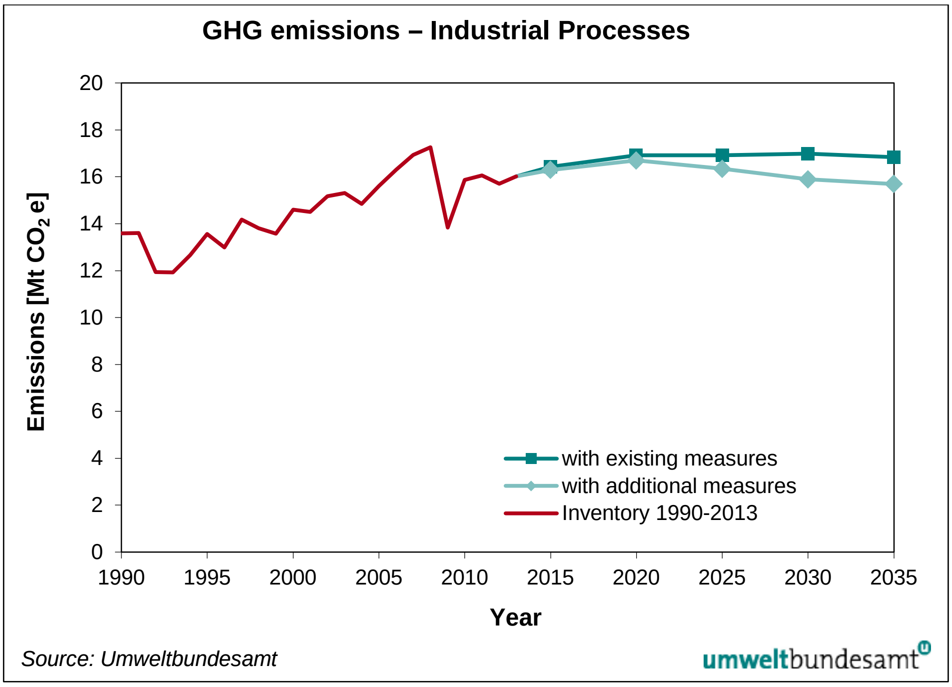


Figure 12: Past trend and scenarios (2014–2035) GHG emissions from 2 – Industrial Processes.

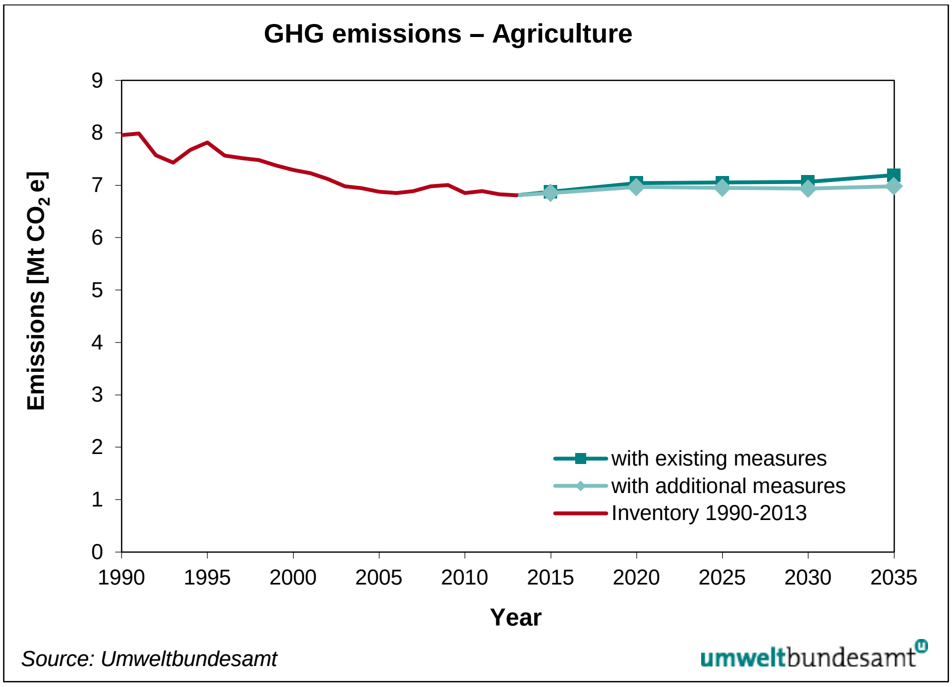
Emissions from industrial processes are expected to see a slight increase in particular until 2020, due to a projected increase in production. The main contributors are the categories "metal production" and "mineral products". After 2030 the higher CO_2 price and the lower economic growth rate are expected to contribute to the stabilisation of the emissions.

Another source in this sector are the fluorinated gas (HFC, PFC and SF_6) emissions. These contributed 12.7% of the emissions in the industrial processes sector in 2013 with a projected decrease to 9.3% by 2035 in the scenario with additional measures, a decrease mainly to be brought about by several legislative measures (see chapter on methodology for more information).

The former CRF source category 3 "Solvents and Other Product Use" (now CRF source category 2D and G, Solvent 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 –38% between 1990 and 2013 due to decreasing solvent and N_2O use and as a result of the positive impact of the laws and regulations enforced in Austria. This trend is expected to continue until 2035.

2.3 Agriculture (CRF Category 3)

Figure 13: Past trend and scenarios (2014–2035) GHG emissions from 3 – Agriculture.



The CRF source category 3 "Agriculture" contributed 8.6% of the total of Austria's greenhouse gas emissions in 2013 (without LULUCF). The Agriculture sector is the largest source of both N_2O and CH_4 emissions in Austria.

From 1990 to 2013, emissions decreased, mainly due to decreasing livestock numbers and reduced fertilizer usage. Between 2013 and 2035 an increase in emissions by 5.7% is expected. Underlying livestock projections indicate that the declining trends will come to an end. Dairy cattle numbers will increase because milk production is likely to expand after the abolition of the milk quota in 2015. Slightly increasing prices for pork will cause higher numbers of pigs.

In the WAM scenario the implementation of policy measures (as outlined in chapter 4) results in a more constant emission trend (+ 2.6% from 2013 to 2035). However, the underlying increasing numbers of dairy cattle and swine affect this trend.

2.4 LULUCF (CRF Category 4)

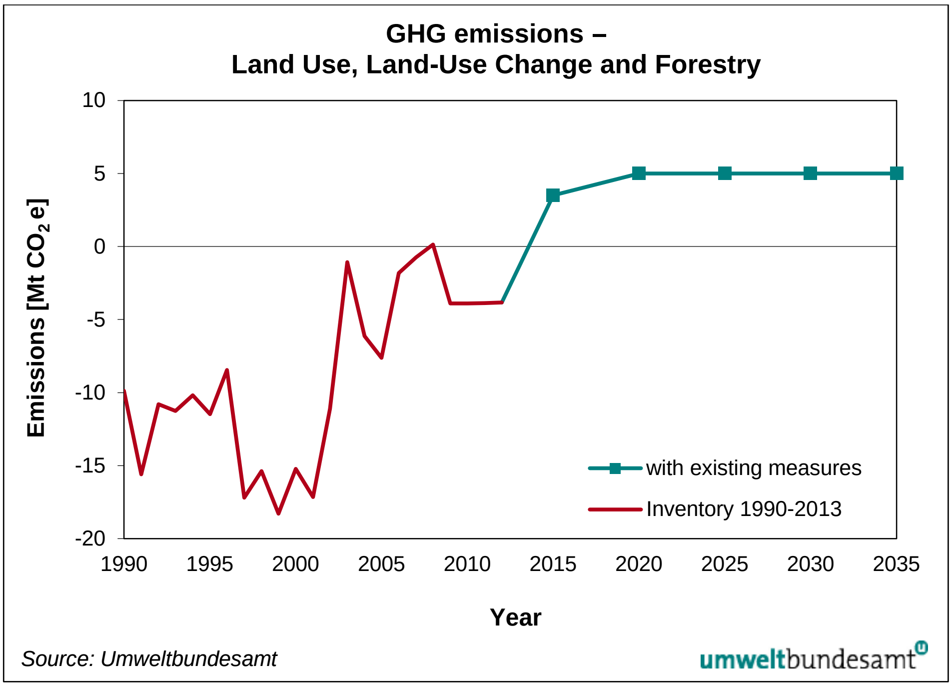


Figure 14: Past trend and scenarios (2014–2035) GHG emissions from 4 – Land Use, Land-Use Change and Forestry[3].

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

For the other LULUCF sub-sectors no projections are available. The emissions/removals reported for 2013 are also reported for later years.

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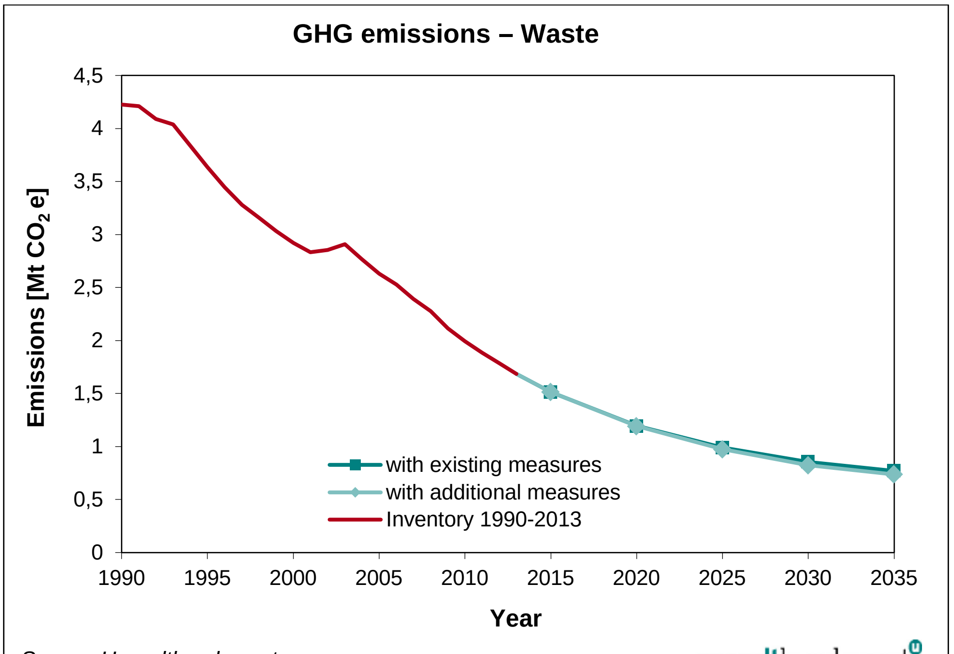
[3] The historical values of category 5.A.1 (having the main impact on LULUCF totals) for the years 2009 and 2010 are based on averages of the NFI observation period 2002 and 2008 and will be revised in line with the results of the next NFI

In the next few months, Austria will be carrying out new projections for forest land, cropland and grassland. These are not available for this submission, but will become available before summer where Austria intends to submit revised LULUCF projections.

2.5 Waste (CRF Category 5)

Figure 15: Past trend and scenarios (2014–2035) GHG emissions from 5 – Waste.



Source: Umweltbundesamt

The scenario shows a further downward trend in waste treatment and disposal up to 2020/2035. This is in line with a decreasing carbon content of historically landfilled waste as well as a decrease in the amount of waste deposited in landfills (due to legislative regulations). Increases in waste incineration (with energy recovery) and a reduction of the amount of wastes treated in MBT plants are further reasons for declining emissions from solid waste disposal and biological treatment of solid waste. Emissions from 'waste water handling and discharge' are slightly increasing under the current policy ('WEM') and with reinforced efforts ('WAM') decreasing until 2030.

The sub-sector 'solid waste disposal' is responsible for a major part of the greenhouse gas emissions from the Waste sector (79% in the year 2013), followed by 'waste water handling and discharge' (11%) and 'biological treatment of solid waste' (10%).

Emissions from 'waste incineration without energy recovery' have been of minor importance since 1993. Emissions from 'waste incineration with energy recovery' are reported under category 1.A (Fuel Combustion).

3 SECTORAL METHODOLOGY

3.1 Energy (CRF Source Category 1)

Total energy demand and production was evaluated on the basis of energy scenarios developed by a consortium of the Environment Agency Austria (Umweltbundesamt), the Austrian Institute of Economic Research (Wirtschaftsforschungsinstitut, WIFO), the Austrian Energy Agency, the Energy Economics Group of the Vienna University of Technology and the Institute for Internal Combustion Engines and Thermodynamics at the Graz University of Technology (UMWELTBUNDESAMT 2015b). The scenarios were developed with the help of several models:

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

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

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

For evaluating the electricity demand, a model based on TIMES has been used. The model has been adapted especially for Austria. For the calculation of the electricity demand it combines a bottom-up (used devices and the characteristics thereof in several sub-sectors) approach for households with a top-down (development of energy intensity and gross-value added) approach for industry, the service sector and agriculture. For transport and heating the results of different models have been used (AEA 2015).

For projecting the production of electricity and district heating the same model (i.e. TIMES Austria) has been used. It is based on available capacities for all types of power plants in combination with energy prices and the demand for electricity and district heating (taken from the model INVERT/EE-Lab). Subsidies (e.g. granted under the Green Electricity Act) and fees (like emission allowances) are also important input parameters (AEA 2015).

For modelling the energy consumption for domestic heating and domestic hot water supply, the software package INVERT/EE-Lab[4] (TU WIEN 2015) 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,

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

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

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

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

3.1.1 Energy Industries (1.A.1)

3.1.1.1 Methodology of the sectoral emission scenarios

The output of the model based on TIMES (see chapter 3.1) provides fuel-specific activity data for the Energy Industries (i.e. Electricity and Heat Production including Waste Incineration). These were multiplied by established and fuel-specific emission factors used by the Austrian Inventory. Emission factors for fuels not specified (e.g. for refinery fuel gas, refinery coke) or for wastes (e.g. municipal solid waste, hazardous waste) were derived from plant-specific data. The methodology for the emission factors is discussed in the Austrian Inventory Report (UMWELTBUNDESAMT 2015a).

As regards the only refinery operated in Austria, no major changes in the production capacities or in the technologies used are expected from the current point of view. Restructuring programmes and a start-up of new production units were undertaken in the past few years. The last one was completed in 2008. Thus, average emissions of the years 2010–2012 have been used for the projection.

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

3.1.1.2 Assumptions

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

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

EU ETS/non-ETS

In “Public Electricity and Heat Production” (1A1a) none of the non-ETS installations uses coal whereas waste is completely burned in non-ETS installations. For natural gas and liquid fuels it is assumed that the current ETS/non-ETS share will remain stable throughout the reporting period for each of the production technologies (i.e. CHP and heat only plants, respectively). “Petroleum Refining” (1A1b) is completely covered by the ETS except for non-CO_2 greenhouse gas emissions. ETS emissions from “Manufacture of Solid Fuels and Other Energy Industries” (1A1c) are expected to evolve proportionally to the gross inland consumption of gas from 2013 onwards. In 2013 additional installations were included in the ETS.

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:

- 13 €/t in 2010, 20 €/t in 2020, 30 €/t in 2030.

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

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

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

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

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

Optimisation of existing hydro power plants

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

Green Electricity Act

For the scenario “with existing measures” it is assumed that the goals of the Green Electricity Act 2012 (Federal Law Gazette I No. 75/2011) will be fulfilled. The Act aims at a construction of hydroelectric power plants with a capacity of 1 000 MW, wind farms with 2 000 MW, photovoltaic systems with 1 200 MW and biomass plants with 200 MW_{th} up to the year 2020. The Green Electricity Act stipulates no specific goals beyond the year 2020. Note that the goals for photovoltaic installations are expected to be surpassed due to their profitability.

Petroleum refining

See chapter 3.1.1.1 for assumptions regarding this sector.

Manufacture of solid fuels and other energy industries

See section 3.1.1.1 for assumptions regarding this sector.

Scenario "with additional measures"

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

A further measure is the setting of additional targets for 2030 in the Green Electricity Act: +2 000 MW wind plants and +1 200 MW photovoltaics (in relation to the 2020 targets). Note that the goals for photovoltaic installations are expected to be surpassed due to their profitability.

Energy efficiency measures (see chapter 3.5.4.2) are expected to have been fully implemented, leading to a decrease in electricity demand.

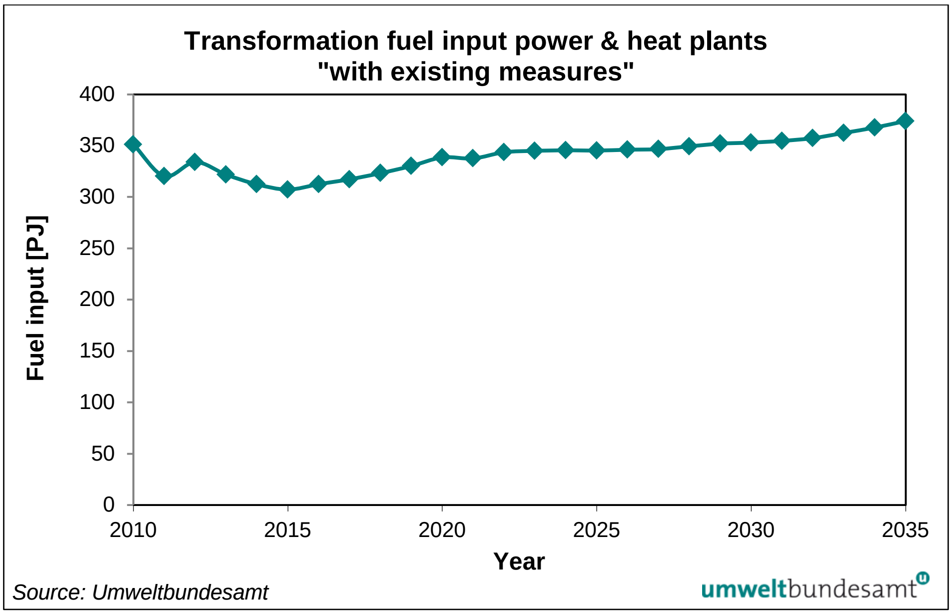
3.1.1.3 Activities

Scenario "with existing measures"

The transformation input to Austrian heat and power plants for the WEM scenario is depicted in Figure 16. The input to coal, oil and gas plants is expected to decline (the input to coal plants is expected to end in 2024, to oil plants in 2016) which will, however, be compensated for by the increased input to hydroelectrical, wind and photovoltaic plants. From 2030 onwards, inputs to gas plants are expected to rise to match the increase in electricity demand.

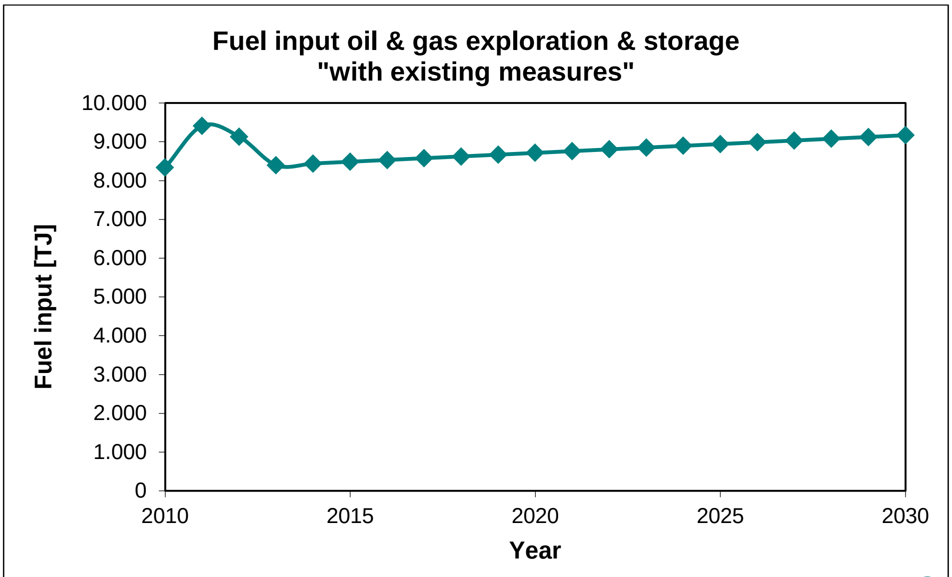
The input of biomass, wind and hydro power and photovoltaics is assumed to increase significantly.

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



Emissions (and thus energy inputs) of the only refinery in Austria are expected to remain stable until 2035 as indicated in chapter 3.1.1.1, both in the WEM and WAM scenarios.

For oil and gas exploration and storage, natural gas is the only fuel source. The input is expected to increase steadily (compared to 2013) (see Figure 17).

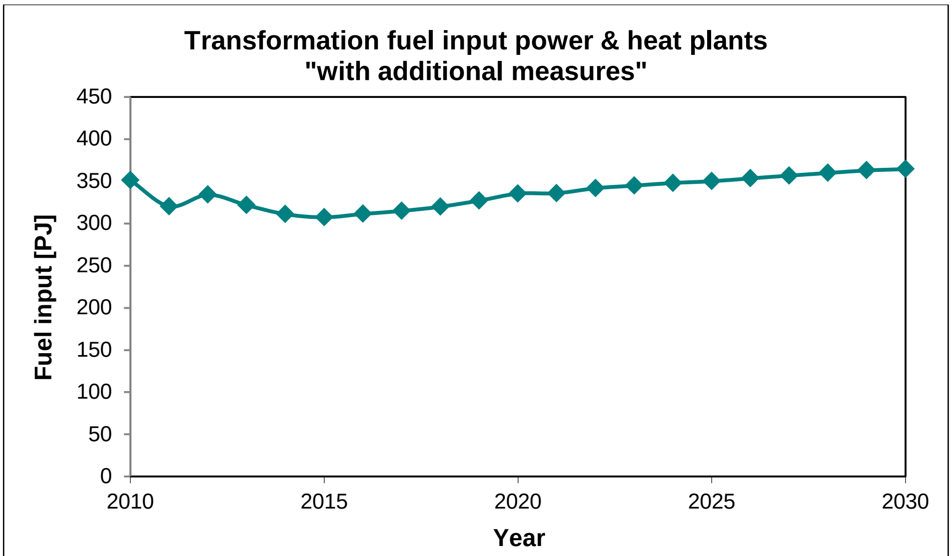


Source: Umweltbundesamt

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 WAM scenario is depicted in Figure 18. Trends and effects are similar to the WEM scenario, with higher inputs in the later years of the period due to increased exports of electricity.



Source: Umweltbundesamt

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

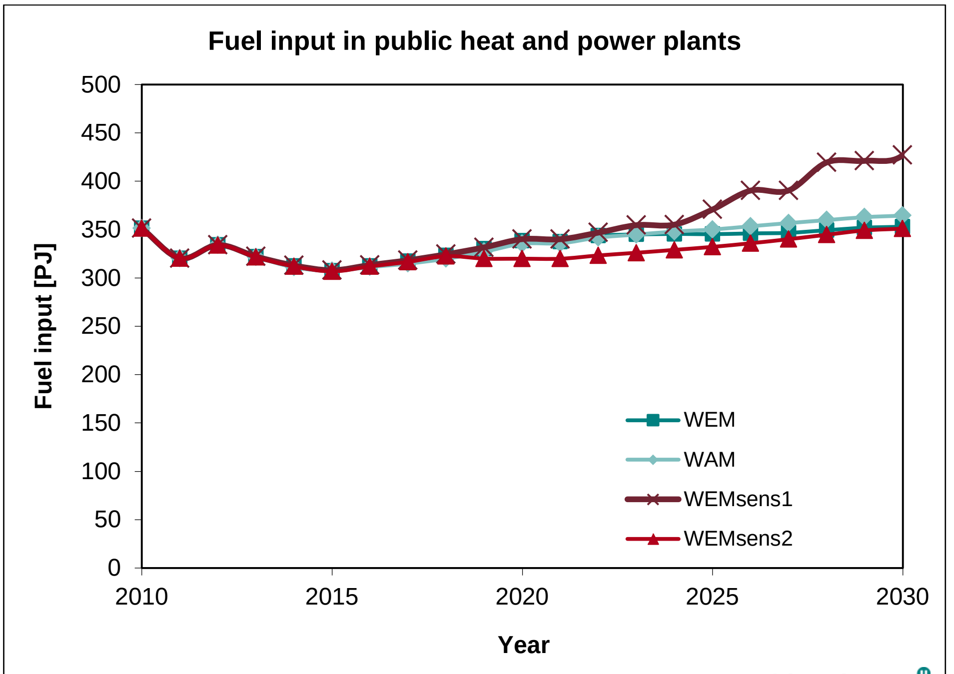
For general assumptions on sensitivity analysis see chapter 1.3.

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

Figure 19 depicts changes in tranformation inputs resulting from lower and higher GDP growth rates. In the first sensitivity scenario (WEM sens 1), it is expected to be economically viable to increase production in existing power plants due to an increased electricity demand.

In the second sensitivity scenario (WEM sens 2), the tranformation input is expected to rise sligthly lower than in the WEM scenario due to the lower growth rate of 0.8% p.a.

Figure 19: Changes in fuel inputs in public heat and power plants according to GDP growth.



Source: Umweltbundesamt

For public electricity and heat production a significant decrease in emissions is expected if GDP growth is lower (15% in 2020). For 2030, with lower imports in the sensitivity scenario, the decrease is expected to be less pronounced (6%). If the GDP growth rate is higher, emissions are expected to increase significantly (22% in 2020 and 61% in 2030) (see Figure 19).

For the only Austrian refinery no GDP growth-related changes are expected. Therefore, trends in 1.A.1 total sensitivity are dependent on the sensitivity in calculated for sub-sector 1.A.1.a (see Figure 20 for comparison).

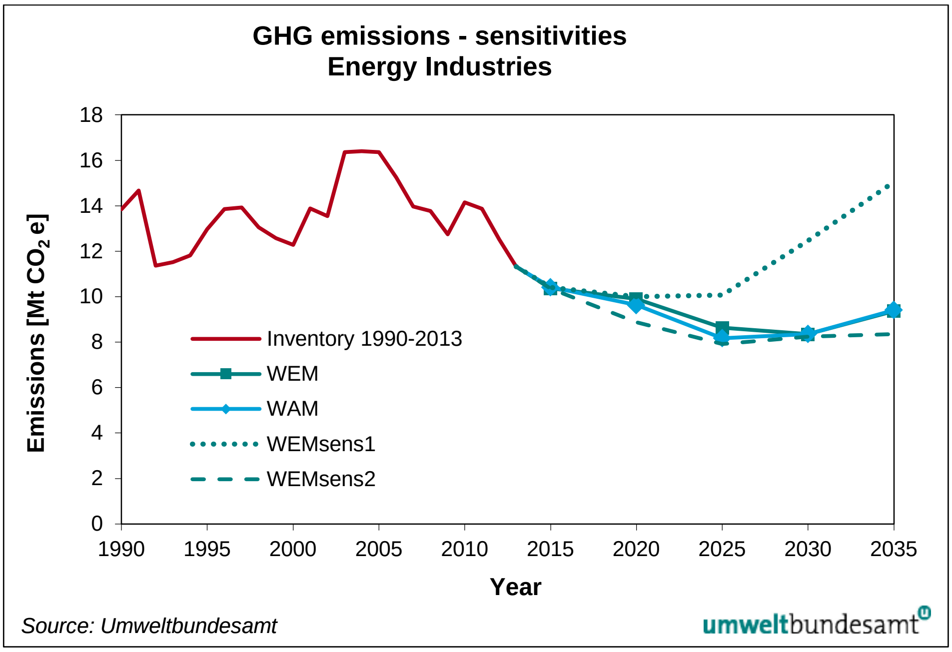


Figure 20: Trend and projections (2014–2035): total GHG emissions for the different scenarios and sensitivities, sector 'Energy Industries'

3.1.1.5 Uncertainty

For uncertainties regarding emission factors see the Austrian National Inventory Report 2015 (UMWELTBUNDESAMT 2015a).

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

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

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

Less uncertainty is associated with population growth in Austria.

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

3.1.2.1 Methodology used for the sectoral emission scenarios

The models are described in the energy chapter 3.1.

3.1.2.2 Assumptions

Scenario "with existing measures"

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

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

Global oil price [US$ 2010]	2010	2015	2020	2025	2030	2035
WEM	78.1	106	118	127	135	137
WEM sens1	78.1	111	130	153	180	212
WEM sens2	78.1	100	108	113	117	122

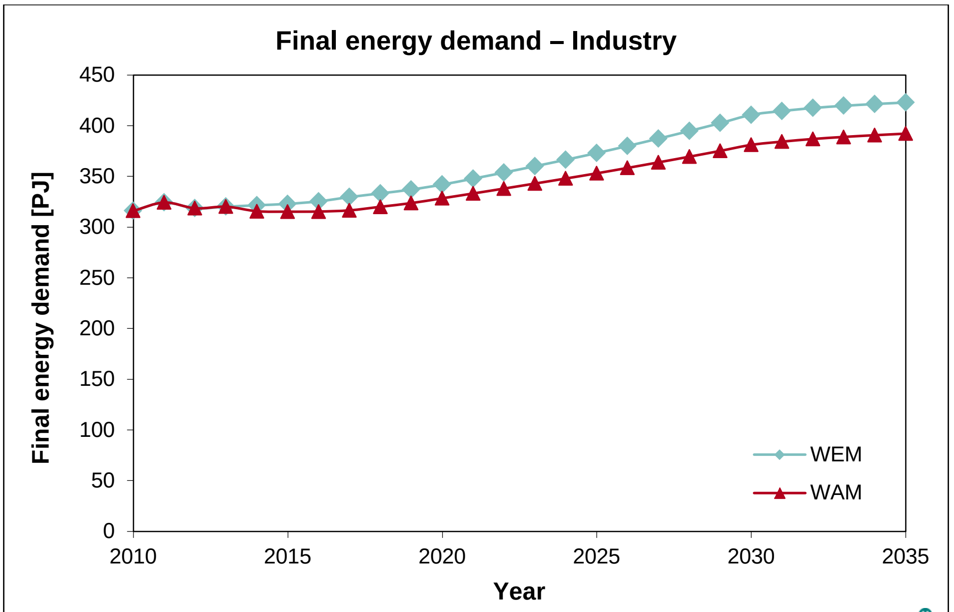
Scenario "with additional measures"

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

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

Energy demand [PJ]	scenario	2010	2015	2020	2025	2030	2035
Industry	WEM	315	323	342	373	411	423
Industry	WAM	315	315	328	353	381	392

Figure 21: Final energy demand in the industrial sector.



Source: Umweltbundesamt

3.1.2.3 Activities

Scenario "with existing measures"

The energy input in the industrial sector is expected to increase continuously from 2012 to 2030. The difference between the WEM and WAM scenarios is mainly due to efficiency measures (see Figure 21 and Table 11). Detailed figures are given in the Annexes.

Scenario "with additional measures"

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

3.1.2.4 Sensitivity Analysis

For general assumptions on sensitivity analysis see chapter 1.3.

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

As can be seen in Figure 22, the fuel input in the sensitivity scenario 1 is expected to be 7% higher in 2020 and 16% higher in 2030. In the sensitivity scenario 2, the fuel input is expected to be 6% lower in 2020 and 12% lower in 2030.

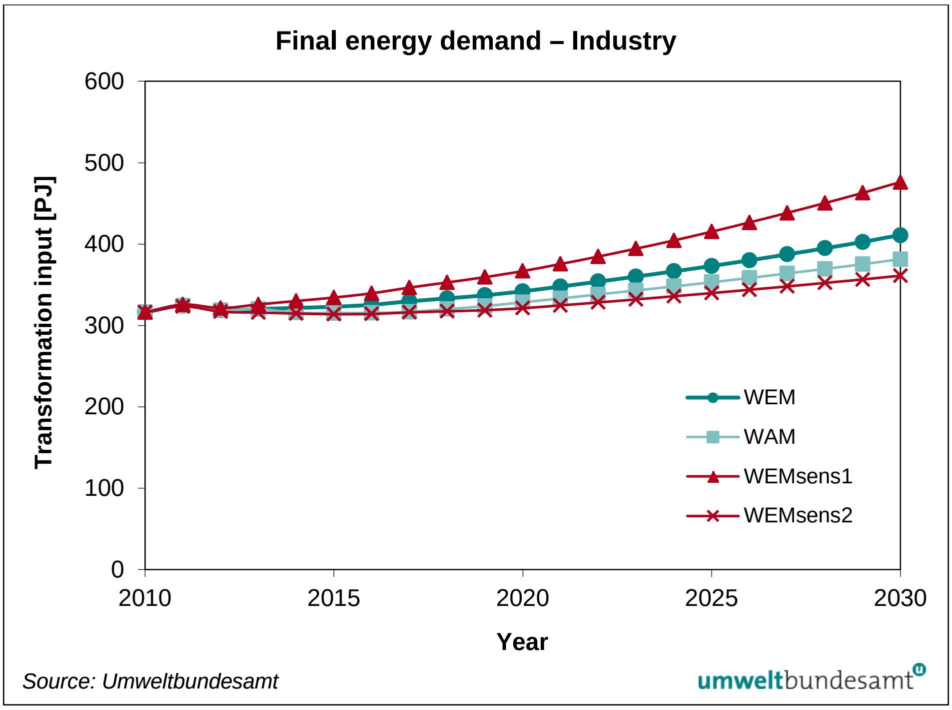
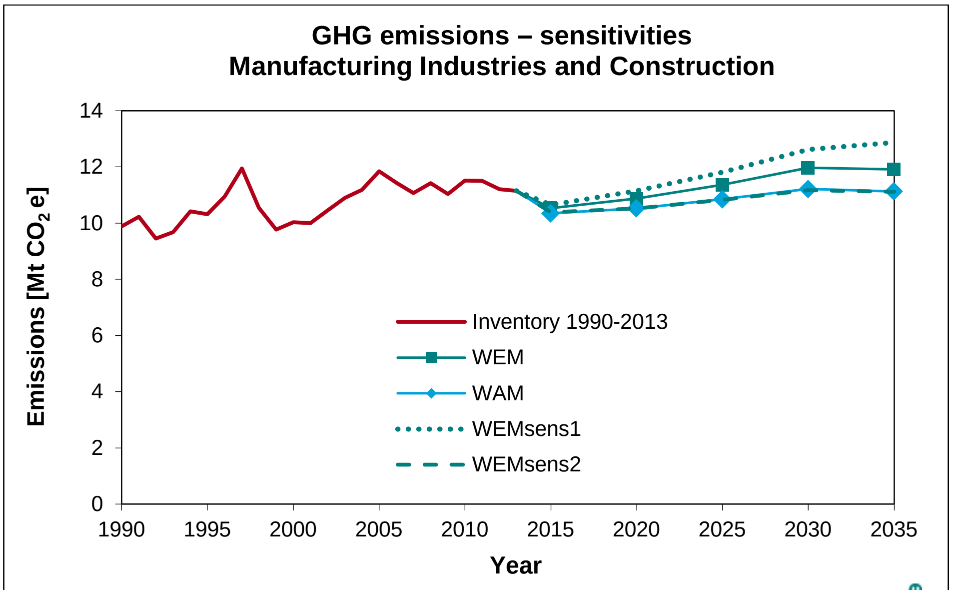


Figure 22: Final energy demand in the Industry sector with sensitivities

Figure 23: Trend and projection (2014–2030) of total GHG emissions for the scenarios and sensitivities, sector: manufacturing industries and construction



Source: Umweltbundesamt

3.1.2.5 Uncertainty

For uncertainties regarding emission factors see the Austrian National Inventory Report 2015 (UMWELTBUNDESAMT 2015a).

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

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

Less uncertainty is associated with population growth in Austria.

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

3.1.3.1 Methodology of the sectoral emission scenarios

The scenarios comprise different models:

1 A 3 Transport (without aviation)

The calculation of transport emissions is based on different models:

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

Emissions from Mobile Combustion have so far been calculated using the GLOBEMI model (HAUSBERGER 1998, HAUSBERGER & SCHWINGSHACKL 2012). The calculations have been based on a detailed depiction of fleet composition, driving behaviour, related energy consumption and emission factors.

From the 2015 submission onwards projections for the time series up to 2050 will be based on the NEMO model – Network Emission Model (DIPPOLD et al.

2012, HAUSBERGER et al. 2015a & 2015b). NEMO is set up according to the same methodology as the former model GLOBEMI and combines a detailed calculation of the fleet composition with a simulation of energy consumption and emission output on a vehicle level. It is fully capable of depicting the upcoming variety of possible combinations of propulsion systems (internal combustion engine, hybrid, plug-in hybrid, electric propulsion, fuel cell …) and alternative fuels (CNG, biogas, FAME, ethanol, GTL, BTL, H2 …).

In addition, NEMO has been designed in such a way as to be suitable for all the main application fields for the simulation of energy consumption and emission output using a road-section based model approach. As there is as yet no complete road network for Austria on a high resolution spatial level, the old methodology based on a categorisation of traffic activities into "urban", "rural" and "motorway" has been applied with the NEMO model.

Furthermore, the model delivers an assumption for the fuel export effect.

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

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

1 A 3 a – Aviation

Projections for energy consumption in the aviation sector up to 2035 are based on jet fuel scenarios provided by the Austrian Institute of Economic Research (WIFO) within the framework of an energy demand scenario for the different CRF sectors in Austria (WIFO 2013).

1 A 3 e – Other transportation – pipeline compressors

Projections for energy demand in pipeline transport up to 2035 are based on expert judgment based on European gas demand, the gas price and electricity price, economic development and a regression analysis of observed historical trends.

3.1.3.2 Assumptions

1 A 3 a – Aviation

Scenario "with existing measures" (WEM)

Projections for energy consumption in the aviation sector up to 2035 are based on scenarios carried out by the Austrian Institute of Economic Research (WIFO) as mentioned above. This scenarios are based on generally accepted parameters for annual GDP growth or domestic income.

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

Scenario "with additional measures" (WAM)

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

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

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

Scenario "with existing measures" (WEM)

The performance of passenger transport has been constantly increasing since 1990. It is assumed that passenger kilometres (pkm) will increase further until 2035. Therefore, elasticities[5] for passenger transport (based on GDP growth as assumed up to 2030) have been calculated (Umweltbundesamt 2015b). This increase will not affect all transport modes in the same way. Passenger car transport will increase rapidly. This assumption includes assumptions about the future fleet of electric and plug-in hybrid cars (assumptions about trends in electric mobility are given below). Bus, rail and electric local public transport are also expected to increase slightly. The following table shows – in consistency with the reporting obligations for GHG emissions – the pkm travelled per transport mode (including pkm travelled by passenger cars which are allocated to fuel exports).

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

Table 12: Past trend and scenarios (2015–2035) increase in passenger kilometres in absolute numbers (in million pkm incl. fuel export).

	passenger cars	buses	mopeds	motor cycles	rail	electric local public transport	pedestrians	bicycles	national aviation
1990	58 351	7 970	443	308	8 912	2 796	1 914	1 213	150
1995	61 360	7 927	416	328	9 590	2 926	1 892	1 235	152
2000	62 270	8 090	401	365	9 957	2 941	1 883	1 242	154
2005	88 419	8 331	386	403	9 764	3 100	1 874	1 249	156
2010	84 547	8 479	376	450	9 949	3 154	1 865	1 256	158
2015	83 709	8 701	369	510	10 124	3 300	1 857	1 264	161
2020	87 203	8 700	363	564	10 222	3 451	1 849	1 272	163
2025	91 734	8 772	359	619	8 709	3 407	1 841	1 280	165
2030	95 868	8 937	359	691	8 537	3 460	1 833	1 288	167
2035	100 569	8 942	355	765	8 554	3 536	1 825	1 296	169

Although the WEM scenario includes measures aiming at a change of the modal split of passenger transport, these measures are not expected to change the modal split significantly.

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

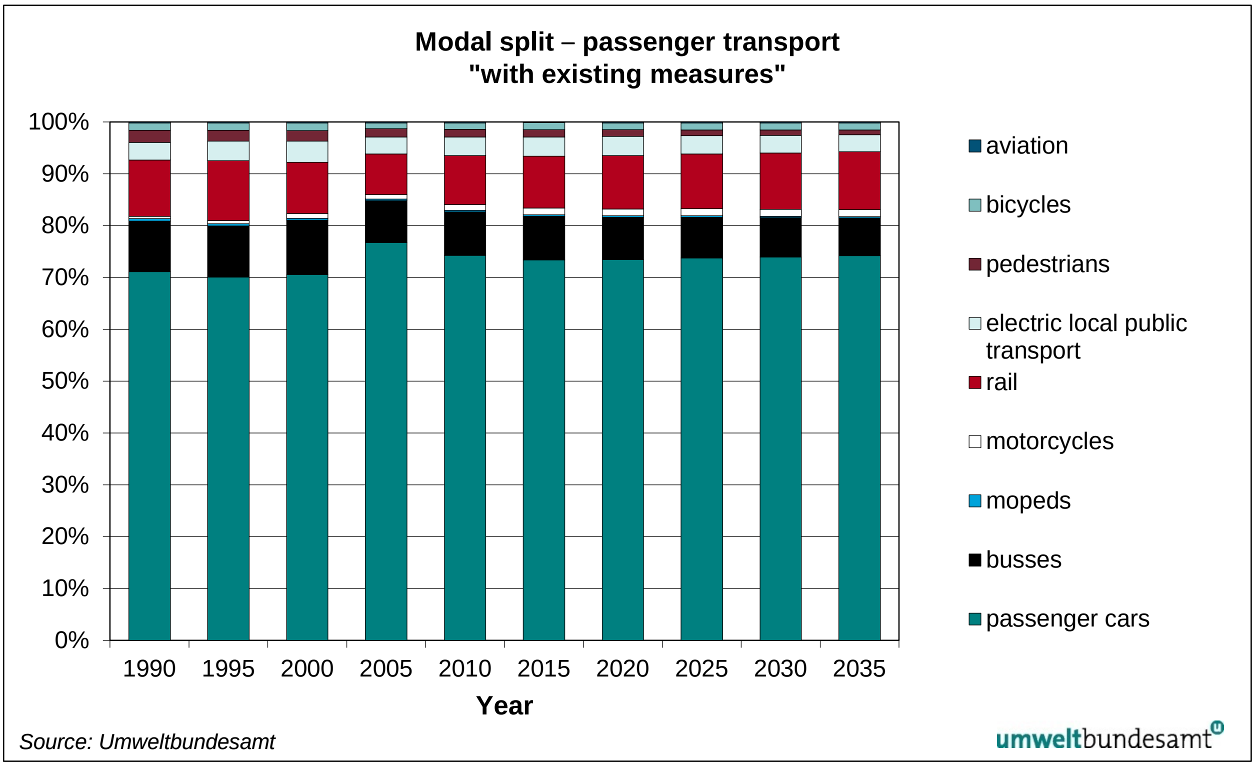


Figure 24: Past trend and scenarios(2015–2035) passenger transport: modal split – scenario "with existing measures" (incl. fuel export).

Scenario "with additional measures" (WAM)

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

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

Scenario "with existing measures" (WEM)

Transport performance (given in tonne kilometres (tkm) for heavy duty vehicles) has increased since 1990 and it is expected that it will increase unimpededly, assuming that GDP dependent freight transport elasticities will continue up to 2030 (UMWELTBUNDESAMT 2015b). Freight rail transport is expected to increase slightly. Freight volumes transported by light duty vehicles, navigation and aviation are expected to remain constant on a low level.

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

Table 13: Past trend and scenarios (2011–2035) increase in freight tonne kilometres (in million tkm incl. fuel export).

	light duty vehicles	heavy duty vehicles	rail	navigation	aviation
1990	1 187	36 681	11 349	101	NE
1995	1 391	55 065	12 321	83	NE
2000	1 649	95 971	15 331	117	2
2005	1 895	128 272	17 253	157	3
2010	2 127	126 938	18 209	73	1
2015	2 237	149 972	19 995	92	2
2020	2 352	156 766	21 895	96	2
2025	2 464	175 309	23 835	101	2
2030	2 575	198 504	25 881	107	3
2035	2 685	222 508	25 881	112	3

** NE: not estimated*

Although the WEM scenario includes measures aiming at a change of the modal split of freight transport, these measures are not expected to change the modal split significantly.

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

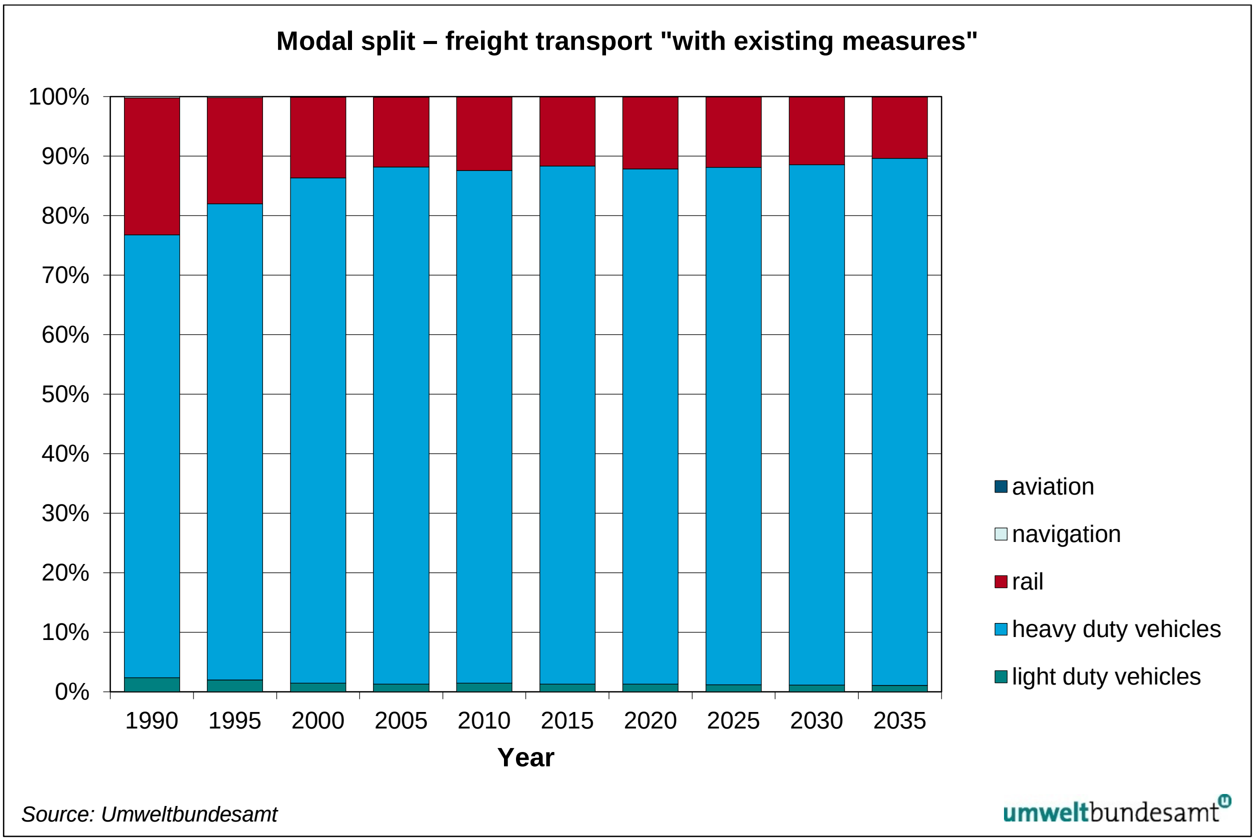


Figure 25: Past trend and scenarios (2015–2035) freight transport: modal split – scenario "with existing measures" (incl. fuel export).

Scenario "with additional measures" (WAM)

Elasticities in freight transport are taken from the WEM scenario. However, the absolute numbers of tkm per transport mode are different to the WEM scenario because of the (additional) measures included in the WAM scenario (mainly fuel tax increase), which are expected to lead to a decrease in road tkm and a slight increase in inland navigation tkm. For a detailed description of the measures foreseen in the WAM scenario see chapter 4.

- **Development in alternative fuels**

Biofuels

Projections for the consumption of alternative fuels in transport are primarily based on the requirement to meet the European objective, i.e. a 10% share of renewable energy in the Transport sector in 2020. This is to be achieved primarily through the blending of biofuels with fossil fuels and an increased use of electric vehicles. Assumptions used in the Austrian Fuels Strategy 2014 (BMLFUW 2014b) have also been used for the development of the scenarios.

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

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

Scenario "with existing measures" (WEM)

The level achieved with biofuel-fossil fuel blends largely depends on the amount of fossil fuels sold on the market. By 2020, at least 10% of total transport energy will have to come from renewable sources such as biofuels in each Member State, or from electricity produced from 100% renewable energy sources.

As regards pure biofuels and their development up to 2035, a reduction of pure biofuel quantities to zero is assumed because of a lack of appropriate measures in place and the fact that a market for pure fuels cannot be guaranteed. An achievement of the relevant objectives (10% by 2020) can only be guaranteed by implementing directly controllable measures, which include biofuel blends rather than quantities of pure biofuels on the market, since their sale largely depends on the market price.

Scenario "with additional measures" (WAM)

Latest vehicle technology developments show that future emission standards (EURO 6) could be met with biofuels too. The approval of heavy duty vehicles for the use of biofuel confirms this. Therefore, it is likely that the current biofuel consumption level (besides blending) will stay at least constant. According to the Austrian Fuel Strategy 2014 (BMLFUW 2014b) pure biofuels will increase slightly in total, while biofuel diversity will increase at the same time (advanced biofuels will be introduced before 2020).

Other fuels

Scenario "with existing measures" (WEM)

Projections for CNG (natural gas), LPG and hydrogen as alternative fuels up to 2020 and beyond are more conservative than in the Energy Strategy Austria (BMWFJ & BMLFUW 2010) since the vehicle registration data indicate no immediate breakthrough for these energy sources.

Scenario "with additional measures" (WAM)

- **Developments in electric mobility**

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

Projections for developments in electric mobility are based on a study conducted by the Environment Agency Austria about scenarios for developments and trends in electric vehicles in Austria up to 2020 and 2050 (UMWELTBUNDESAMT 2010, UMWELTBUNDESAMT 2015c). A comprehensive supply-demand analysis was performed for the period up to 2020 and beyond. Within the first half of the next decade a lack of supply of electric vehicles is expected to be the main obstacle for an increase in electric mobility. The results of the study provided the basis for the WAM scenario, which then also served as a guideline for a more conservative estimate of electric mobility development, as described in the WEM scenario.

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

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

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

1 A 3 e – Other transportation – pipeline compressors

EU ETS/non-ETS

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

3.1.3.3 Activities

1 A 3 a – Aviation

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

In the WEM scenario it is projected that the national aviation sector will reach the GHG emissions level of the peak year 2007 after 2020. For GHG emissions from national aviation a 44% increase over 2010 levels is projected until 2020 and a 54% increase until 2035.

1 A 3 b – Road Transport

Since the end of the 1990s the gap between Austrian fuel sales and computed domestic fuel consumption has become wider, amounting to roughly 30% of the total fuel sales in road transport since 2003. A possible explanation for this discrepancy is “fuel export in vehicle tanks”, which is a result of the relatively low fuel prices in Austria in comparison to the neighbouring countries (see also Table 14). A large number of motorists tend to fill up their cars with fuel in Austria and consume it abroad. This has been confirmed by two national studies (MOLITOR et al. 2004, MOLITOR et al. 2009).

Table 14: Differences in gross diesel prices in €/l (5/3/2015) (BMWFW 2015).

Gross diesel prices	€/l	Difference to Austria
Austria	1.180	
Czech Republic	1.146	– 0.03
Italy	1.460	+ 0.28
Germany	1.231	+ 0.05
Hungary	1.228	+ 0.05
Slovakia	1.127	– 0.05
Slovenia	1.220	+ 0.04

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

Since 2005 the energy demand has decreased in road transport with a low in 2009 (as a result of the economic downturn) and a further low in 2011.

In the WEM scenario it is projected that up to 2035 GHG emissions will not reach the level of the peak year 2005. For GHG emissions from road transport, a 4% increase over 2010 levels is projected until 2020 and a 1% increase until 2035. The share of GHG emissions from fuel exports is expected to increase further until 2035 (assuming that traffic volumes are going to rise and that the difference between fuel prices paid in Austria and those paid in the neighbouring countries will remain constant).

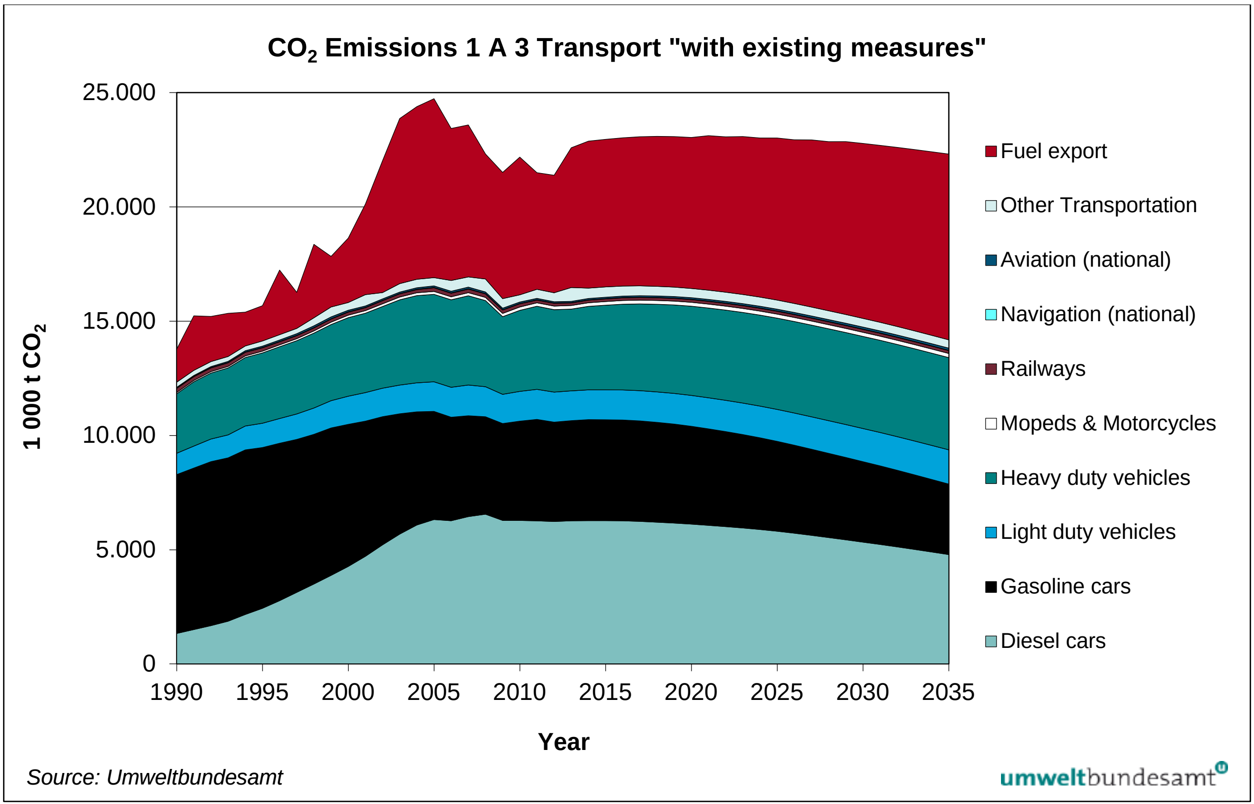


Figure 26: Past trend and scenarios (2014–2035) CO_2 emissions from transport – scenario "with existing measures".

- **Biofuels – developments and trends**

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

The following graphs show the developments in biodiesel, bioethanol, vegetable oil and biogas deployment up to 2035 (baseline year 2013 showing actual data). As blended biofuels take the main share in biofuels, every reduction of energy consumption caused by other measures also results in a similar reduction of the biofuel amounts. This is especially the case in the WAM scenario, where the effect of two fuel tax increases in 2016 and in 2019 can be seen. Details on energy consumption by fuel type can be found in Annex 2.

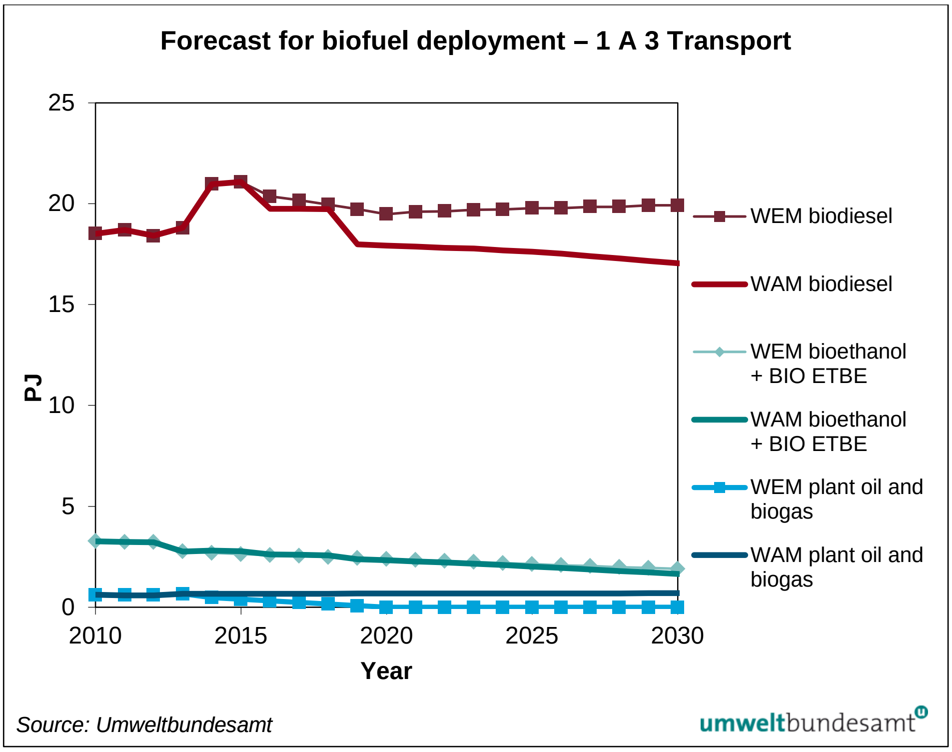
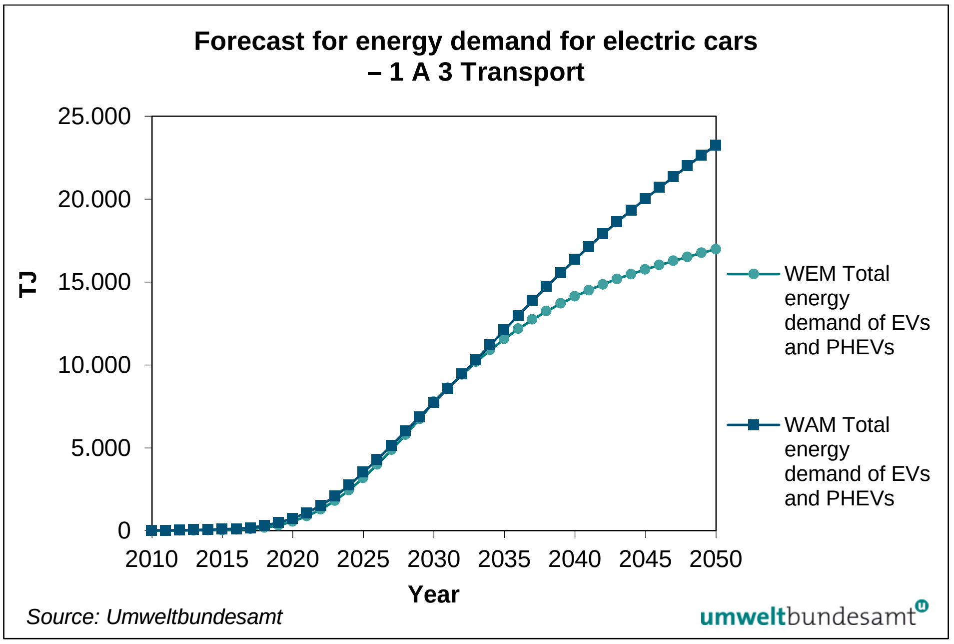


Figure 27: Scenario for biofuel deployment in Austria – WEM and WAM scenarios.

- **Development of electric mobility**

The following graph shows the estimated energy demand for electric vehicles (EVs, passenger cars) and plug-in hybrid electric vehicles (PHEVs) in road transport in Austria up to 2050 for the WEM and WAM scenarios.

Figure 28: Scenario for electromobility in Austria – WEM and WAM. scenarios



1 A 3 e – Other transportation – pipeline compressors

Energy demand is expected to rise up to 2013 and to decrease constantly thereafter by a total of 20% to 2035.

3.1.3.4 Sensitivity Analysis

For general assumption on sensitivity analysis see chapter 1.3.

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

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

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

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

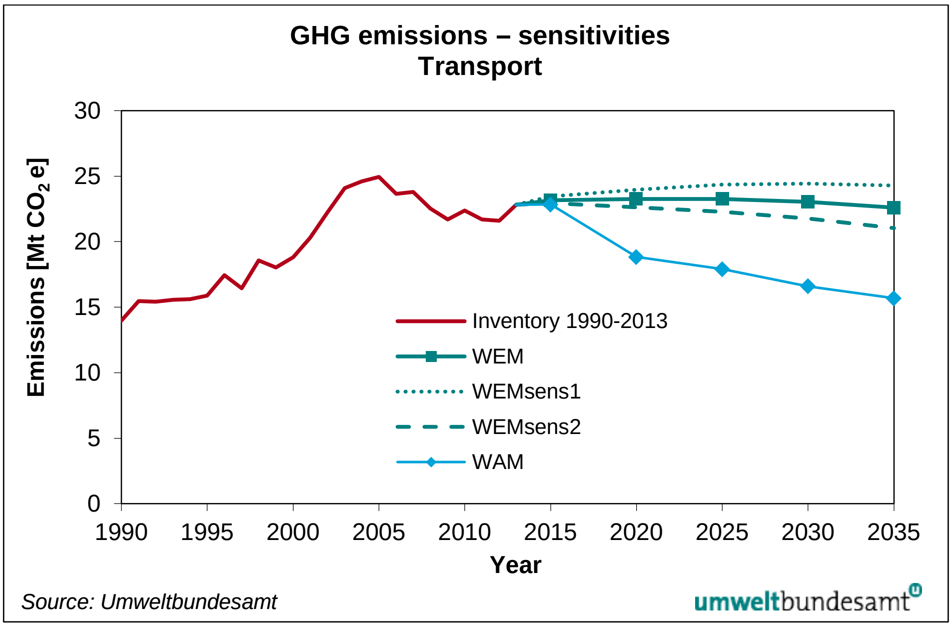


Figure 29: Trends and projections (2014–2030): total GHG emissions for the different scenarios and sensitivities, Transport sector

3.1.3.5 Uncertainty

Numerous exogenous factors have an influence on the projections:

- fuel price development and trend
- fuel export development and trend (fuel purchased in Austria and consumed abroad because of lower fuel prices in Austria compared to the neighbouring countries)
- fuel efficiency development in newly registered vehicles.
- effectiveness of the implementation of the Energy Efficiency Directive (2012/27/EC)

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

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

3.1.4.1 Methodology used for sectoral emission scenarios

To calculate energy consumption separately for stationary sources in the sub-sector 'residential and commercial', a comprehensive building model (INVERT/ EE-Lab) is used. For the stationary sources in 1.A.4.c (e.g. greenhouses, drying facilities) the macroeconomic model DEIO (WIFO 2013) is used.

Emissions from the mobile sources in 1.A.4.b and 1.A.4.c are described in chapter 3.1.3, and are added to the total sum of 1.A.4.

Emission factors have been taken from the national emission inventory system. The methodology and references are discussed in Austria's National Inventory Report (UMWELTBUNDESAMT 2015a).

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

The energy demand model for heating systems in buildings: Methodology

This model, operated by the Energy Economics Group (EEG) of the Vienna University of Technology, is referred to as INVERT/EE-Lab. It is a comprehensive dynamic bottom-up simulation tool (TU WIEN 2015).

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

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

The scenario model starts with the year 2002, based on a complete survey of all Austrian buildings for the year 2001. For model calibration the basic sampling period from 2003 to 2007 has been extended to 2012 by using current National Energy Balance data of Statistik Austria. Based on the trend in energy demand (primary fuels) in this sector, a model calibration of non-monetary parameters has been performed.

The basic decision algorithm

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

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

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

Modelling energy demand

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

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

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

Overview of technology options

The technology options available are divided into "single option" and "combined option". Single options 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 options include: change of heating system and domestic hot water system, insulation of outside walls and new windows, thermal improvement of the whole building shell, insulation of outside walls and ceiling, complete renovation.

Within each technology segment, a broad range of new systems can be selected for implementation, namely 20 different space heating options (with the possibility of hot water integration) and 5 different stand-alone hot water systems. Solar hot water generation and solar combined systems (solar space heating and hot water system) are integrated into the model. For building shell alterations, up to 10 different insulation materials for different parts of buildings and 6 different window types are implemented in the model. The thickness of insulation is calculated by using an optimisation algorithm (with upper and lower boundaries).

Austrian stock of buildings and heating systems

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

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

3.1.4.2 Assumptions

Despite decreasing population growth rates in Austria, the number of permanently occupied dwellings (principal residence) is expected to increase by about 17% from 2010 to 2035 (see Annex 1 and 2). This is due to the fact that the trend towards single households is stronger than the overall population growth.

As regards the number of buildings, an overall increase of 17% is expected from 2010 to 2035, whereas the number of buildings with more than two apartments is expected to rise by about 16% in this period. Residential buildings with one or two apartments, which make up the majority (about 90% of the total residential building stock) in Austria, are expected to increase by around 17% from 2010 to 2035. The strongest increase (with about 25% until 2035) is expected for commercial (non-residential) buildings.

The total gross floor area in residential buildings is assumed to increase by 19% until 2035, whereas for commercial buildings the total gross floor area is expected to increase by about 25% from 2010 to 2035.

Price assumptions are especially important in this sector because they may influence decisions as to which fuels will be preferred for heating systems in the long term, as well as decisions regarding the quality and quantity of thermal renovation activities. Over a period of about twenty years this can have a noticeable effect on specific energy demands. Energy prices are expected to rise considerably for all fossil fuels (about 10–38%) from 2010 to 2035. For bio fuels, wood logs, wood chips and wood pellets an increase around 14% is expected by 2035.

Detailed assumptions can be found in Annex 1 and 2.

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

Scenario “with existing measures”

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

The renovation rate indicates the proportion of buildings (or households) where improvement measures on the thermal building envelope (house front, windows, top and bottom floor ceiling) are performed. It is therefore an indicator of the renewal of buildings, which usually reduces their heating demand. The renovation rate for residential buildings is assumed to decrease from 0.8% in 2010 to 0.7% in 2035 and for commercial buildings from 0.6% in 2010 to 0.58% in 2035. Individual rates differ for each type of building (see Annex 1 and 2).

Model-based results predict a rise in the boiler exchange rate in residential buildings from 1.2% in 2010 to 2.0% in 2035 and in commercial buildings from 0.6% to 1.6% within the same time span. Even higher rates are expected during the period 2021 to 2025 with about 4.5% for households and a boiler exchange rate of 3.9% in non-residential buildings.

Moreover, the average heating demand for residential buildings is expected to decrease from 141 kWh/m² gross floor space in 2010 to 97 kWh/m² gross floor space in 2035, while the average heating demand for commercial buildings is expected to decrease from 173 kWh/m² to 108 kWh/m².

Scenario “with additional measures”

The funding budget for the renovation of existing buildings and new buildings – including all relevant funding programmes of the federal government and the federal provinces – is raised compared to the WEM scenario. Furthermore, the share of subsidies is shifted from new buildings to thermal insulation measures (to a certain degree).

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

The total renovation rate (up to 1.0% by 2030) in the WAM scenario is noticeably higher for residential buildings than in the WEM scenario. Moreover, the boiler exchange rate for residential buildings is expected to increase to about 2.0% until 2035, with a higher peak during the period 2021 to 2025 than in the WEM scenario.

In the WAM scenario the average heating demand is further reduced and expected to be 85 kWh/m² gross floor space for residential buildings in 2035. The average heating demand for commercial buildings is expected to decrease to 94 kWh/m² gross floor space by 2035.

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

3.1.4.3 Activities

Emissions were calculated on the basis of the consumption of coal, wood log and wood briquettes, wood chips, wood pellets, natural gas, liquefied petroleum gas (LPG) and heating oil, and separately for the sectors 1.A.4.a commercial and 1.A.4.b residential, which were modelled with INVERT/EE-Lab.

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

Scenario "with existing measures"

There is a discernible trend towards renewable and alternative energies, which can partly be seen from an increase in the use of wood pellets, solar heat and heat pumps. More specifically, the use of pellets is expected to rise three-fold in the period from 2010 to 2035. Alternative energies like solar heat and ambient energy are expected to increase by 63% and 88% (in residential buildings) until 2035. As regards log wood, energy consumption is expected to decline by around 45%, 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 67% reduction in the use of heating gasoil is expected until 2035, as well as a 17% decline in natural gas consumption and a 98% decrease in coal use.

Whereas overall energy consumption without electricity is expected to decline by 4% in the residential sector, total energy demand without electricity will slightly increase by 3% in the commercial sector (until 2020). Until 2035 the overall energy consumption reductions relative to 2010 are about 15% for residential buildings and 14% for commercial buildings. This means a decrease in fossil fuels like heating gasoil (– 77%), coal (– 72%) and natural gas (– 36%) in commercial buildings until 2035. Wood chips are expected to rise by 156%. With respect to the small quantities of pellets used in 2010, an approximately 4.3 times higher consumption is assumed for 2035. Similar to the trend in the residential sector, the use of log wood is expected to decline by about 38% until 2035. A considerable gain in energy demand is expected for solar heat (29%) and ambient energy (224%). Detailed data are included in Annex 1 and 2.

Scenario "with additional measures"

Due to additional measures (bringing about a quicker increase in the renovation rate), the overall demand for energy in the sub-sectors 'residential' and 'commercial' is expected to be further reduced. Therefore, the specific changes in energy consumption until 2035 are expected to be less pronounced than in the WEM scenario.

For detailed information see Annex 1 and 2.

3.1.4.4 Sensitivity Analysis

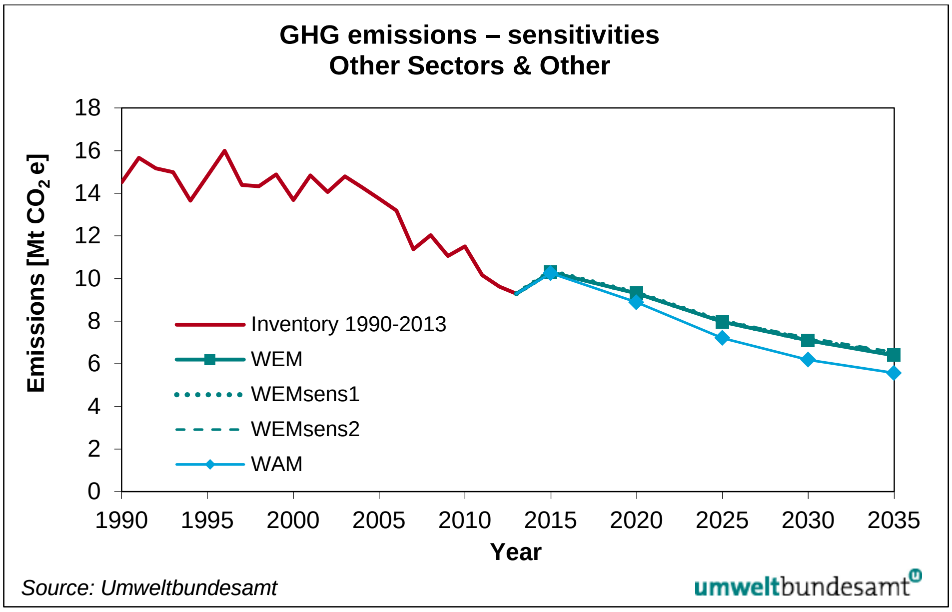
The INVERT/EE-Lab model provides the projected results for the energy demand calculated for stationary sources in residential and commercial buildings. Two complete scenarios with different assumptions on economic growth and energy prices were calculated:

- WEMsens1 and
- WEMsens2.

Average economic growth was assumed to be 2.5% per year in WEMsens 1 and 0.8% per year in WEMsens2.

The GDP variations (see chapter 1.3. 'general sensitivity analysis') do not produce a huge effect on the emissions in this sector (see Figure 30).

Figure 30: Trends and projections (2014–2035): total GHG emissions for the different scenarios and sensitivities, sector 'other sectors & other'



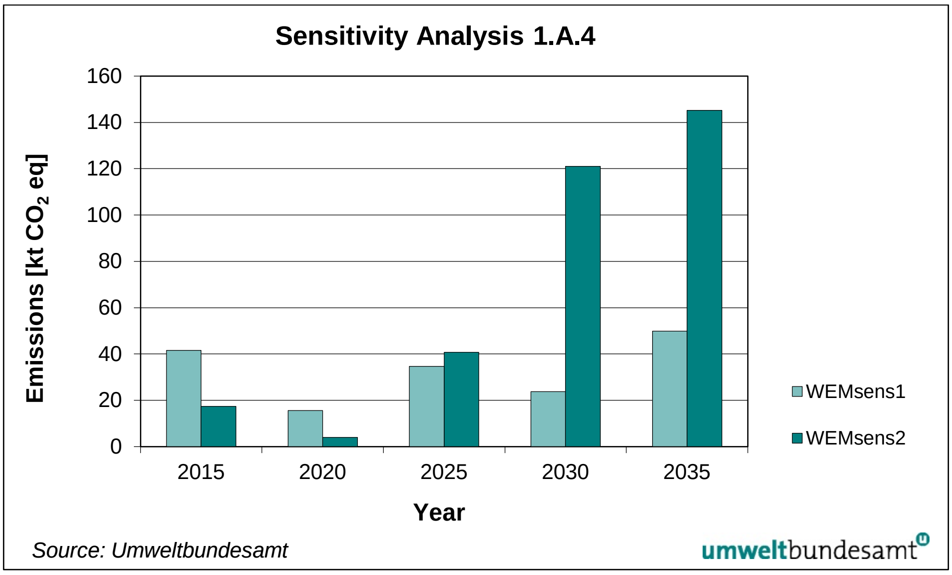


Figure 31: 1.A.4 Other Sectors (stationary sources), results of sensitivity analysis – difference to WEM scenario.

The variation of the GDP shows that the influence of those two parameters alone is low. The greenhouse gas emissions vary by 2.8% at the most.

Increased economic growth in WEMsens1 leads to an increase in fossil energy demand compared to the WEM scenario (especially natural gas). Overall fuel demand for heating is slightly above the WEM scenario (0.4% in 2035).

In WEMsens2 the total fuel demand for heating is substantially higher than in the WEM scenario due to reduced investments in renovation measures. The total fuel demand for heating in 2035 surpasses the WEM scenario by 2.3%. Fuel oil use reduction is less pronounced than in the WEMsens1 scenario.

3.1.4.5 Uncertainty

The sensitivity analysis shows that variations of assumptions for GDP slightly influence emission projections (see previous chapter).

Some uncertainty is associated with the implementation and acceptance of measures which influence the overall heating demand, e.g. the renovation rate and the boiler exchange rate.

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

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

3.1.5 Other (1.A.5)

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

3.1.6 Fugitive Emissions from Fuels (1.B)

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

3.1.6.1 Methodology used for sectoral emission scenarios

The methodology applied for calculating projected emissions is the same as the one used in the Austrian GHG inventory (UMWELTBUNDESAMT 2015a).

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 network length by an implied emission factor.

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 2013. Projected emissions are calculated by multiplying the oil or natural gas production by averaged implied emission factors of historical years.

3.1.6.2 Assumptions

No policies and measures are considered in the emission scenarios.

In 2006 the last brown coal open surface mine closed in Austria and it has been assumed that there will be no coal mining in the period up to 2035.

The length of the distribution network has been extrapolated by means of the average yearly grow rate 2009–2013 (214 km/year) which results in an increase of 16% from 2013 to 2035, assuming that the number of end consumers will grow continuously. CH_4 emissions have been calculated by means of the implied emission factor of 2013.

The total main and medium range pipeline length is assumed to have the same proportion to the natural gas distribution network length as the average ratio of 2009 to 2013 (main and medium range pipeline length = 24% of distribution network length). This leads to an estimated growth of about 14% between 2013 and 2035. CO_2 and CH_4 emissions have been calculated by means of the implied emission factors of 2013. Forecasts for natural gas storage are based on plans for storage site extensions from the Austrian Oil Exploration Company (RAG, Rohöl-Aufsuchungs AG). Capacities are set to be extended to 5.7 billion m^3 until 2017. However, according to the inventory the storage capacity was already slightly higher in 2013. Therefore the CH_4 emissions from storage have been estimated by means of a constant yearly storage capacity of 5.7 billion m^3 from the year 2014 to 2035 and the implied emission factor of 2013.

CH_4 emissions of the refinery are calculated by means of the emission factor from the GHG inventory and the refinery intake from the energy scenarios which is assumed to be constant between 2014 and 2035 but slightly (– 2%) lower than in 2013.

CH_4 and CO_2 emissions of natural gas processing are calculated by means of the average implied emission factors for the period 2009 to 2013 and domestic natural gas production as assumed in the energy scenarios.

3.1.6.3 Activities

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

Past trend and scenarios pipeline and distribution lengths and natural gas storage are presented in Table 15.

Table 15: Past trend and scenarios (2014–2035) activity data: natural gas distribution, transmission and storage.

	Pipeline length [km]	Gas network length [km]	Natural gas stored [Mm³]
1990	3 628	11 672	1 500
2000	5 966	24 099	1 665
2010	6 798	28 733	3 070
2013	7 177	29 417	5 747
2015	7 130	29 844	5 700
2020	7 385	30 913	5 700
2025	7 640	31 981	5 700
2030	7 896	33 049	5 700
2035	8 151	34 118	5 700

3.1.6.4 Sensitivity Analysis

The calculations do not show any sensitivity for the different scenarios because the parameters used for the emission calculations (natural gas production and refinery intake) are the same for all types of energy projections.

3.1.6.5 Uncertainty

The uncertainty in the projections for fugitive emissions is closely linked to the uncertainty in the Energy Industries sector (see chapter 3.1.1.5). A higher level of uncertainty has to be expected when predicting CO_2 emissions from natural gas refineries since they depend on the composition of explored natural gas.

3.2 Industrial Processes (CRF Source Categories 2)

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

Figure 32 shows greenhouse gas emissions aggregated into four categories of industrial processes. The sectors ‘mineral industry and ‘metal industry are expected to show an increase until 2035, mainly due to constant economic growth. Emissions from the chemicals industry are expected to remain static, whereas emissions from other processes (mainly F-gases) are expected to follow an increasing trend until 2020, which is to be followed by a decrease up to 2035.

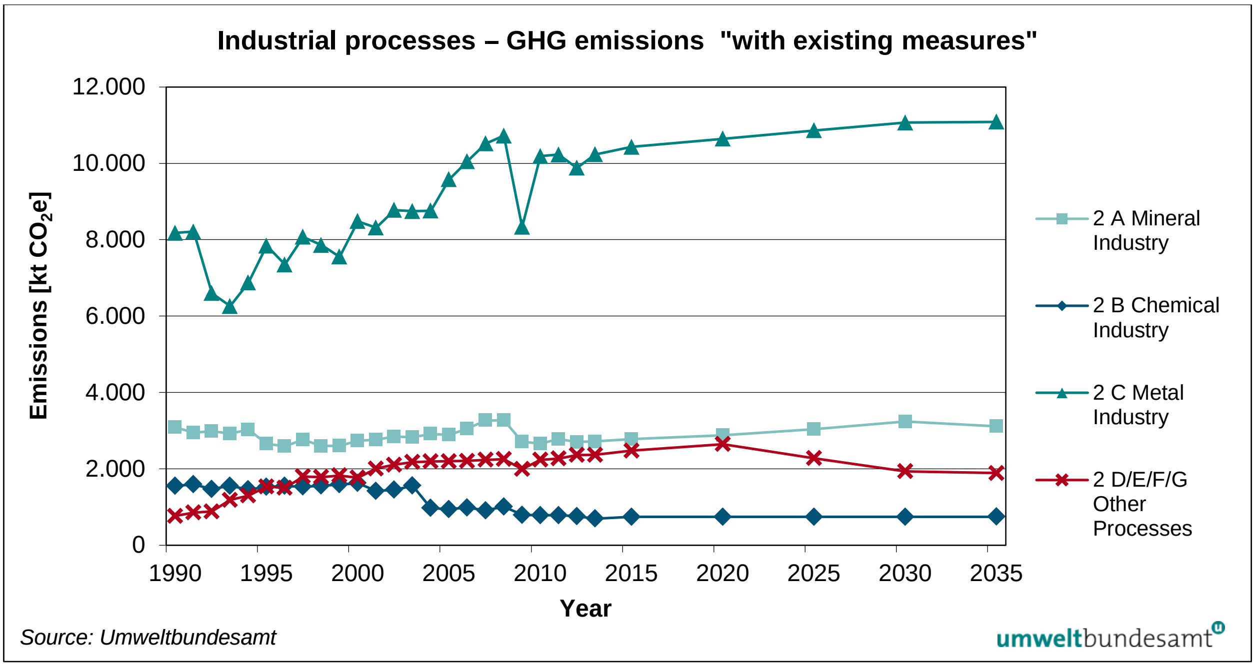


Figure 32: GHG emissions and projections (2014–2035) from industrial processes – WEM scenario.

3.2.1 Mineral Industry (2.A)

3.2.1.1 Methodology used for sectoral emission scenarios

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 2015a).

3.2.1.2 Assumptions

Activities for the cement industry and for other sources (i.e. lime stone use, ceramic industry and soda ash use) have been derived from the total energy input, which has been allocated to the different sources according to their historical share in the total energy inputs. Consistent with IPCC 2006 Guidelines for inventory compilation, the demand for lime stone in the iron and steel industry has been accounted for under 'iron and steel industry'.

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

3.2.1.3 Activities

Figure 33 presents the assumptions made for the production of cement clinker.

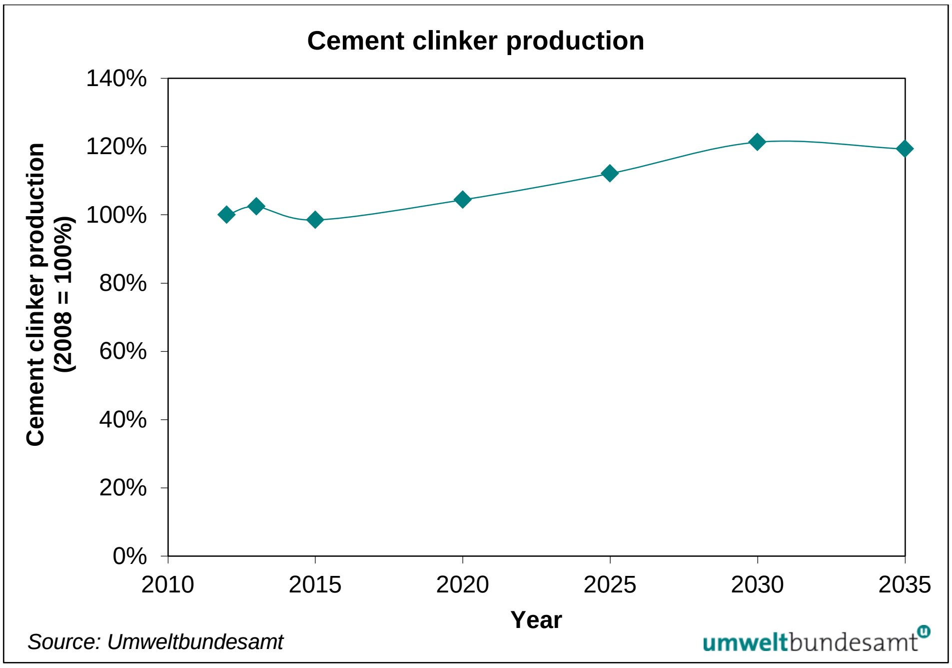


Figure 33: Assumption for the production of cement clinker.

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

3.2.2 Chemical Industry (2.B)

3.2.2.1 Methodology used for sectoral emission scenarios

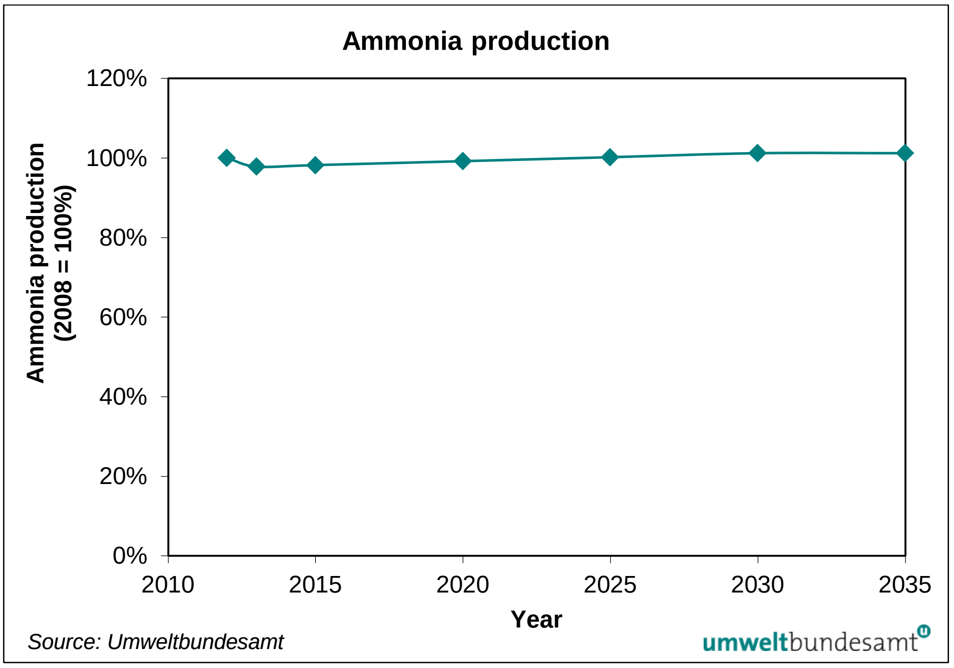
The methodology used here is the same as the one used in the Austrian Inventory and the emission factors and methodology are discussed in detail in the Austrian Inventory Report (UMWELTBUNDESAMT 2015a).

3.2.2.2 Assumptions & Activities

Activities for the production of ammonia are assumed to have remained constant (see Figure 34). Other production activities (nitric acid) have been combined with these activities.

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

Figure 34: Assumption for the production of ammonia.



3.2.3 Metal Industry (2.C)

3.2.3.1 Methodology used for sectoral emission scenarios

The methodology used to calculate the emission factors is discussed in the Austrian Inventory Report (UMWELTBUNDESAMT 2015a). This source category covers CO_2 emissions from iron and steel production (2.C.1) and from ferro-alloy production (2.C.2) as well as PFC emissions in aluminium production (2.C.3) and SF_6 used in aluminium and magnesium foundries (2.C.4).

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

3.2.3.2 Assumptions

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

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

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

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

3.2.3.3 Activities

Figure 35 presents the assumptions made for the production of crude steel (basic oxygen furnace – BOF).

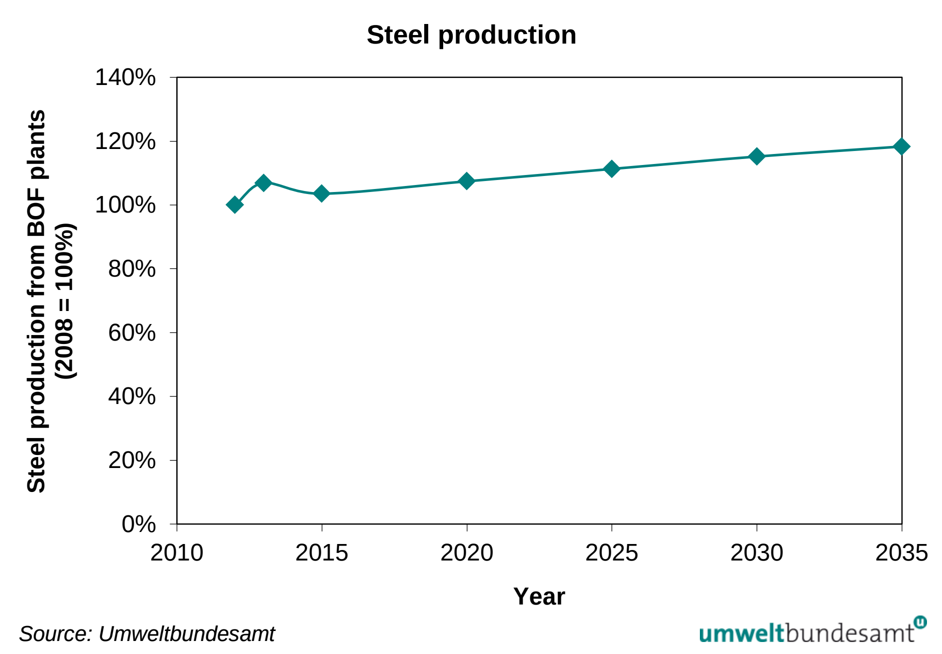


Figure 35: Assumptions for the production of steel (only basic oxygen furnace plants).

3.2.4 Fluorinated Gases (2.E, 2.F, 2.G)

There is no production of fluorochemicals (2.B.9) in Austria and the scenario assumes that there will be none during the period up to 2035**.**

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

Although fluorinated gases are not used in large amounts (around 1 kt per year), they contribute approximately 2% of the total GHG emissions due to their high GWPs. In Austria's Third National Communication to the UNFCCC (2001) fluorinated gases were expected to reach 3% of the total GHG emissions by 2010 and as much as 5% by 2020 in the business-as-usual scenario. This forecast was based on the fact that HFCs are used in many applications as substitutes for ozone layer depleting "Montreal gases" and that, without reduction measures, their use would strongly increase. Because of this expected scenario, the Federal Environment Ministry started a consultation procedure in spring 2001 with the aim to produce a draft ordinance on reducing and phasing out HFCs, PFCs and SF_6 in all relevant applications on the basis of the Federal Chemicals Act. The Austrian Ordinance on fluorinated gases was adopted in 2002 (Federal Law

Gazette II No. 447/2002) and amended in 2007 (Federal Law Gazette II No. 139/ 2007). On European level the European Parliament and the Council of the European Union adopted the Regulation on certain fluorinated greenhouse gases (842/2006/EC) and the Directive relating to emissions from air-conditioning systems in motor vehicles (2006/40/EC). In 2014, the European Regulation was revised and changed into Regulation 517/2014, repealing the 2006 Regulation. In addition to the measures set forth in the 2006 Regulation, the 2014 Regulation aims at controlling the placing on the market of F-gases within the EU. Certain F-gases (those with a GWP above 2 500) will be banned, and only a certain amount of F-gases will be allowed for sale each year in the community market.

3.2.4.1 Methodology of the sectoral emission scenarios

The emission calculation is based on results of the Austrian GHG inventory, and performed with the same level of detail. The projections until 2020 are generally based on (GSCHREY 2010). However, they have been modified so as to be fully consistent with IPCC Categories 2.E –G according to the 2006 IPCC Guidelines.

For most sub-categories, projected emissions until 2020 were calculated on the basis of the 2013 emissions by taking into account growth rates for the different sectors and by including relevant technological improvements, both based on the above named study (industry inquiries and/or expert judgments). For the years 2025 and 2030, trends were extrapolated, taking into account assumptions made in SCHWARZ et al. (2011). For WAM, assumptions for the revised F-gas Regulation were included.

3.2.4.2 Assumptions

Scenario "with existing measures"

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

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

(c) Growth rates as well as changes in EFs as described by SCHWARZ ET AL. 2011 were also taken into account.

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

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

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

- domestic refrigeration has been phased out and that only emissions from disposal occur

- production of commercial refrigeration (including some exported domestic refrigeration equipment) will remain constant
- all other sub-categories will remain unchanged, while assuming growth rates of 1–1.5% for refrigeration and air conditioning and 3% for heat pumps.

Mobile Air Conditioning: The MAC Directive (EU 2006/40/EC) requires the introduction of refrigerants with a GWP < 150 in new passenger cars during the period 2011–2017. Calculations are based on the assumption that industry will introduce the use of HFC-1234yf as an alternative refrigerant as the GWP of this substance is 4. The assumption was made that in 2014 10% and in 2020 100% of R134a would be replaced by R1234yf (in cars).

Foam Blowing: The Austrian Ordinance bans the use of fluorinated gases in this subcategory (the use of XPS foams with a layer thickness of more than 8 cm containing HFCs with a GWP < 300 was still allowed until they were banned in 2008). However, emissions from waste disposal are still occurring (long lifetime of XPS/PU plates).

Fire Extinguishers: A constant emission factor of 1.5% is assumed as well as constant annual HFC consumption until 2035.

Aerosols: The Austrian Ordinance bans the use of fluorinated gases in this subcategory except for medical uses but exceptions are possible. The EU F-Gas Regulation bans the use of HFCs in novelty aerosols from 2009 onwards. It is thus assumed that HFC emissions from metered dose inhalers will not be affected. A 0.5% p.a. growth rate (according to SCHWARZ et al. 2011) has been assumed.

Semiconductors: Projections are based on emissions in 2013. Based on the information in SCHWARZ et al. 2011, constant emissions are assumed from 2013 onwards. The national F-Gas Ordinance requires the implementation of appropriate technical devices in order to reduce F-gas emissions from this sector to no more than 70% of the annual consumption of these substances. This emission reduction target was reached in 2002, while the level was 80% in 2010; it is assumed that this level will be sustained throughout the whole time period.

Electrical equipment: Constant emissions have been assumed for the period after 2013. This sector will continue growing, but emission abatement techniques will also improve and therefore cancel out an increase in emissions.

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

Scenario “with additional measures”

For the WAM scenario one additional measure concerning “Stationary Refrigeration and Air Conditioning” was implemented.

3.2.5 Solvent and Other Product Use (2.D & 2.G)

Solvents are chemical compounds which are used to dissolve substances such as paint, glue, ink, rubber, plastic, pesticides, or they are used for cleaning purposes (degreasing). After their application (or other procedures involving 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.

3.2.5.1 Methodology of the sectoral emission scenarios

CO_2 emissions from Solvent and Other Product Use

Emission projections for 2013–2035 are calculated using the emissions of the latest inventory year (2013; submission 2015) and by extrapolating the trends (2000–2013) from activity data in each sub-sector.

The basic data for the Austrian Air Emission Inventory (OLI) 2014 (data 2013) were provided by surveys (WINDSPERGER et al. 2002a, 2002b, 2004; WINDSPERGER & SCHMID-STEJSKAL 2008) as well as import-export statistics (foreign trade balance) and production statistics provided by Statistik Austria.

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

The trend in the quantities of solvents (substances) and solvent-containing products, i.e. the relationship between imports and exports, was extrapolated from the 2000–2013 data series. The production of solvents is assumed to be a constant value (value of 2013). It is further assumed that the prospected error/deviation caused by extrapolation and using constant values is comparatively small compared to the total level of uncertainty.

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

N_2O Emissions from Solvent and Other Product Use

The basic data for the Austrian Air Emission Inventory (OLI) 2014 (data 2013) were provided by the companies selling N_2O or are based on estimates provided by the Austrian Industrial Gases Association (Österreichischer Industriegaseverband, ÖGIV) and default emission factors according to IPCC Guidelines. The methodology recommended in the IPCC Guidelines was applied.

For projections of N_2O emissions from 2 G “Other Product Use” constant emissions from 2013 onwards are assumed.

3.2.5.2 Assumptions

Scenario "with existing measures"

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

For the emission scenarios it is assumed that the growth rate of CO_2 emissions for the period 2013–2035 will follow the trend in emissions since 1990.

Scenario "with additional measures"

No additional measures are planned in this category.

3.2.6 Sensitivity Analysis

For general assumptions on sensitivity analysis see chapter 1.3.

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

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

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

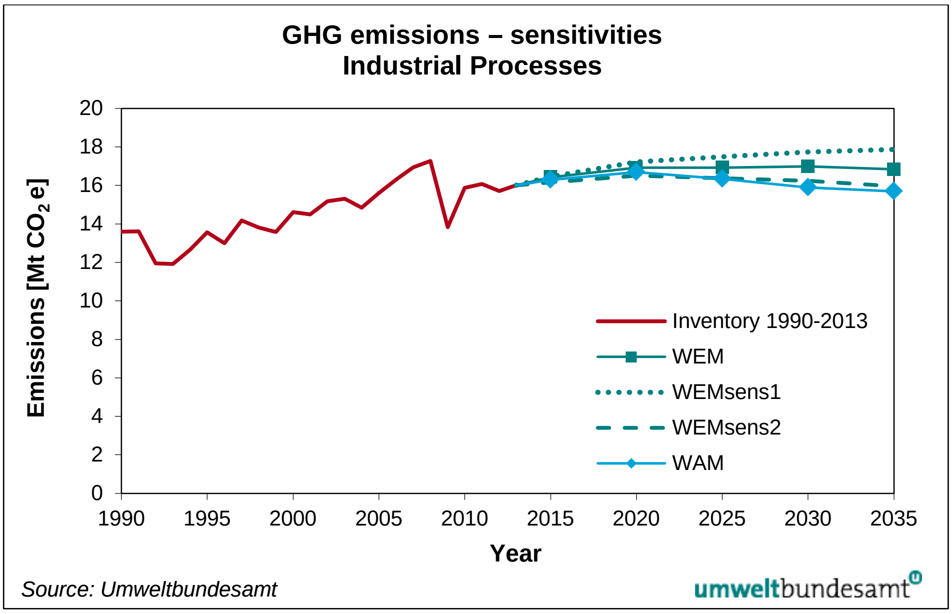


Figure 36: Trends and projections (2014–2030): total GHG emissions for the different scenarios and sensitivities, 'Industrial Processes' sector

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 the annual consumption of fluorinated gases and leakage rates. As past experiences are not available, assumptions about changes in leakage rates have a particular influence on the overall uncertainty of forecast emissions.

While EU Regulation 517/2014 sets the rules for a quota for placing F-gases on the market, the percentage applicable for Austria is unclear. This has a certain influence on the overall uncertainty of forecast emissions.

For 2.D solvent use

A simple method has been used for projecting CO_2 emissions in the sub-sector 2.D ”Non-Energy Products from Fuels and Solvent Use”. One therefore has to expect that the level of uncertainty will be considerably high.

3.3 Agriculture (CRF Source Category 3)

3.3.1 Sector Overview

In this sector, the focus is on sources of methane (CH_4) and nitrous oxide (N_2O) emissions. This chapter gives an overview of the European and Austrian farm policy, provides information on basic economic and technological assumptions and describes the methodologies used for the sectoral scenarios 2020–2035.

Common Agricultural Policy

In 2008 the EU agriculture ministers reached a political agreement on a ‘Health Check’ of the Common Agricultural Policy (EC 2011). Among a considerable range of measures, the most important change was the abolition of the EU milk quota system, due to be implemented in 2015.

The new CAP introduces a new architecture of direct payments. The objective is to make payments better targeted, more equitable and greener. The role of direct payments as a safety net that strengthens rural development has become more important. The internal convergence of direct payments brings considerable changes of the distribution of farm payments in Austria. The consequence will be that regions in which cattle and milk production prevails will reap the benefits.

Additionally, the EU programme for rural development is of major importance for the Austrian agricultural sector, because transfers from this source outweigh transfers from the "first pillar of the CAP", e.g. commodity-related instruments . In the new period 2015–2020 climate policy goals will rank high on the agenda because climate change mitigation (and adaptation) is a horizontal issue that has to be addressed in every programme.

International food markets

European farm commodity markets are interlinked with international food markets in many ways. Given the imbalances between supply and demand in 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. Global demand for food and technological progresses (e.g. the adoption of GMO crops in major producing countries, organic food production) will be major driving forces in agricultural production in the next decade. In the medium term, the world's agricultural markets are projected to be essentially supported by a rising food demand driven by an improved macro-economic environment, a growing population, urbanisation and changes in dietary patterns (OECD-FAO 2014).

National energy policies

Austrian energy policy is committed to the substitution of non-renewable energy sources by renewable ones. Raw materials produced by agriculture are a major alternative source. Two major legal sources are of interest in this context: the Austrian law for the provision of green electricity (Ökostromgesetz) and the European Biofuels Directive (EU 2003), repealed by the EU Directive on Renewable Energy (Directive 2009/28/EC). Both measures are channelled into the agricultural sector via the price system: regulations to boost bioenergy crop production work like a subsidy for farm commodities.

3.3.2 Methodology used for the sectoral scenarios

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 2015 (UMWELTBUNDESAMT 2015a).

Activity data

Projected activity data for both scenarios are the result of calculations carried out with the Positive Agricultural Sector Model Austria (PASMA), developed by the Austrian Institute of Economic Research (WIFO) (WIFO & BOKU 2015). The model maximises sectoral farm welfare and is calibrated on the basis of historical crops, forestry, livestock, and farm tourism activities, using the method of Positive Mathematical Programming (PMP). This method assumes a profit-maximising equilibrium (e.g. marginal revenue equals marginal cost) in the base run and derives coefficients of a non-linear objective function on the basis of observed levels of production activities.

Economic assumptions

Price estimates are specific to the Austrian market situation, derived from OECD-FAO outlooks on agricultural markets (OECD-FAO 2014). For Austria lower milk prices are assumed than in the OECD-FAO scenarios for the EU. The reasoning behind this deviation is that for countries which are likely to expand their milk production, lower prices may prevail over a long period until a new equilibrium is established (see SINABELL et al. 2011a for more elaboration on this assumption). Other exogenous economic assumptions for Austria (like the GDP or population size) are not necessarily essential for the model used in this analysis because the partial equilibrium model of the agricultural sector mainly depends on prices of outputs and inputs. Since the Austrian agriculture is an integral part of the common market, carry-over effects from European demand patterns are noticeable and determine the results.

Other assumptions

- Increase in milk yield per cow from 15% (2020) to 30% (2030) relative to the reference period in both scenarios
- loss of agricultural land following the long-term trend in both scenarios

Main results for both scenarios:

The number of dairy cows is expected to be larger in each of the scenarios analysed. The reason is that milk production is likely to expand after the abolition of the milk quota (2015). Additionally, the Programme of Rural Development promotes farming in mountain regions where milk production is the most profitable activity if sufficient labour is available.

Slightly increasing prices for pork lead to an increasing number of pigs. The expansion of production is consistent with the overall outlook at European level (EC 2014) but it is not consistent with the currently observed trend of declining numbers of pigs. An expansion of pork production is not unrealistic if the sector makes the same adjustment as the milk sector which gained significant market shares beyond the domestic market.

According to the model results, poultry production will decrease. This result is not consistent with the observed trend of increasing numbers of heads. Following international projections (EC 2014) one would expect more poultry as well. The model result is the consequence of relative prices. Poultry and egg producers in Austria have to cope with considerably higher costs than producers in other countries.

The sale of mineral nutrients is likely to decline. This result is consistent with the long term trend but not consistent with observations of more recent sales data. Given the relative increase in energy costs which determines the fertiliser costs, along with the fact that agricultural land will decline and the increasing production of manure from increasing livestock numbers, the result seems to be plausible

Scenario "with existing measures" (WEM)

This scenario includes existing measures already implemented in the context of the Austrian Agri-Environmental Programme 2007–2013 as they will continue to be effective in the following programme period (2014–2020), and regulations related to the implementation of the CAP Reform 2013. Information on these measures is presented in detail in chapter 4.

Scenario "with additional measures" (WAM)

In the WAM scenario additional policy measures (as discussed by Austrian stakeholders) were implemented. A detailed description of policy measures is presented in chapter 4.

Emission calculation

Emissions are calculated on the basis of the methodology used for the Austrian Greenhouse Gas Inventory. A comprehensive description can be found in the Austrian National Inventory Report 2015 (UMWELTBUNDESAMT 2015a).

3.3.2.1 Enteric Fermentation (3.A)

Feed intake parameters and the methane conversion rate are the same as the ones used in the national greenhouse gas inventory (UMWELTBUNDESAMT 2015a). GE intake of dairy cows was calculated on the basis of projected milk yields (see Annex 2).

Projected activity data for both scenarios are the result of calculations carried out with the PASMA model (WIFO & BOKU 2015).

Data on livestock projections are presented in Annex 2.

3.3.2.2 Manure Management (3.B)

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

In the scenario "with additional measures", special attention is given to the anaerobic digestion of animal manures: it is assumed that 10% of cattle, swine and chicken manures will be anaerobically treated in 2020. This share will be increased up to 25% in 2035. Additionally, an increased feeding efficiency, a larger number of covered slurry tanks and more grazing of suckling cows will have been achieved (see chapter 4). Austria-specific VS and N excretion values for dairy cows have been calculated on the basis of projected milk yields (see Annex 2).

3.3.2.3 Rice Cultivation (3.C)

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

3.3.2.4 Agricultural Soils (3.D)

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

For both scenarios mineral fertiliser application data have been taken from (WIFO & BOKU 2015). The WAM scenario includes a more efficient mineral fertiliser use and an increased share of band spreading of animal manures (for measures in detail see chapter 4).

3.3.2.5 Prescribed Burning of Savannas (3.E)

There is no prescribed burning of savannas in Austria and the scenario assumes that there will be none until 2035.

3.3.2.6 Field Burning of Agricultural Residues (3.F)

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

The contribution of emissions from the category *Field Burning of Agricultural Waste* to the total emissions is very low. Thus a simplified approach has been applied: 2013 values have been used as activity data for all projected years.

3.3.3 Sensitivity Analysis

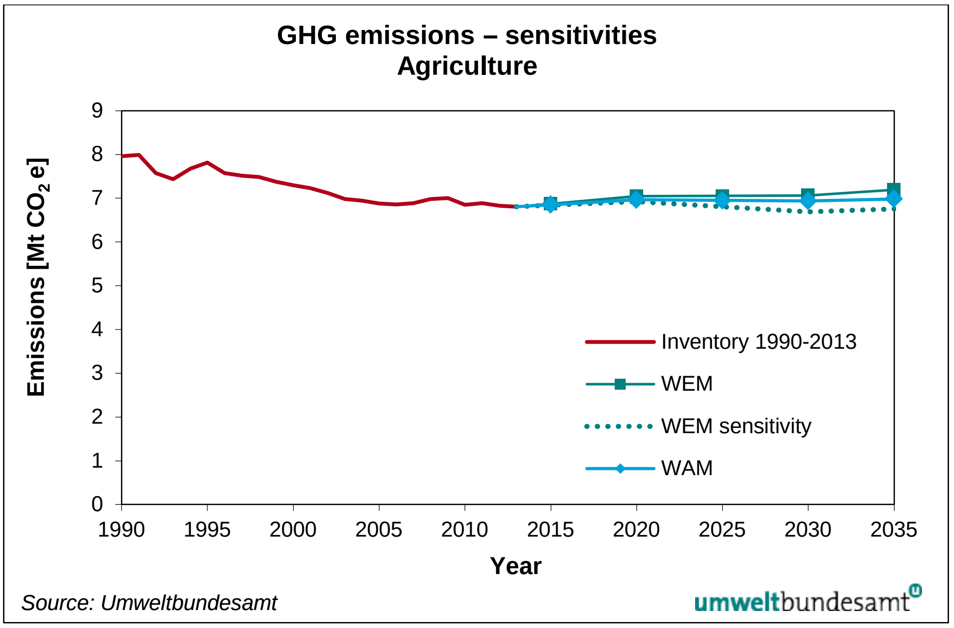
In the sensitivity analysis two assumptions have been made:

- no more losses of agricultural land
- no more increase in milk yield (same milk yield as in reference year)

The results of the analyses performed indicate that milk production will not dominate livestock production (as is the case in the other scenarios). In the absence of increasing annual milk yields per cow, the competitiveness of milk production is diminished. Given the attractive prices of pork, the expansion of production will be strong enough to divert resources from crop production to livestock production.

As in the sensitivity analysis it is assumed that the loss of agricultural land comes to a halt, and that consequently more arable land and more grassland will be used for the production of agricultural commodities. It is mainly crop production that benefits from the additional resources.

Figure 37: Trends and projections (2014–2030): total GHG emissions for the different scenarios and sensitivities, agricultural sector



Source: Umweltbundesamt

3.3.4 Uncertainty

Projections into the future are fraught with a range of uncertainties which have to be kept in mind when the results of this analysis are considered:

Model uncertainty: The first type of uncertainty is related to the type of model. The model is static by design and adjustments to future situations are calculated in discrete steps which are based on exogenous assumptions (prices, costs, technical coefficients) and model-endogenous coefficients (marginal costs) which are based on observations in the reference period. Investment costs are not considered in the model as it is based on gross margin calculations. The model assumes a swift adaptation of land uses and management and an efficient use of resources. In practice such adaptations may be over-optimistic because farmers are not able or willing to adjust as the model suggests. Such a situation may happen e.g. if the model allocates nutrients in the most cost-effective way in a region while actually there may be frictions that prevent this (e.g. blocked roads). In order to account for this type of uncertainty different scenarios are analysed in this study in which technical coefficients are set at different levels (e.g. loss of nutrients; efficiency of feeding; number of lactations).

Market uncertainty: A review of past projections of OECD-FAO and the observed outcomes on the markets suggests that there is a considerable deviation between those two. The range of such uncertainties can be accounted for and actually is discussed broadly in the most recent OECD-FAO report (2014). To account for this type of uncertainty in the analysis presented here would require hundreds of simulations which capture alternative price scenarios with various probabilities. The benefit would be that one would have a more realistic view on the range of potential future outcomes. The costs to achieve this would be considerable and probably not worth the effort because the most likely scenario is the scenario chosen for this analysis. A value added when taking into consideration market uncertainty would be to attach a certain probability to the most likely scenario based on observations in the past.

Policy uncertainty: Policies affect decisions of farmers and other market participants in various ways. The range of policies is not limited to agricultural policies alone: energy policies affect energy prices and thus input costs; urban planning regimes affect decisions about developments of residential and commercial areas which have an impact on the availability of agricultural land; climate policies are likely to take into consideration the results of studies like this and induce incremental or significant adjustments. In order to account for this type of uncertainty different scenarios are analysed in this study in which policy instruments are set at different levels (e.g. support for organic farms; introduction of a tax on commercial fertilizer).

3.4 Land Use, Land-Use Change and Forestry (CRF Source Category 4)

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 4.A.1), which is the most important sub-category of CRF Source Category 5.

No scenario is available for any other LULUCF sub-category than 'forest land remaining forest land' (4.A.1) in CRF category 4 – therefore the data reported for the future years are historical data.

3.4.1 Forest land remaining forest land (4.A.1)

3.4.1.1 Methodology for the sectoral scenarios

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

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

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

3.4.1.2 Assumptions

Special importance was attached to the silvicultural relevance of tending activities through intensive preliminary cuttings and thinning. Final cutting was assumed to have happened at those stands whose growth in economic value was negative. In addition to silvicultural aspects, economic and ecological facts were considered in the calculations. The harvesting costs were estimated via different harvesting models and compared to the revenues calculated from diverse price scenarios[6].

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

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

[6] 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 the biomass price will double (same development as oil price over period 1985–2005).

	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
kt 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
kt CO_2e	71–162 €	– 37 700	– 37 700	– 37 700
increment minus harvest:				
kt 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

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

3.4.1.3 Activities

According to the national inventory report, systematically measured statistics – such as the national forest inventory (NFI) – are considered to have the highest reliability when it comes to reporting on forest area and land use changes from and to forests, as well as stock, increment and drain (felling) (NIR; UMWELTBUNDESAMT 2015a).

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

Projections are based on the result of a "wood and biomass supply study" which was conducted by the Federal Research Centre for Forests in the years 2007 and 2008, based on NFI data as referred to above. This study includes projections for 2020, using the growth and harvest models implemented in a simulation program known as PROGNAUS.

3.4.1.4 Sensitivity Analysis

For the projections for the source category 4.A.1 no sensitivity analysis has been performed.

3.4.1.5 Uncertainty

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

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 4.A.1.

In addition, the following aspects of emission factors contribute significantly to the uncertainty associated with sector 4.A.1 'biomass estimates': conversion factors for converting stem wood to biomass as well as equations for estimating branch and root biomass. The uncertainty over historical figures for net biomass removals listed in 4.A.1, as reported under UNFCCC (for years covered by NFIs), is of the order of ± 40%. The uncertainty related to the reported historical forest soil C stock changes is significantly higher.

3.5 Waste (CRF Source Category 5)

This chapter includes information on the methods used for greenhouse gas projections, as well as assumptions on activity data projections in view of anticipated waste management and waste treatment activities. The projections described in this chapter include projections on Solid Waste Disposal, Biological Treatment of Solid Waste, Waste Incineration and Waste Water Treatment and Discharge.

Most of the measures taken into account in the projections pertain to the scenario "with existing measures". One additional measure is defined for the reduction of N_2O from wastewater handling.

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

3.5.1 Solid Waste Disposal (5.A)

3.5.1.1 Methodology used for the sectoral emission scenarios

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

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

x = starting year of data records until t
t................. year of inventory
x .... years for which input data should be added
A................ $(1 - e^{-k})/k$; (0<A<1) normalisation factor which corrects the summation
k .... methane generation rate constant [a^{-1}]; k = ln2/t•1/2
t•1/2........... half-life
MSW(x) ..... municipal solid waste (MSW) deposited in year x [Gg/a]
L_0 (x).......... methane generation potential = [MCF(x) • DOC(x) • DOC_F • F • 16/12 [Gg CH_4/Gg MSW_{wet}]
MCF(x) ...... methane correction factor in year x (fraction) [7]
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)

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

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

Historical activity data are based on a country-specific source. The parameters and values used in the emissions calculation are described in UMWELTBUNDESAMT 2015a.

3.5.1.2 Assumptions

In the scenarios of future waste generation and disposal amounts predictable future trends in waste management (resulting from the implementation of legal provisions, especially those foreseen in the Landfill Ordinance, at national level) are considered. As mainly residues from pre-treatment are considered for new current and future disposal amounts, assumptions are in line with the assumptions made for the CRF Sector 5.B.

Moreover, a constantly decreasing share of methane recovered was assumed based on historical values 2008–2012.

Activity data: see 3.5.1.3

Parameters: The parameters/values used for emission projections are the same as those used in the (historical) Austrian greenhouse gas inventory (see UMWELTBUNDESAMT 2015a).

3.5.1.3 Activities

Since 2009 the disposal of waste on landfills without pre-treatment has no longer been allowed (in accordance with the Landfill Ordinance). The main fraction relevant for current and future waste disposal is thus made up by residues from the pre-treatment of waste (covered by the main category 'non residual waste'), especially residues/stabilised waste from mechanical biological treatment plants. It is expected that amounts undergoing mechanical biological treatment, and thus also residues from this activity, will decrease steadily until 2020 and then remain constant for the rest of the projected period, in conformity with the assumption made for sector 5.B (Biological Treatment of Solid Waste). Another waste fraction deposited on landfills is sludge from wastewater handling and waste from sewage cleaning. The basis for hte projections for this activity is the mean value of the waste amounts reported for the years 2005–2013. As the First Order Decay Method is applied for emissions projections, data on historical waste disposal are also taken into account in the calculation (covering both 'residual' and 'non residual' waste). These contribute most to current and future emissions.

Table 17: Past trend (1990–2013) and scenarios (2015–2035) activity data for landfilled "Residual waste" and "Non-residual Waste".

Year	Residual Waste [kt/a]	Non-residual Waste [kt/a]	Total Waste [kt/a]
1990	1 995.7	648.7	2 644.4
2005	241.7	389.7	631.4
2008	129.3	319.9	449.3
2010	0.0	244.8	244.8
2013	0.0	185.2	185.2
2015	0.0	173.0	173.0
2020	0.0	137.9	137.9
2025	0.0	137.9	137.9
2030	0.0	137.9	137.9

3.5.1.4 Sensitivity Analysis

No sensitivity analysis has been performed in this sector.

3.5.1.5 Uncertainty

According to the Austrian National Inventory Report 2014 (UMWELTBUNDESAMT 2015a), the uncertainty in emission factors for Solid Waste Disposal is 25% and 12% for activity data, respectively.

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

3.5.2 Biological Treatment of Solid Waste (5.B)

3.5.2.1 Methodology used for the sectoral emission scenarios

Sector 5.B includes emissions from composting of biogenic waste and waste treated in mechanical-biological treatment (MBT) plants. Composted biogenic waste comprises bio-waste (biogenic waste collected from households by separate collection system) and green waste (municipal garden and park waste) treated in composting plants (centralised composting), as well as bio-waste composted 'at source' (home composting).

CH_4 and N_2O emissions are calculated by multiplying the quantity of waste by the corresponding emission factor (see Table 18).

Table 18: Emission factors for composting and mechanical-biological treatment.

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

3.5.2.2 Assumptions

It is assumed that collected bio-waste, as well as home-composted waste amounts, will increase in accordance with the population growth rates expected for the forecast period. Amounts of municipal garden and park waste are expected to remain constant at 2013 level.

As regards the amount of waste undergoing a mechanical-biological treatment (MBT) in Austria, it is assumed that activities will decline due to expected closures and reconstructions of MBT plants triggered amongst others by future requirements stipulated in the BREF Document for waste treatment industries which is currently under revision.

Activity data projections are based on a detailed analysis of existing MBT plants and expected plant-specific developments and trends in input amounts, assuming that the planned BREF update will be completed by the end of 2015 and contain transition and adjustment periods until the end of 2019. Projections for input amounts have been made for the years 2015, 2020, 2025, 2030 and 2035 (see Table 19); the values in between have been interpolated.

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

The emission factors used for the projections are in accordance with the Austrian National Inventory Report (UMWELTBUNDESAMT 2015a; see also Table 19).

3.5.2.3 Activities

On the basis of the assumptions made, the projected activity data are as follows:

Table 19: Past trend (1990–2013) and scenarios (2015–2035) activity data for biological waste treatment.

[kt]	1990	2005	2008	2010	2013	2015	2020	2025	2030	2035
Bio-waste and green waste	418	2 612	2 848	2 935	3 034	3 055	3 103	3 146	3 186	3 221
Mechanical-biologically treated waste	345	623	619	551	379	360	284	284	284	284

3.5.2.4 Sensitivity Analysis

No sensitivity analysis has been performed in this sector.

3.5.3 Incineration and Open Burning of Waste (5.C)

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

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

3.5.3.1 Methodology used for the sectoral emission scenarios

For this calculation the simple CORINAIR methodology has been applied: the quantity of waste oil is multiplied by an emission factor for CO_2, CH_4 and N_2O. Emission factors are consistent with the emission factors used in the Austrian Inventory (UMWELTBUNDESAMT 2015a).

Table 20: 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

3.5.3.2 Assumptions

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

3.5.3.3 Activities

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

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

Constant values (500 Mg of clinical waste and 500 Mg of waste oil) are predicted for incineration activities without energy recovery until 2035.

3.5.3.4 Sensitivity Analysis

No sensitivity analysis has been performed in this sector.

3.5.4 Waste Water Treatment and Discharge (5.D)

3.5.4.1 Methodology used for the sectoral emission scenarios

N_2O emissions occur as direct emissions from wastewater treatment plants and from indirect emissions from wastewater after disposal of effluent into waterways or lakes (IPCC 2006 GL). Accordingly in the Austrian inventory N_2O emissions from wastewater handling are calculated separately for:

1. Direct N_2O emissions from advanced centralised waste water treatment plants
2. Indirect N_2O emissions from effluent originating from wastewater treatment plants
3. Indirect N_2O emissions from effluent from the population not connected to wastewater treatment plants

N_2O emissions from wastewater treatment plants are calculated applying Equation 6.9 from the IPCC 2006 GL, but applying CS activity data and EF:

$$N_2O_{PLANTS} = P * T_{CND\text{-}PLANTS} * F_{IND\text{-}COM} * EF_{PLANT}$$

N_2O_{PLANTS}= total N_2O emissions from plants in inventory year, kg N_2O/yr

P = human population

$T_{CND\text{-}PLANTS}$ = degree of utilisation of modern, centralised wastewater treatment plants [%] (CS)

$F_{IND\text{-}COM}$ = fraction of industrial and commercial co-discharged protein (CS)

EF_{PLANT} = emission factor [BMLFUW 2015] (CS)

For the calculation of indirect N_2O emissions Equation 6.7 from the IPCC 2006 GL is used, applying CS activity data on nitrogen effluent:

$$N_2O\ Emissions = N_{EFFLUENT} * EF_{EFFLUENT} * 44/28$$

$N_{effluent} = N_{effluent\ plants} + N_{effluent\ population\ not\ connected}$

EF_{PLANT}= [0.005 kg N_2O-N/kg N] (IPCC 2006 GL)

Data on $N_{effluent\ plants}$ are retrieved from EMREG ("Emissionsregister – Oberflächenwasserkörper", abbreviated "EMREG-OW"[8]), an electronic register of material emissions to surface water bodies from point sources, especially municipal sewage treatment plants. The $N_{effluent\ population\ not\ connected}$ is based on investigations made by ZESSNER & LINDTNER 2005. For projections N flows are expected to increase in line with Austrian population growth rates.

CH_4 emissions from domestic wastewater disposal in septic systems are calculated pursuant to the IPCC 2006 GL, using mainly IPCC default values.

A detailed description of the methodologies will be included in the National Inventory Report 2015 (UMWELTBUNDESAMT 2015a).

[8] BGBl. II Nr. 29/2009: Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über ein elektronisches Register zur Erfassung aller wesentlichen Belastungen von Oberflächenwasserkörpern durch Emissionen von Stoffen aus Punktquellen (EmRegV-OW)

3.5.4.2 Assumptions

The following assumptions were made with regard to N_2O emissions:

- In determining future indirect N_2O emissions, the nitrogen effluent increases with the population.
- N_2O emissions from wastewater treatment plants (direct emissions) in the WAM scenario are expected to decrease by 10 t until 2020 and then by another 108 t until 2030. This projection is based on the assumption that all wastewater treatment plants improve their N removal to 80% at least by improving their operation mode (BMLFUW 2015). This is expected to be achieved by 2030, with some plant operators adapting earlier.

  As also the population increase is taken into account in the projection, the decreasing effect of operation optimisation on N_2O emissions is counteracted to a certain extent.

  In the WEM scenario N_2O emissions from wastewater treatment plants are expected to increase with population numbers. A constant nitrogen removal (level 2013) is assumed. The level of connection to municipal treatment plants will continue to increase slightly from 94.5 in 2012 to 95.0% by 2020. Given the settlement structure in Austria, 100% cannot be achieved.
- CH_4 from wastewater handling will increase with the slightly increasing population discharging to septic tanks (despite slightly decreasing connection rate to septic systems).
- Data on future developments in population growth have been taken from (ÖROK 2010) and are also reported in Annex 1.

Table 21: Past Trend (1990–2013) and scenarios (2015–2035) indicators of waste water management in Austria.

	1990	2005	2010	2013	2015	2020	2025	2030	2035
Inhabitants [1 000]	7 678	8 225	8 361	8 477	8 555	8 733	8 889	9 034	9 162
Wastewater treatment [%]	59.0	88.9	93.9	94.5	94.6	95.0	95.0	95.0	95.0
Nitrogen effluent [t]	41 031	17 136	11 998	11 452	11 534	11 610	11 779	11 937	12 075

3.5.4.3 Sensitivity Analysis

No sensitivity analysis has been performed for this sector.

4 POLICIES & MEASURES

This chapter describes the policies and measures included in the WEM and WAM projection scenario.

The content of the chapter policies and measures (PaMs) is in compliance with Art. 22 (2) of the Implementing Regulation (EU) 749/2014 and uses the tabular format set out in Annex XI to this regulation. It also meets the requirements of the UNFCCC "Guidelines for the preparation of national communications by Parties" (FCCC/CP/1999/7). An excel document following the layout of Annex XI of the above mentioned regulation has been submitted in conjunction with this report.

4.1 The framework for Austria's climate policy

In order to provide information on the legal and institutional steps to prepare for the implementation of international commitments, the following paragraphs list significant milestones of the Austrian climate policy[9].

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

  In November 2011 the Austrian Climate Change Act for compliance with the GHG emissions targets and the promotion of effective measures for climate change mitigation was implemented. It stipulates maximum emission quantities for each sector for the period 2008–2012 (according to the targets of the

[9] More detailed information can be found in the Sixth National Communication of the Austrian Federal Government: http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/aut_nc6.pdf

Climate Strategy 2007, BMLFUW 2007). An amendment to the Climate Change Act in 2013 defines now also maximum quantities per sector for 2013–2020, based on the Annual Emissions Allocation for Austria under the Effort Sharing Decision.

Based on this legislation, Austria is obliged to reach the target of -16% by 2020 (compared to 2005) in all sectors not covered by the European emission trading scheme. In addition to domestic measures flexible instruments may be used to a limited extent in order to achieve the target.

Two new bodies have been established by the new law, namely the Climate Change Committee (CCC) – consisting of ministries, provinces, social partners – and the Climate Change Advisory Board (CCAB) – consisting i.a. of NGOs, political parties, sciences. Both are chaired by the Ministry of Agriculture, Forestry, Environment and Water Management.

The Austrian Climate Change Act shall ensure clear sectoral targets, responsibilities and rules and allows for a coordinated implementation of measures.

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

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

The measures must lead to a measurable, reportable and verifiable reduction of GHG emissions or to an enhancement of carbon sinks that are reported in the National GHG inventory. The Federal Minister of Agriculture, Forestry, Environment and Water Management has to submit an annual report on the progress achieved in complying with the emission targets to the Austrian Parliament and the National Climate Change Committee. Should the emission limits be exceeded, additional measures must be planned and implemented

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

However, thorough documentation and evaluation of impacts of policies and measures (in order to enhance transparency and comparability in policies and measures reporting and evaluation) are currently the subject of discussions and research at EU as well as the national and regional levels. Efforts have been made to enhance consistency and transparency in the reporting of measures for Austria.

4.2 Sectoral methodologies

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

The following sections need to be read in conjunction with the information provided according to Annex XI of the Implementing Regulation (EU) 749/2014. It lists all policies and measures included either in the WEM or WAM scenario in tabular form (excel document).

In general, the measures included in the scenarios are based on the reports on sectoral scenarios for energy (UMWELTBUNDESAMT 2015b, AEA 2015), transport (TU GRAZ 2015), or other sectors – buildings (TU WIEN 2015), and agriculture (WIFO & BOKU 2015). The results of the negotiations between civil servants and other stakeholders about measures under the Austrian Climate Change Act (Klimaschutzgesetz) are considered as well.

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

The allocation of measures is undertaken on the basis of the following categories:

- Cross-cutting: includes measures which are relevant for more than one sector
- Energy Industries (CRF 1.A.1) & Manufacturing Industries and Construction (1.A.2)
- Transport (CRF 1.A.3)
- Other sectors, which is representing energy consumption in commercial, institutional and residential buildings (CRF 1.A.4)
- Industrial Processes and product use (CRF sector 2)
- Agriculture (CRF sector 3)
- LULUCF (CRF sector 4): No measures have been defined for the LULUCF sector.
- Waste (CRF sector 5)

The same categories have been used for the reporting of projections, therefore ensuring consistency between the reporting of projections and policies and measures.

If measures concern more than one sector, they have been allocated to the sector "cross-cutting policies and measures". This is the case for the EU Emission Trading Scheme, which targets the Energy Supply and the Industry sector. Two other measures allocated to this section are national funding mechanisms which provide support to climate friendly projects in various sectors.

Compared to the 2013 submission, the reporting of policies and measures has improved. The objective of the changes applied was to achieve a consistent approach across all sectors and to allow for consistency in the reporting of policies and measures under various reporting requirements of the EU and the UNFCCC. Instruments which contribute to achieving a certain policy target have been aggregated and are now represented by a single policy or measure.

So, the policies and measures which were reported in 2013 have been reviewed, new ones have been added, and finally all instruments have been grouped into 24 measures in total (see Table 23). In the following sections each policy and measure is described, including details on the underlying actions, ambitions and assumptions. Summary data can be found in Annex I.

Table 22: Overview of Austrian Policies and Measures

N°	PAM Name	Instrument(s)	Scenario
Cross-cutting Policies and Measures			
PAM N°1	EU Emission Trading Scheme	N/A	WEM
PAM N°2	Domestic Environmental Support Scheme	N/A	WEM
PAM N°3	Austrian Climate and Energy Fund (KLI.EN)	N/A	WEM
Policies and Measures for the Sectors: Energy Industries (CRF 1.A.1) and Manufacturing Industries and Construction (1.A.2)			
PAM N°4	Increase the share of renewable energy in power supply and district heating	• Green Electricity Act 2012 and Feed-In tariff ordinance	WEM
PAM N°5	Increase energy efficiency in energy and manufacturing industries	• Implementation of the National Energy Efficiency Action Plan 2011 • Promotion of combined heat and power	WEM
PAM N°6	Further enhancement of renewable energy in energy supply	• Green Electricity Act – beyond 2020	WAM
PAM N°7	Further enhancement of energy efficiency in energy and manufacturing industries	• Energy Efficiency Act	WAM
Policies and Measures for the Sector: Transport (CRF 1.A.3)			
PAM N°8	Increase share of clean energy sources in road transport	• Implementation of the Directive 2009/28/EC on the promotion of the use of energy from renewable sources • Implementation Plan for electric mobility	WEM

N°	PAM Name	Instrument(s)	Scenario
PAM N°9	Increase fuel efficiency of road transport	• Fuel tax increase in 2011 • Greening the truck toll • Fuel saving initiative • Air quality induced speed limits	WEM
PAM N°10	Modal shift to environmentally friendly transport modes	• Mobility management and awareness – klimaaktiv mobil programme • Promotion of corporate rail connections for freight transport	WEM
PAM N°11	Further enhancement of clean energy sources for transport	• Promotion of alternative fuels and biofuels • Promoting electric vehicles	WAM
PAM N°12	Further enhancement of fuel efficiency in road transport	• Fuel tax increase in 2016 and 2019 • Implementation of Energy Efficiency Directive • Implementation of the Infrastructure Costs Directive	WAM
PAM N°13	Further modal shift to environmentally friendly transport modes	• Promoting mobility management including the Bicycle Master Plan & the Walking Master Plan • Incentives for an increased use of public transport • Implementation of the National Action Plan Danube Navigation	WAM
Policies and Measures for the Sector: Other sectors (CRF 1.A.4)			
PAM N°14	Increased energy efficiency of buildings	• OIB guideline 6 (– Energy savings and thermal insulation (OIB Richtlinie 6 – Energieeinsparung und Wärmeschutz) • Building renovation initiative for private buildings to improve energy performance (renovation cheques) • Building renovation initiative for commercial and industrial buildings to improve energy performance • Recast of the Energy Performance of Buildings Directive	WEM
PAM N°15	Increased share of renewable energy for space heating	• Stepping up the replacement of heating systems • District Heating and District Cooling Act • Funding for wood heating systems and solar heating systems	WEM

N°	PAM Name	Instrument(s)	Scenario
PAM N°16	Increased energy efficiency in residential electricity demand	• Ecodesign requirements for energy using products • End-use efficiency and energy services • Energy labelling of household appliances	WEM
PAM N°17	Further enhancement of energy efficiency in buildings	• Adaptation of existing funding programmes • Effect of Energy Efficiency Directive • National plan for non-residential buildings	WAM
Policies and Measures for the Sector: Industrial Processes and Product Use (CRF Sector 2)			
PAM N°18	Decrease emissions from F-gases and other product use	• Prohibition and restriction of the use of (partly) fluorinated hydrocarbons and SF6 • Implementation of EU F-gas Regulation (EC) No 842/2006 • Reducing HFC emissions from air conditioning in motor vehicles • Solvent Ordinance to reduce VOC emissions from paints and varnishes • Limitation of VOC emissions from the use of organic solvents in industrial installations	WEM
PAM N°19	Further minimisation of F-gas emissions	• Quota system for production and import of F-gases	WAM
Policies and Measures for the Sector: Agriculture (CRF Sector 3)			
PAM N°20	Implementation of EU agricultural policies	• Programme for rural development 2007–2013 • Common agricultural policy (CAP)	WEM
PAM N°21	Emission reduction through livestock und feeding management	• Increase dairy cow lactation and increase the efficiency of other livestock production • Feeding measures for cattle and pig • Promotion of grazing	WAM
PAM N°22	Sustainable N management	• Anaerobic fermentation of animal manure • Sustainable N management • Organic farming	WAM

N°	PAM Name	Instrument(s)	Scenario
Policies and Measures for the Sector: Waste (CRF Sector 5)			
PAM N°23	Reduce Emissions from Waste Treatment	• Landfill Ordinance • Emission reduction from mechanical biological treatment plants	WEM
PAM N°24	Enhanced reduction of emissions from waste treatment	• Emission reduction from waste water treatment plants	WAM

4.3 Cross-cutting measures

4.3.1 PaM N°1: EU Emission Trading Scheme (ETS)

GHG affected: CO_2, N_2O

Type of policy: regulatory, economic

Implementing entity: federal government

Mitigation impact: not available

EU legislation	National Implementation	Start
Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community	Federal Law Gazette I No. 118/2011 (Emissions Allowance Trading Act)	2005
Commission Regulation 601/2012/EU on the monitoring and reporting of greenhouse gas emissions		

Legal basis

The basis for the EU Emissions Trading System (EU ETS) is the Emissions Trading Directive 2003/87/EC, which was last amended in 2009. This Directive was transposed into Austrian law by adopting the Emissions Allowance Trading Act 2011 (Emissionszertifikategesetz EZG 2011, Federal Law Gazette I No. 118/ 2011).

First and second trading period

The first trading period of the EU ETS was a trial period and covered the years 2005–2007. The second period ran from 2008–2012. In the first two trading periods the EU ETS included CO_2 emissions and from 2010 onwards also N_2O emissions in Austria. The system covers large emitters from the industry sectors and energy supply.

Current trading period

The current trading period runs from 2013–2020. Subsequent eight year periods are foreseen in the Emissions Trading Directive. Directive 2009/29/EC revised Directive 2003/87/EC and introduced substantial improvements to the EU ETS. The revised Directive was transposed into Austrian law via the Emissions Allowance Trading Act 2011 (Federal Law Gazette I No. 118/2011).

Electricity generation installations no longer receive free allowances (apart from a few exceptions) but have to purchase allowances on the market or acquire them through auctioning. For the industry sectors and for heat generation the allocation is still free, on an interim basis. Industry sectors with a significant risk of carbon leakage receive up to 100% free allocations, whereas for other sectors the allocation decreases each year (starting from 80% in 2013 and decreasing to 30% in 2020) based on a benchmarking system.

In the current trading period more than 200 installations are covered by the EU ETS in Austria. As a result of the extension of the scope of the EU ETS from 2013 onwards more than 20 additional installations are now included in the EU ETS (compared to the previous periods).

4.3.2 PaM N°2: Domestic Environmental Support Scheme (Umweltförderungsgesetz)

GHG affected: CO_2, CH_4, N_2O

Type of policy: economic

Implementing entity: federal government

Mitigation impact: 1,000 kt CO_2 equ. in 2020

*National policy (*Federal Law Gazette I No. 40/2014 (last amendment), Federal Law Gazette No. 185/1993)

The objective of the domestic environmental support scheme is environmental protection by the prevention and reduction of pressures such as air pollution, greenhouse gases, noise and waste. The Ministry of Agriculture, Forestry, Environment and Water Management puts the focus of its funding policy on climate change. In 2013, about 94% of the fund were provided from projects with climate relevance. Most projects were targeted at renewable energy (45.4%) and efficient energy use (53.2%). Biomass heating, the distribution of heat and the switch to LED lighting were the most frequently requested funding areas. (BMLFUW 2014c)

According to an evaluation (BMLFUW 2014c), the accumulated CO_2 savings due to projects granted in 2013 will amount to 3.1 million tonnes by 2020. About 78% are expected to be achieved through renewable energy projects, and about 22% through projects focusing on energy efficiency. In 2012, final energy savings of about 241 GWh per year and CO_2 reductions of almost 400 000 t were achieved.

4.3.3 PaM N°3: Austrian Climate and Energy Fund (KLI.EN)

GHG affected: CO_2, CH_4, N_2O

Type of policy: economic

Implementing entity: federal government

Mitigation impact: not available

In 2007, the Federal Government established a specific fund (Climate and Energy Fund – KLI.EN) in order to support the reduction of GHGs in Austria in the short, medium and long term (Federal Law Gazette I No. 40/2007). Since 2007 the fund has made € 934 million available to support more than 76 000 projects (in 27 programmes), ranging from basic and applied research to subsidies for the implementation of climate friendly technology. Support is provided for companies, research institutions or municipalities as well as for individuals, depending on the respective programme.

The KLI.EN fund supports measures in the field of mobility, buildings, industrial production and energy supply, sector which are the main emitters of GHGs.

Quantification/Projected GHG emissions/removals:

A quantification of the effect on GHGs is not carried out due to high uncertainties associated with it, but the potential is estimated to be high in the long term. The emission saving potential depends very much on how far research, pilot projects or model regions can penetrate the market in the future and contribute to substantial emission savings.

4.4 Energy Industries (CRF 1.A.1) and Manufacturing Industries and Construction (1.A.2)

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

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

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

4.4.1 WEM measures for Energy/Industry

4.4.1.1 PaM N°4: Increase the share of renewable energy in power supply and district heating

Due to the abundance of surface water in Austria, large and small scale hydro power production has long played (and still plays) a major role in power supply. The promotion of other sources of renewable energy for electricity generation and of biomass for district heating became an important policy making topic in the 1990ies (BMU 1995, BMUJF 1997). Fixed feed-in tariffs still are an appropriate instrument to promote electricity produced from renewable energy sources. In addition to the instrument described below, investment support for biomass based district heating systems under the Domestic Environmental Support Scheme (see also chapter 4.3.2) is a relevant climate instrument in this sector.

GHG affected: CO_2

Type of policy: regulatory, economic

Implementing entity: federal government

Mitigation impact: 5,300 kt CO_2 equ. in 2020 (Green Electricity Act)

The instrument listed below has been taken into account in the current scenario.

Green Electricity Act 2012 and Feed-In tariff ordinance (Ökostromgesetz 2012 und Ökostrom-Einspeisetarifverordnung 2012)

Type: EU and National policy

EU legislation	National Implementation	Start
RES Directive 2009/28/EC (repealing RES-E Directive 2001/77/EC and Biofuel Directive 2003/30/EC),	Federal Law Gazette I No. 75/2011 (Green Electricity Act 2012, Amendment)	2012
Internal electricity market 2009/72/EC (repealing 2003/54/EC)	Federal Law Gazette I No. 149/2002 (Green Electricity Act 2002)	2002
Energy efficiency 2012/27/EU (repealing Directives 2004/8/EC and 2006/32/EC)	Federal Law Gazette II No. 307/2012 (Feed-in tariff ordinance)	2012

Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources was implemented through the Green Electricity Act. The Green Electricity Act not only addresses the main issues specified in the Directive, but also provides for a harmonisation of the system for promoting electricity production from renewable energy sources by granting fixed feed-in tariffs for various forms of electricity generation from renewable sources, e.g. biomass, wind power, small hydropower, geothermal energy and photovoltaics.

The 2012 amendment of the Green Electricity Act, implementing the RES directive, was designed to increase funding for the expansion of renewables. It includes new expansion targets for 2020 for renewables:

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

Furthermore, the guaranteed feed-in time period was extended in 2009 to 13 years in general, and to 15 years for power plants based on biomass and biogas fuels.

Quantification/Projected GHG emissions/removals:

In accordance with this Act, more electricity (i.e. an additional 18 PJ approximately) will be produced in green electricity plants by 2015 compared to 2010, and an additional 48 PJ (approximately) by 2020, resulting in yearly emission reductions of about 400 kt CO_2 eq. in the period 2010–2015 and about 5 300 kt

CO_2 eq. in the period 2015–2020, respectively (using an emission factor of 0.4 kt CO_2-eq./GWh). The above mentioned target for photovoltaic installations is expected to be surpassed as these installations will have reached their economic profitability.

4.4.1.2 PaM N°5: Increase energy efficiency in energy and manufacturing industries

Energy efficiency has been an important topic in policy making for a long time, and a distinct improvement in energy efficiency throughout the last decades has been observed. The national energy efficiency action plan and the promotion of combined heat and power are the main instruments to increase energy efficiency in the industry sector.

GHG affected: CO_2

Type of policy: planning, economic, regulatory

Implementing entity: federal government, federal provinces

Mitigation impact: not available

In addition to the instruments described below, the cross-cutting measures described in Chapters 4.3.2 and 4.3.3 are also relevant in this category.

Implementation of the National Energy Efficiency Action Plan 2011 (Nationaler Energieeffizienzaktionsplan 2011)

Type: *EU policy*

EU legislation	National Implementation	Start
Directive 2006/32/EU on Energy End-Use Efficiency and Energy Services (meanwhile repealed by Directive 2012/27/EU)	National Energy Efficiency Action Plan 2011	2011

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

In the second NEEAP 2011 (national energy efficiency action plan), Austria defines its targets regarding the reduction of energy consumption as follows: It aims at stabilising final energy consumption in 2020 at the level of 2005, which means a maximum of 1,100 PJ. By 2016 Austria wants to save 80.4 PJ. The highest reductions in final energy consumption have already been achieved in the building and heating sector (80% of the reductions up to 2010). The major part of these reductions was achieved through measures undertaken by the federal provinces.

The first NEEAP under Directive 2012/27/EU was submitted in April 2014 (see chapter 4.4.2.2).

Quantification/Projected GHG emissions/removals:

It was not possible to estimate the reduction potential of this measure, due to the fact that there are strong linkages with measures targeting energy efficiency in the building sector.

Promotion of combined heat and power (Kraftwärmekopplungs-Gesetz)

Type: EU policy

EU legislation	National Implementation	Start
Combined Heat and Power (CHP) Directive Promotion of cogeneration 2004/8/EC (meanwhile repealed by Directive 2012/27/EU)	Federal Law Gazette I No. 111/2008	2008
Internal electricity market 2009/72/EC (repealing 2003/54/EC)		

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 and the 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 law provides for support for installations put into operation by the end of 2020 at the latest according to an extension of the provisions recently approved by the European Commission.

The amounts of future subsidies for new CHP plants are limited to 12 million € per year. However, any additional effects are estimated to be low, because of the low profitability of CHP plants based on natural gas under current market conditions.

4.4.2 WAM measures for Energy/Industry

Only some of the WAM measures for this sector have been quantified individually. For this reason, the sum of quantified policy effects is much lower than the WAM-WEM difference gathered from the projections. Furthermore, additional measures leading to reduced electricity and/or district heat consumption in other sectors are also relevant for this sector as less electricity and/or district heat has to be produced.

4.4.2.1 PaM N°6: Further enhancement of renewable energy in energy supply

The existing legal provisions for the support of green electricity, as shown in section 4.4.1.1., are effective only until 2020. However, an extension of the support measures for the time beyond 2020 can be expected and is taken into account in the WAM scenario.

GHG affected: CO_2

Type of policy: regulatory

Implementing entity: federal government

Mitigation impact: not available

The instrument listed below has been taken into account in the current scenario.

Green Electricity Act – beyond 2020

Type: National policy

Status: planned, based on experts' judgement

In comparison to the WEM scenario, it is assumed for the WAM scenario that the support to be provided for green electricity will not come to an end in 2020, but will go on until 2030. Old power plants will be replaced by new ones. Moreover, it is assumed that new power installations will be supported further on until 2030, leading to a 1,600 MW increase in wind power. Biomass capacity is expected to remain stable after 2020 while in WEM it is expected to shrink. No changes are expected in photovoltaic capacity compared to WEM as these installations are expected to reach profitability in the coming years and therefore will no longer have to be supported.

Quantification/Projected GHG emissions/removals:

This measure will only be effective after 2020 and lead to an additional 17 PJ of electricity from wind and biomass plants compared to WEM. However, expected emission reductions are limited as fossil power plants will be operated at times when there is a simultaneous district heat demand due to low profitability. Thus, additional green electricity production is expected to result in reduced electricity imports and emission savings in other European countries.

4.4.2.2 PaM N°7: Further enhancement of energy efficiency in energy and the manufacturing industries

There is potential for further improvements in energy efficiency in industry e. The EU has enacted provisions aiming at a 20% decrease of primary energy demand in the EU, which have been transposed into national law. The relevant instrument at national level, which is described below, has been adopted at a late stage of the scenario calculations and was therefore included in the WAM scenario only.

GHG affected: CO_2

Type of policy: regulatory

Implementing entity: federal government

Mitigation impact: not available

The instrument listed below has been taken into account in the current scenario.

Energy Efficiency Act (Energieeffizienzgesetz)

Type: EU policy

EU legislation	National Implementation	Start
Energy efficiency Directive 2012/27/EU, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC	Federal Law Gazette I No. 72/2014 (Energy Efficiency Act)	2014

The Directive 2012/27/EU on energy efficiency was implemented by adopting the Energy Efficiency Act, which targets a cost efficient energy efficiency increase to be achieved in businesses and households by 2020. It includes different provisions for energy suppliers, companies and the federal government, respectively.

The Energy Efficiency Act includes among others:

- Mandatory external energy audits every four years or mandatory introduction of energy or environmental management systems including regular energy audits for big companies.
- Energy suppliers are supposed to deliver yearly savings either themselves or to end users amounting to 0.6% of their yearly energy supply.
- The federal republic has to fulfill a yearly renovation goal of 3% through refurbishments or other energy savings.
- Energy efficiency action plans including the monitoring of binding goals and measures.

An energy efficiency action plan was submitted to the European Commission in April 2014.

Quantification/Projected GHG emissions/removals:

The Energy Efficiency Act is expected to deliver savings of 14 PJ in the manufacturing industries and construction sector. However, it was not possible to quantify the total effect on the projected GHG emissions in the energy and manufacturing industries sector as the reductions in electricity and district heat demand in other sectors are also relevant.

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

In this chapter the WEM and WAM measures relevant for the Transport sector will be specified.

The measures and GHG mitigation potentials used in the WEM scenario are described below. The measures are ranked according to their absolute reduction potential in 2020, starting with the highest potential.

4.5.1 WEM measures for Transport

4.5.1.1 PaM N°8: Increase share of clean energy sources in road transport

The substitution of fossil diesel fuel by RME, either as pure "biodiesel" or up to a 3% share in conventional diesel, was promoted at the end of the 1990s already, as well as alternative motor concepts like hybrid and electric vehicles (BMLFUW 2002). Legislation providing for an increase of biofuel in road transport and promotional measures for electric mobility have been taken into account in the current scenarios, representing the two main instruments for promoting clean energy sources.

GHG affected: CO_2

Type of policy: regulatory, fiscal, planning, economic, research

Implementing entity: federal government

Mitigation impact: see details below

The instruments listed below have been taken into account in the current scenario.

Implementation of Directive 2009/28/EC on the promotion of the use of energy from renewable sources (Umsetzung der Richtlinie Erneuerbare Energieträger (2009/28/EG) gemäß Kraftstoffverordnung 2012)

Type: EU policy

EU legislation	National Implementation	Start
RES Directive 2009/28/EC (Amendment)	KVO Federal Law Gazette II No. 398/2012 (last amendment 2014)	2012
RES-E Directive 2001/77/EC	KVO Federal Law Gazette II No. 168/2009	2009
Biofuel Directive 2003/30/EC	Federal Law Gazette II No. 417/2004	2004
Fuel Quality directive 2009/30/EC	Federal Law Gazette No. 267/1967	

Both the Directive on the promotion of renewable energy sources (2009/28/EC) as well as the Fuel Quality directive (2009/30/EC) can be regarded as successors to the Biofuels Directive (2003/30/EC). They both lay down – directly and indirectly – goals for the use of biofuels. Apart from an overall goal, i.e. a certain percentage of its total energy needs to be fulfilled with renewables by 2020, the Renewable Energy Directive also defines a goal for the use of renewables in the Transport sector. By 2020, each Member State must replace at least 10% of the fuels used in transport by renewables such as biofuels, or use electricity from renewable energy sources.

In Austria, the Directive was implemented in 2004 by amending the Austrian Fuel Ordinance (Kraftstoffverordnung – KVO 2012). According to this ordinance, there is an obligation to substitute 2.5% of the amount of diesel and petrol (measured by energy content) put on the market since 1 October 2005 by renewable fuels. This minimum share was increased to 4.3% on 1 October 2007 and again to 5.75% on 1 January 2009.

Biofuels have been on the Austrian market since 2005 mainly in the form of a mix of biodiesel with conventional diesel. Since October 2007 ethanol has been added to petrol. Currently there are standards for gasoline fuel E10 and diesel fuel B7. This means that at the moment it is possible to blend 10% ethanol with gasoline fuels and 7% FAME (fatty-acid methyl ester) with diesel fuels. In addition, the transport fleets of the municipalities and companies were converted to run on pure biofuels or on a share of more than 40% of biofuels. This was especially promoted by "klimaaktiv mobil", an initiative of the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW – see also klimaaktiv instruments).

Assumptions about the development of the volume of biofuels blended with fossil fuels depend largely on the amount of fossil transport fuels sold. Except for blending, biofuels usage, e.g. pure FAME used in fleets, is expected to decline to zero in 2020 in WEM due to market uncertainties. In the WAM scenario the consumption of pure biofuels is assumed to increase slightly from present levels.

According to the amendment to the Austrian Fuel Ordinance (KVO 2012 in force since 1.1.2013) the substitution target will be 8.45% (compared to the energy content) from 1 October 2020 onwards, measured by the total gasoline and diesel fuel used or when first put into free circulation on the territory of the Federal Republic of Austria.

Regarding the renewable energy share within the Transport sector, the subtarget of 10% will be reached thanks to the additional activities incorporated. Besides rail and underground transport, the Transport sector in total also includes ski lifts which are electrically powered.

Further details can be found in Austria's annual report on biofuels in the Transport sector (BMLFUW 2014a).

Quantification/Projected GHG emissions/removals:

2020: 2,243 kt CO_2 eq (incl. fuel export) / 1,302 kt CO_2 eq (excl. fuel export)

Implementation Plan for electric mobility (Umsetzungsplan Elektromobilität)

Type: National policy

In the WEM scenario only measures and incentives implemented up to now have been taken into account on the basis of former studies about the development of e-mobility (UMWELTBUNDESAMT 2010, UMWELTBUNDESAMT 2015c). Many measures and initiatives with the aim to encourage the development of electric vehicles have already been used. These are in particular:

- Implementation plan for electric mobility as a joint initiative undertaken by three ministries (BMLFUW & WIKO 2010),
- klimaaktiv mobil (initiative launched by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management)
- Climate Fund (research funding and application-oriented promotion e.g. model regions).

In addition, instruments have been implemented which, although not suitable for a wider audience, are designed to make electric mobility compatible with customer expectations more quickly. From surveys it is well known that users have seen improvements, especially in the following areas:

- costs
- range
- infrastructure

With appropriate policies (e.g. taxation) especially the costs and the medium-term infrastructure (preparation of standards and suitable conditions as well as the construction of and concessions for charging infrastructure) could be adapted.

Demand is weak in the WEM scenario. Consequently, the incentives are lower for the automobile industry to invest in R&D for the serial production of electric vehicles. In 2013, about 2 100 electric cars and 400 plug-in hybrid cars were part of the Austrian fleet. In the conservative WEM scenario the fleet of electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) (passenger cars) is estimated to consist of 66 000 vehicles. This would imply that approx. 1% of the Austrian fleet is electrified and the share of new registrations of electric vehicles could increase to approx. 9% (UMWELTBUNDESAMT 2015c).

Quantification/Projected GHG emission removals:

2020: 120 kt CO_2 eq (domestic effects only) (UMWELTBUNDESAMT 2015c)

4.5.1.2 PaM N°9: Increase fuel efficiency in road transport

Final energy demand for transport in Austria has more than doubled in the course of the last three decades. Even if fuel exports in the vehicle tank have significantly contributed to this development, increasing transport demand and the growing size and weight of cars have been driving factors too. An increase in the fuel efficiency of road vehicles is essential if emissions from transport are to be reduced. Several instruments, including taxes and tolls along with awareness raising and training, have been taken into account in the current scenarios.

GHG affected: CO_2

Type of policy: fiscal, education, information, voluntary/negotiated agreement, regulatory, economic

Implementing entity: Federal government, federal provinces, companies

Mitigation impact: see details below

The instruments listed below have been taken into account in the current scenario.

Fuel tax increase in 2011 (*MöSt-Erhöhung 2011* „Klimabeitrag“)

Type: national policy

EU legislation	National Implementation	Start
Framework for the taxation of energy products and electricity (2003/96/EC)	Mineralölsteuergesetz Federal Law Gazette I No. 630/1994 (last amended 2014)	2011

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

The purpose of increasing the fuel tax is to reduce individual motorised transport and encourage people to switch to public transport. Moreover, the aim is to reduce GHG emissions from fuel export.

Quantification/Projected GHG emissions/removals:

2020: 1,222 kt CO_2 eq (incl. fuel export) / 37 kt CO_2 eq (excl. fuel export)

Greening the truck toll (Ökologisierung der LKW-Maut)

Type: National policy

EU legislation	National Implementation	Start
Taxation of heavy goods vehicles 2006/38/EC	Federal Law Gazette I No. 109/2002) (last amendment 2014)	2002

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

The reduction potential of this measure is based on an expert estimate and has been included into the NEMO model. The reduction potential of this measure is decreasing over time, given the future fleet renewal cycle of heavy duty vehicles as determined in the fleet module of the NEMO model, which results in the continuous removal of older vehicles.

Quantification/Projected GHG emissions/removals:

2020: 233 kt CO_2 eq (domestic effects only)

Mobility management and awareness raising – klimaaktiv mobil fuel saving initiative (klimaaktive *Spritsparinitiative*)

Type: National policy

Training sessions for fuel-efficient driving are expected to reduce fuel consumption. In comparison to the conventional style of driving GHG emissions can be reduced by 5–15%. The intiative „klimaaktiv mobil" by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management aims at promoting fuel-efficient driving.

Nationwide competitions and pilot campaigns for companies owning large fleets have been organised and have already led to energy savings.

In addition, training programmes for all types of vehicle drivers have been launched and more than 22 000 people have participated in these programmes.

Since 2008 fuel-efficient driving has been a compulsory part of the training in driving schools. For this reason more than 1 200 trainers for fuel-efficient driving have been qualified. Under the Austrian training programme in driving schools

80 000 learner drivers are participating in one fuel-efficiency training session per year. Besides, the programme also helps to inform people about alternative fuels and motors, e.g. in terms of guidelines for fleets. 26 driving schools have been rewarded for their outstanding commitment to learner driver tuition and the operation of their schools.

Quantification/Projected GHG emissions/removals:

2020: 57 kt CO_2 eq (domestic effects only)

The CO_2 mitigation potential is kept on a constant level up to 2035.

Air quality induced speed limits (Bestehende Tempolimits gemäß Immissionsschutzgesetz-Luft)

Type: national policy

EU legislation	National Implementation	Start
Air quality Directive 2008/50/EC	Federal Law Gazette I No 115/1997 (last amendment 2010)	1997/NA

The Ambient Air Quality Act lays down ambient air quality limit values for several pollutants.

In order to reduce and avoid exceedances of the limit value for NO_2, the speed limits have been lowered on certain parts of the Austrian motorways, either permanently or in sections controlled by traffic management systems. Based on an analysis of mileage-based speed, a difference in driving speeds of 6.2 km/h was used as input for the NEMO model (DIPPOLD et al. 2012). The calculated reduction potentials for energy use and emissions was simulated in the NEMO model. Traffic volumes and traffic speed on the respective motorway sections were used to calculate the emissions.

Quantification/Projected GHG emissions/removals:

2020: 34 kt CO_2 eq (domestic effects only)

4.5.1.3 PaM N°10: Modal shift to environmentally friendly transport modes

Austria belongs to the EU Member States with the highest share of rail transport in the modal split. This applies to passenger transport as well as to freight transport. Nevertheless, a shift from road transport to environmentally friendly transport modes with a lower energy demand has been the focus of Austrian environmental policy for some time. Considerable investments of the order of several billion euros have been made to improve the railway infrastructure (new high-speed links, modernisation of railway stations) in the last decade.

GHG affected: CO_2

Type of policy: information, economic

Implementing entity: federal government, federal provinces, municipalities, companies

Mitigation impact: see details below

The instruments listed below have been taken into account in the current scenarios.

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Mobility management and awareness – klimaaktiv mobil initiative (Mobilitätsmanagement und Bewusstseinsbildung – klimaaktiv mobil Programm)

Type: National policy

The klimaaktiv mobil initiative of the Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management offers extensive initiatives for promoting climate-friendly mobility management, alternative fuels, electric mobility and renewable energy in the Transport sector, as well as cycling and fuel-saving initiatives. It is intended to motivate the relevant stakeholders and decision makers and to support them in the development and implemention of projects for the promotion of climate-friendly, efficient and sustainable mobility. The cornerstones of klimaaktiv mobil are the funding programme for businesses, communities and associations, target group-oriented counselling programmes, awareness-raising initiatives, partnerships, and training and certification initiatives. Numerous projects have already been successfully implemented:

- Mobility management for commercial, building promoters and fleet owners: 410 100 t CO_2 reduction/year (status 12/2014, source: Austrian Energy Agency)
- Mobility management for leisure, tourism and youth: 77 000 t CO_2 reduction/year (status 12/2014, source: Austrian Energy Agency)
- Mobility management for cities, municipalities and regions: 103 000 t CO_2 reduction/year (status 12/2014, source: Austrian Energy Agency).

Furthermore, 5 700 climate-friendly mobility projects have been initiated – implemented by 4 200 establishments, 650 cities, municipalities and regions, 600 tourist facilities and 250 schools.

- Annual savings: 590 000 t CO_2;
- Grants amounting to EUR 74.8 million for mobility projects trigger an investment volume of around EUR 500 million;
- Around 5 800 jobs, so-called "green jobs" have been secured or created;
- Around 13 800 alternative vehicles have been promoted, including more than 11 900 electric vehicles;
- More than 150 cycle projects were promoted, including cycle promoting projects in all provinces and major cities;
- 1 200 fuel-saving driving instructors have been trained and 26 klimaaktiv mobil driving schools certified.

Quantification/Projected GHG emissions/removals:

2020: 447 kt CO_2 eq (domestic effects only)

The CO_2 mitigation potential is kept on a constant level up to 2035.

Promotion of corporate rail connections for freight transport *(Anschlussbahnförderung)*

Type: National policy

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

The railway infrastructure service company (SCHIG) which is responsible for implementation, the Federal Ministry for Transport, Innovation and Technology and the Climate and Energy Fund (KLI.EN) have provided estimates of the CO_2 emission reduction potential by 2020.

Quantification/Projected GHG emissions/removals:

2020: 72 kt CO_2 eq (domestic effects only)

4.5.1 WAM measures for Transport

WAM measures suitable for modelling were taken from a list of measures, derived from negotiations about implementing the Austrian Climate Change Act (CCA) in 2012 with an update in 2014. This law, adopted in November 2011, sets emission ceilings for a total of six sectors and regulates the development and implementation of effective climate action outside the EU emissions trading scheme. It is an essential part of Austrian climate policy until 2020.

For all measures the absolute reduction potential was estimated. A comparison of quantified emission reductions achieved through WAM measures shows that they are in line with the projections (WAM minus WEM).

4.5.1.1 PaM N°11: Further enhancement of clean energy sources for transport

Existing instruments have brought about a considerable share of clean energy sources for road transport. The potential for a further increase of this share is expected to be still significant.

GHG affected: CO_2

Type of policy: regulatory, planning, fiscal, economic, research

Implementing entity: federal government, federal provinces, municipalities, companies

Mitigation impact: see details below

The instruments listed below have been taken into account in the current scenario.

Promotion of alternative and biofuels (Forcierung von Alternativen und Biokraftstoffen gemäß Treibstoffstrategie 2014)

Type: national policy

On the basis of the new development of Austrian fuel pathways up to 2020 under the Austrian Fuels Strategy 2014 (BMLFUW 2014b), which take into account the changing conditions and the active involvement of relevant stakeholders, the potential for a promotion of alternative fuels and biofuels has been estimated. In the course of the project the various energy sources were screened, with the involvement of stakeholders, and realistic scenarios were developed. The former 2013 projections were used as a basis for discussion. In some cases, additional data already new scenarios and different variants (monitoring mechanisms) were used.

According to the Directive on the promotion of renewable energy sources (2009/28/EC) Austria has to reach a minimum of 10% of renewable energy sources in the Transport sector by 2020. These renewable fuels include not only biofuels – they must meet certain sustainability criteria in order to be credited to the target– but also electricity or hydrogen derived from renewable sources. This measure shows the realistic potential for all these alternative fuels in addition to the potential calculated in the WEM scenario. For activity details see chapter 3.1.3.3 Activities – Biofuels – developments and trends.

Quantification/Projected GHG emissions/removals:

2020: 233 kt CO_2 eq (incl. fuel export)

Promoting electric vehicles (*Forcierung Elektromobilität*)

Type: National policy

The scenario WAM is an optimistic scenario assuming additional measures for the development of e-mobility in Austria in addition to the measures implemented and planned up to now (UMWELTBUNDESAMT 2015c). Many measures and initiatives with the aim to encourage the development of electric vehicles have already been used. These are in particular:

- Implementation plan for electric mobility as a joint initiative undertaken by three ministries (BMLFUW & WIKO 2010),
- klimaaktiv mobil (initiative launched by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management)
- Climate Fund (research funding and application-oriented promotion e.g. model regions).

Here the limiting factors, from today's perspective, such as the development of the new car market, the fleet renewal rates used for estimating the maximum ranges of electric vehicles etc. are taken into account.

In 2013, about 2 100 electric cars and 400 plug-in hybrid cars were part of the Austrian fleet. Ideal political and economic circumstances for the introduction and development of e-mobility in Austria are assumed in the WAM scenario. It is assumed that all stakeholders strive for a nationwide expansion of e-mobility. Under these optimistic circumstances the fleet of electric vehicles (which includes electric and plug-in hybrid cars) is estimated to include 174 000 vehicles in 2020. This would imply that 3.4% of the Austrian fleet is electrified and the share of new registrations of electric vehicles could increase to approx. 18% (UMWELTBUNDESAMT 2015c).

The Austrian Energy Strategy and the Implementation Plan for Electric Mobility specifies that the Austrian fleet should contain 250 000 electric vehicles in 2020, a goal which seems difficult to reach from today's perspective.

Quantification/Projected GHG emissions/removals:

2020: 283 kt CO_2 eq (domestic effects only) = 120 kt CO_2 eq WEM potential + 163 kt CO_2 eq WAM potential (UMWELTBUNDESAMT 2015c)

4.5.1.2 PaM N°12: Further enhancement of fuel efficiency in road transport

Economic incentives are essential for a further increase in the fuel efficiency of road transport. Taxation of fossil fuels is crucial for promoting alternative fuels and combustion technologies. Laws on energy efficiency help accelerate this trend.

GHG affected: CO_2

Type of policy: fiscal, regulatory, economic

Implementing entity: federal government, federal provinces, municipalities, companies

Mitigation impact: see details below

The instruments listed below have been taken into account in the current scenario.

Fuel tax increase in 2016 and 2019 *(MöSt Erhöhung 2016 und 2019)*

Type: National policy

An increase in the fuel tax has been included in the WAM scenario in two steps. The first increase was simulated with an increase on 1 January 2016 by 5 euro-cent (excluding VAT) for petrol and diesel. The second increase of the fuel tax was calculated with an increase on 1 January 2019 of an additional 5 euro-cent (excl. VAT) for petrol and 6 euro-cent (excl. VAT) for diesel. This increases Austria's fuel prices, resulting (in the fuel export model) in a lower demand and fuel consumption. In neighbouring countries an increase of the fuel tax by 2 euro-cent up to 2030 has been taken into account. The assumptions on future tax increases are based on expert judgement.

Quantification/Projected GHG emissions/removals:

2020: 3 183 kt CO_2 eq (incl. fuel export)

Implementation of Energy Efficiency Directive (2012/27/EU) *(Umsetzung Energieeffizienzgesetz – EEffG 2014)*

Type: EU policy

EU legislation	National Implementation	Start
Energy Efficiency Directive (2012/27/EU)	Federal Law Gazette I No. 72/2014	2015

The goal of the Federal Energy Efficiency Act is to increase energy efficiency by 20% in 2020 while improving energy supply security, to increase the share of renewables in the energy mix and to achieve a reduction of greenhouse gas emissions. The national target is to achieve 1 050 PJ of gross final energy demand in 2020 which corresponds to a 20% increase in energy efficiency in 2020.

The implementation of the Energy Efficiency Act in the Transport sector in the model has been undertaken using direct targets for savings in 2020 (16 PJ) and 2030 (35 PJ), beginning in 2015. Precise measures – how companies will manage to achieve improvements in energy efficiency – were not known at the time when the project was carried out. Therefore, the potential for improvement was implemented in the model using an increased vehicle efficiency, in addition to the business as usual trend development.

In general, it can be said that a certain amount of time is required to achieve the potential for energy efficiency for the vehicles, as considered in the model, which is technically feasible. But a rapid emergence of these efficient vehicles in the fleet seems to be very ambitious. The off-road sector is not affected by the Law.

Quantification/Projected GHG emissions/removals:

2020: 975 kt CO_2 eq (domestic effects only)

Implementation of the Road Infrastructure Charging Directive 2011/76/EU in Austria *(Umsetzung der Wegekosten-RL 2011/76/EU in Österreich)*

Type: EU policy

EU legislation	National Implementation	Start
EU Directive 2011/76/EU	Planned	

The new EU Directive on the charging of heavy goods vehicles for the use of certain infrastructures 76/2011/EU provides for charges imposed on road users to cover certain environmental costs. A new external cost is added to the lorry toll. It has been assumed that heavy vehicles that belong to the EURO 4 and EURO 5 class will have been substituted by EURO 6 class vehicles by 2020. Heavy duty vehicles from the EURO classes 0–3 are not affected by this measure because they have comparably low mileages. They will still be used especially for short distances.

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

Quantification/Projected GHG emissions/removals:

2020: 37 kt CO_2 eq (domestic effects only)

4.5.1.3 PaM N°13: Further modal shift to environmentally friendly transport modes

Further efforts have to be taken to induce a considerable modal shift in passenger as well as freight transport. Therefore, instruments supporting cycling and walking can be set up through already existing initiatives like klimaaktiv mobil. But also the Danube's potential as an alternative mode of freight transport has to be taken into account.

GHG affected: CO_2

Type of policy: information, economic, education, voluntary

Implementing entity: federal government, regional entities, local governments, companies

Mitigation impact: see details below

The instruments listed below have been taken into account in the current scenario.

Promoting mobility management including a Bicycle Masterplan & a Walking Masterplan (*Forcierung Mobilitätsmanagement inkl. Masterplan Radfahren & Masterplan Gehen*)

Type: National policy

This instrument targets mobility management and the promotion of eco-friendly mobility including cycling and walking. The potentials were calculated based on the reduction and substitution of kilometres travelled by passenger car and using kilometres travelled by bicycle or on foot instead. The Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) has provided the following estimates of emission reduction potentials by 2020:

- 100 000 t CO_2 from the Bicycle Masterplan (BMLFUW 2015)
- 50 000 t CO_2 from the Walking Masterplan (expert judgement)
- 50 000 t CO_2 from the "general mobility management" programme (expert judgement).

The total savings of 200 000 tonnes of CO_2 are kept constant from 2020 to 2035. Shifts to public transportation have not been considered.

Quantification/Projected GHG emissions/removals:

2020: 200 kt CO_2 eq (domestic effects only)

Incentives for an increased use of public transport *(Anreize für verstärkte ÖV-Nutzung)*

Type: national policy

This instrument includes several incentives for enhancing the use of public transport (e.g. using public transport tickets or passes for work or business-related travel) and reducing existing barriers: an Austria-wide cross-modal, attractive design of tariff-systems for public transport, examination of the insurance and trade law situation for car pooling or car sharing, or other incentives or tax-free so-called job tickets, a measure which was derived based on an assessment of the potential for tax-free job tickets in the WAM scenario in the former projections 2013. Also, employees who do not receive a commuter tax allowance because their travelling distance is less than 20 km (one-way) will be allowed to claim “job” tickets for using public transport.

Quantification/Projected GHG emissions/removals:

2020: 30 kt CO_2 eq (domestic effects only)

Implementation of the National Action Plan Danube Navigation (*Umsetzung Nationaler Aktionsplan Donauschifffahrt (NAP)*)

Type: National policy

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

Quantification/Projected GHG emissions/removals:

2020: 1 kt CO_2 eq (domestic effects only)

4.6 Other sectors (1.A.4)

Measures included in this sector concern energy consumption in buildings and are interlinked with the energy supply sector.

Significant national policy instruments that promote the implementation of measures are the Housing Support Scheme („Wohnbauförderung“ – WBF), the 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 klimaaktiv programme. The last three programmes are funded by the national government.

Further details on the Domestic Environmental Support Scheme and the Austrian Climate and Energy Fund are provided in the description of cross-cutting measures (section 4.3).

4.6.1 WEM measures for other sectors (1.A.4)

Where applicable, an updated WOM scenario was taken as a fictitious reference scenario for a quantification of the mitigation impact where a single measure had no effects.

4.6.1.1 PaM N°14: Increased energy efficiency in buildings

This measure targets the energy efficiency of buildings by tightening construction standards and providing financial support for new building and the thermal renovation of buildings. Furthermore, energy performance certificate obligations for real estate transactions are included, but their mitigation impact could not be quantified. However, the effect is estimated to be rather low.

GHG affected: CO_2

Type of policy: Regulatory, economic, information, voluntary *Implementing entity:* National government, regional entities

Mitigation impact: 463 (66 new building, 397 renovation) kt CO_2 equ. In 2020

The instruments listed below have been taken into account in the current scenario.

OIB guideline 6 – Energy savings and thermal insulation (*OIB Richtlinie 6 – Energieeinsparung und Wärmeschutz*)

Type: EU policy, national policy

EU legislation	National Implementation	Start
Recast of the Energy performance of buildings (Directive 2010/31/EU) amending 2002/91/EC	OIB Guideline 6	2012–2015 (depending on the legislation of the federal provinces)
	National plan, addressing residential buildings only	2012

The new edition of the OIB guideline No 6 of the Austrian Institute for Constructional Engineering (released in October 2011) transposes the EU Directive on the energy performance of buildings (Directive 2010/31/EC) into national law. The federal provinces are responsible for translating this guideline into their respective regional laws. The OIB Guideline No 6, and more precisely the National plan, requires that new buildings improve their building standard every two years to achieve a “nearly zero energy” building standard which will comply with the target of the EU Directive in 2020. The focus is no longer just on the thermal heat demand of buildings but also on hot water, ventilation, cooling, the demand for electricity and photovoltaics impacts on the total energy efficiency.

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

Quantification/Projected GHG emissions/removals:

The reduction potential of this single instrument is expected to amount to 13–71 kt CO_2 equivalents by 2020, depending on the date of the amendments carried out in the federal provinces and further (planned) improvements to the OIB Guideline No 6 on Energy saving and heat insulation[10]. However, the National Plan included in the WEM scenario 2015 only addresses residential buildings. Therefore, the additional reduction potential for non-residential buildings can be attributed to the WAM scenario (see chapter 4.6.2.1 for details).

National and funding programmes (*Bundes- und Förderprogramme*)

Type: national policy

In the WEM scenario 2015 it has been assumed that the following funding and national programmes will be continued in order to improve the energy efficiency of buildings:

- Klimaaktiv:
  - e5-communities: consultancy for communities to promote climate policies
  - energy saving: education, information and advice for consumers and commercial enterprises to reduce energy consumption
  - renewable energy: provide know-how and support networking for committed companies and associations
- Domestic Environmental Support Scheme (UFI):
  - KLI.EN: This is a fund included in the Environmental Support Scheme which supports energy efficiency measures for buildings (for more details see 4.3.3).
- Housing Support Scheme (WBF)
- Renovation of federal buildings (federal real-estate property) and construction of new federal buildings
- Building renovation initiative for commercial and industrial buildings to improve their energy performance: This measure includes funding for heat recovery, efficient energy use in industrial processes, optimisation or exchange of heating systems.
- Consultancy service and information campaigns

Funding for thermal renovation and new building includes all relevant funding programmes of the federal government and the federal provinces.

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[10] Source: Umweltbundesamt, 2014 (internal paper) " VORSCHLAG FÜR EIN KSG-PROGRAMM 2015-2020"

In the WEM scenario it is assumed that funds provided under the Domestic Environmental Support Scheme will drop by about 20% until 2015 and remain constant thereafter.

Instruments to support efficient new residential buildings, the thermal renovation of existing dwellings and the replacement of heating systems within the Housing Support Scheme (WBF) are regulated by the Austrian "15a BV-G Agreement" of the Federal Constitutional Law between the federal government and the federal provinces. This constitutional agreement between the federal provinces and the federal government came into effect in 2006 (Federal Law Gazette II No. 19/2006, succeeded by Federal Law Gazette II No. 251/2009) and provided for further improved standards as a prerequisite for receiving subsidies and for a shift to subsidies supporting the thermal renovation of existing dwellings. With regard to the quality of the renovations, new enhanced minimum standards shall be developed for the amendment planned for 2015.

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

In the WEM scenario the funding guidelines of the Housing Support Scheme will be adapted in order to fulfil the requirements of the building codes of the provinces two years in advance (see instrument 'OIB guideline No 6' above). In 2020 new residential buildings must fulfil at least 20% of the building code requirements of 2021 to be eligible for funding under the Housing Support Scheme.

Subsidies for thermal renovation from the Housing Support Scheme are assumed to follow their declining trend until 2017 and to remain constant afterwards. New building subsidies from the Housing Support Scheme are set to remain constant at the average level for 2009–2012, starting from 2020. All other subsidies taken into account are assumed to remain constant at the mean level for 2009–2012.

The total funding volume for new building is supposed to increase from € 659 million annually in 2012 to € 704 million annually by 2020, while thermal insulation subsidies are expected to drop from € 375 million to € 262 million annually within the same time span. Starting from 2020 until 2030 all funding volumes will remain constant (par value). Beyond 2030 the actual values are set to remain constant, so that the par values will increase.

The total funding volume for thermal insulation also includes the funding of the federal building renovation initiatives: In the WEM scenario it is assumed that the funds provided via renovation cheques (€ 100 million annually) will drop by about 20% until 2015 and remain constant thereafter. For further details see the corresponding chapters regarding these two instruments below.

Quantification/Projected GHG emissions/removals:

The reduction potential has not been estimated.

Building renovation initiative for private buildings to improve the energy performance (renovation cheques) *(Sanierungsscheck zur Verbesserung der Energieeffizienz von Privatgebäuden)*

Type: national policy

EU legislation	National Implementation	Start
Recast of the Energy performance of buildings (Directive 2010/31/EU) amending 2002/91/EC	Federal Law Gazette I No. 40/2014 (last amendment)	Start 2014
	Federal Law Gazette I No. 185/1993	1993

The "renovation cheque" is an incentive launched by the federal government to promote the renovation of private buildings. The already existing building renovation initiative is planned to be continued and to become more attractive for private households in 2015 and beyond.

Funding is available for the thermal renovation of buildings that are older than 20 years: insulation of front walls and ceilings, exchange of windows and front doors, exchange of the heating system. The initiative is focused on owners of and tenants in rented apartments in multi-storey buildings as well as detached/semi-detached family houses.

Quantification/Projected GHG emissions/removals:

The reduction potential is expected to amount to 190–220 kt CO_2 by 2020[11].

Building renovation initiative for commercial and industrial buildings to improve energy performance (*Sanierungsoffensive zur Verbesserung der Energieeffizienz von betrieblichen Gebäuden*)

Type: national policy

EU legislation	National Implementation	Start
Recast of the Energy performance of buildings (Directive 2010/31/EU) amending 2002/91/EC	Federal Law Gazette I No. 40/2014 (last amendment)	Start 2014 End 2015
	Federal Law Gazette I No. 185/1993	1993

As an incentive of the federal government to promote the renovation of commercial and industrial buildings, the domestic environmental support scheme fund (UFI) recently provided about € 30 million annually for this purpose. It is assumed that this instrument will be continued beyond 2015.

[11] Source: BMLFUW 2013 (internal paper): „Maßnahmentabelle Bund, Stand 18.01.2013"

Funding is available for the thermal renovation of buildings that are older than 20 years: heat recovery, efficient energy use in industrial processes, optimisation or exchange of the heating system. The initiative is focused on companies and commercial organisations, such as registered associations and professional organisations.

Quantification/Projected GHG emissions/removals:

The reduction potential has not been estimated.

Recast of the Energy Performance of Buildings Directive *(Energieausweis-Vorlage-Gesetz 2012 – EAVG 2012)*

Type: EU policy

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

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

- Definition of calculation methods for total energy efficiency and minimum requirements
- Specifications for the creation, submission and notice of the energy performance certificate
- Inspections of heating and cooling systems.

The new elements include requirements for building technology systems, requirements for low-energy buildings and the compulsory creation of financial incentives by the Member States.

Austria has implemented the Buildings Directive and introduced several measures such as the 'Energy Certification Providing Act' („Energieausweis-Vorlage-Gesetz 2012 – EAVG 2012") and the Austrian Institute of Construction (OIB) Engineering Guidelines have been adopted to maximise energy efficiency in new and existing residential buildings in Austria.

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

Quantification/Projected GHG emissions/removals:

The reduction potential has not been estimated.

4.6.1.2 PaM N°15: Increased share of renewable energy for space heating

This measure includes instruments that promote the exchange of conventional heating systems for heating systems running on renewable energy and district heating. Furthermore, it addresses district cooling.

GHG affected: CO_2

Type of policy: economic, regulatory

Implementing entity: national government, regional entities

Mitigation impact: 585 kt CO_2 equ. In 2020

The instruments listed below have been taken into account in the current scenario.

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

Type: National policy

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

Quantification/Projected GHG emissions/removals:

The reduction potential has not been estimated.

District heating and district cooling Act *(Wärme- und Kälteleitungssausbaugesetz)*

Type: National legislation Federal Law Gazette I No. 72/2014 (last amendment), Federal Law Gazette I No. 58/2009 (amendment), Federal Law Gazette I No. 113/2008.

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

This law shall lead to a permanent reduction of 3 000 kt CO_2, as specified in the respective law (Federal Law Gazette I No. 58/2009).

Quantification/Projected GHG emissions/removals:

The reduction potential has not been estimated.

Funding for wood heating systems and solar heating systems (Ausbau der Förderung von Holzheizungen für private Haushalte und Erweiterung der Förderung großer Solarthermie-Anlagen)

Type: National legislation: Federal Law Gazette I No. 40/2014 (last amendment), Federal Law Gazette I No. 185/1993.

This funding initiative intends to enforce the installation of environmentally friendly heating systems in private households. It is financed under the domestic environmental support scheme (UFI) via the KLI.EN funds.

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

This funding initiative, launched in 2012, has been extended until 2015. It is assumed that this instrument will be continued beyond 2015.

Quantification/Projected GHG emissions/removals:

This initiative is expected to save 69–79 kt CO_2 by 2020.[12]

4.6.1.3 PaM N°16: Increased energy efficiency in residential electricity demand

This measure includes the ecodesign requirements for energy using products, the requirements of Directive 2006/32/EC on energy end-use efficiency and energy services and the energy labelling of household appliances, all of which relate to the electricity demand of households.

GHG affected: CO_2

Type of policy: regulatory, information

Implementing entity: national government, regional entities, companies / businesses / industrial associations

Mitigation impact: not available

The instruments listed below have been taken into account in the current scenario.

Ecodesign requirements for energy using products *(Ökodesign-Verordnung)*

Type: EU policy

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

[12] Source: BMLFUW 2013 (internal paper): "Maßnahmentabelle Bund, Stand 18.01.2013"

The Eco-design Ordinance transposes the EU Eco-design Directive 2009/125/EC into national law. It consists of minimum eco-design requirements for specific energy-using products. These products have to be marked with the CE label and have to meet the minimum requirements defined in the EU Directive.

The product design must consider environmental impacts (resource use and energy consumption, emissions and recyclability) and safety-related requirements, taking into account the whole product life cycle, from the choice of raw material until final waste disposal.

During the first phase of the implementation of the Eco-design Directive, primarily consumer products (household appliances) were affected. The amended directive extends the scope to services and industries, such as heating systems, ventilation and air conditioning, machines, pumps and transformers.

Quantification/Projected GHG emissions/removals:

The reduction potential has not been estimated.

End-use efficiency and energy services (Directive 2006/32/EC)
(Endenergieeinsatz und Energiedienstleistungen)

Type: EU policy

EU legislation	National Implementation	Start date
Directive 2006/32/EC on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC	Constitutional Article 15a Agreement between the federal government and the federal provinces implementing Directive 2006/32/EC on energy end-use efficiency (Federal Law Gazette I No. 5/2011)	
	2nd National Energy Efficiency Action Plan	2011
	1st National Energy Efficiency Action Plan	2007

Directive 2006/32/EC was repealed by the Energy Efficiency Directive which is considered in the WAM scenario, as implementation only started after February 2014.

The Directive aims at making the end use of energy more efficient. Member States must adopt and achieve an indicative energy saving target of 9% by 2016 in the framework of a National Energy Efficiency Action Plan (NEEAP). Furthermore, energy saving targets for the public sector have to be set and harmonised indicators and benchmarks for energy efficiency have to be established. In Austria the End-use Efficiency and Energy Services Directive also directly influences the Article 15a Agreement between the federal government and the provinces (Federal Law Gazette I No. 5/2011), as many topics addressed in the Directive do not belong to the legislative competences of the federal government.

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

Quantification/Projected GHG emissions/removals:

This instrument has been taken into account in the building sector. A quantification of the emission reductions is not possible, as there are strong linkages with other instruments. In the WEM scenario it is assumed that Austria will meet the objectives set out in the Directive.

Energy labelling of household appliances (Produkte-Verbrauchsangabenverordnung 2011 – PVV 2011)

Type: EU policy

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

Directive 2010/30/EU on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products was implemented in Austria in 2011 (Federal Law Gazette II No. 232/2011). It specifies different energy classes, starting from A+++ (the best class) to D (the poorest performance class). As under the amendment to the Eco-design Directive, the scope of this Directive has been expanded to include a larger group of energy consuming products.

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

New specific requirements have been established for the following products: dishwashers, refrigerators, freezers, washing machines, televisions, room air conditioning appliances, laundry dryers, vacuum cleaners, space and combination heaters, water heaters and electric lamps.

Quantification/Projected GHG emissions/removals:

The reduction potential has not been estimated.

4.6.2 WAM measures for other sectors (1.A.4)

In the WAM scenario 2015, measures have been integrated which remain to be implemented, but have already been decided upon or their implementation can be regarded as likely. It should be noted at this point that the WAM scenario is far from containing all possible measures. Therefore the WAM scenario cannot be interpreted as an upper limit for the renovation potential or for the use of renewable energy.

4.6.2.1 PaM N°17: Further enhancement of energy efficiency of buildings

This measure consists of three instruments: adaptation of existing funding programmes, the Energy Efficiency Directive (2012/27/EU) and the amendment to the National Plan for non-residential buildings.

GHG affected: CO_2

Type of policy: Regulatory, economic, information, voluntary

Implementing entity: National government, regional entities

Mitigation impact: 413 kt CO_2 equ. In 2020

The instruments listed below have been taken into account in the current scenario.

Adaptation of existing funding programmes *(Anpassung bestehender Förderprogramme)*

Type: National policy

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

Funding for the renovation of existing buildings and new buildings include all relevant funding programmes of the federal government and the federal provinces. In the WAM scenario it is assumed that all subsidies remain at same level as for the WEM scenario until the year 2015. The total funding volume is thereafter assumed to rise by € 103 million until 2021 (compared to the WEM scenario). The share of total funding for thermal renovation is expected to reach 39%. The total funding volume for new buildings is supposed to decrease from € 659 million in 2012 to € 644 million in 2020, while thermal insulation subsidies increase from € 375 to € 425 million until 2021. Starting from 2020 (or 2021) until 2030, all funding volumes are expected to remain constant (par value). Beyond 2030 the actual values are set to remain constant, so that the par values increase.

Quantification/Projected GHG emissions/removals:

The reduction potential has not been estimated.

Effect of Energy Efficiency Directive (2012/27/EU) *(Bundes-Energieeffizienzgesetz)*

Type: EU policy

EU legislation	National Implementation	Start date
Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance	Federal Law Gazette I No. 72/2014	2014

EU legislation	National Implementation	Start date
	First National Energy Efficiency Action Plan of the Republic of Austria 2014 in accordance with the Energy Efficiency Directive 2012/27/EC	2014

The Federal Energy Efficiency Act (Bundes-Energieeffizienzgesetz) transposes the EU Energy Efficiency Directive 2012/27/EC into national law. It consists, inter alia, of final energy demand guidance levels to be attained by 2020 and it specifies measurements to assess energy efficiency gains, while enhancing the security of energy supply, increasing the renewable energy share and reducing greenhouse gas emissions. The most important provisions are:

- Increase in energy efficiency by at least 3% in buildings owned by the federal state annually
- Introduce mandatory energy management systems or external energy audits in enterprises with more than 250 employees
- Energy providers are obligated to provide proof of final energy demand savings and measures within their own organisations, amongst their own customers or with other final energy users.

However, there are still uncertainties especially when it comes to accounting for measures and the practical embodiment of measures. Rebound effects and free rider effects associated with measures which would also be adopted without the Federal Energy Efficiency Law have to be eliminated from any accurate measures accounting system.

For the WAM scenario, it has been assumed that energy savings resulting from the Federal Energy Efficiency Act are fully achieved in addition to the WEM scenario. Consequently, the WAM scenario's reduction potential represents an upper estimate because of possible linkages with given WEM measures.

National plan for non-residential buildings (OIB Richtlinie 6 – Energieeinsparung und Wärmeschutz)

Type: national policy

EU legislation	National Implementation	Start
Recast of the Energy performance of buildings (Directive 2010/31/EU) amending 2002/91/EC	OIB Guideline 6	2012–2015 (depending on the legislation of the federal provinces)
	National plan, addressing residential and non-residential buildings	2014 (latest amendment)
	National plan, addressing residential buildings only	2012

The supplement of the National Plan that is considered within the WAM scenario 2015 addresses non-residential buildings, while mitigation effects of residential buildings are accounted for under PaM N°14 in the WEM scenario (see chapter 4.6.1.1 for more details).

Quantification/Projected GHG emissions/removals:

The reduction potential is expected to amount to 1–4 kt CO_2 equivalents by 2020, depending on the date of the amendments carried out in the federal provinces and further (planned) improvements to the OIB Guideline No 6 on Energy saving and heat insulation[13]. However, the National Plan considered in the WAM scenario only addresses non-residential buildings. Therefore, the reduction potential for residential buildings is attributed to the WEM scenario (see chapter 4.6.1.1 for more details).

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

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

4.8 Industrial Processes and Product Use (CRF Source Category 2)

The measures listed here target only F-gas emissions and emissions from product use, as other measures relevant for the Industry sector are covered in the Energy sector. These measures focus on energy efficiency and the use of renewable energy sources, which also affect GHG emissions from industrial processes. In the WAM scenario there is only one F-gas measure included.

4.8.1 WEM measures for industrial processes and solvent use

4.8.1.1 PaM N°18: Decrease emissions from F-gases and other product use

Instruments to reduce emissions from F-gases have been implemented since 2002 (BMLFUW 2006). National bans and restrictions have been complemented by EU legislation at a later stage.

GHG affected: HFCs, PFCs and SF_6

Type of policy: regulatory, information

Implementing entity: federal government

[13] Source: Umweltbundesamt, 2014 (internal paper) " VORSCHLAG FÜR EIN KSG-PROGRAMM 2015–2020"

Mitigation impact: not available

The instruments listed below have been taken into account in the current scenario.

Prohibition and restriction of the use of (partly) fluorinated hydrocarbons and SF6 (*Industriegasverordnung)*

Type: National policy

EU legislation	National Implementation	Start
	Federal Law Gazette II No. 139/2007 (amendment)	2002

In Austria restrictions and bans on F-gases have first been enacted on national level by the Industrial Gas Ordinance – „Industriegasverordnung" (Federal Law Gazette II No. 447/2002, amended by Federal Law Gazette II No. 139/2007). The provisions are thematically related to the EU F-gas Regulation.

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

Implementation of EU F-gas Regulation (EC) No 842/2006 *(Umsetzung der EU-F-Gas-Verordnung 2006)*

Type: EU policy

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

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

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

Quantification/Projected GHG emissions/removals:

The impacts of this policy were not estimated.

Reducing HFC emissions from air conditioning in motor vehicles (Verringerung von HFC Emissionen durch Klimaanlagen von Kraftfahrzeugen)

Type: EU policy

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

According to the EU Directive on HFCs in mobile air conditioning units, car manufacturers are no longer allowed to use refrigerants with a GWP (global warming potential) higher than 150 in new passenger cars. This affects the period from 2013 onwards.

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

Quantification/Projected GHG emissions/removals:

A quantification of the reduction potential is not available.

Solvent Ordinance to reduce VOC emissions from paints and varnishes *(Lösemittelverordnung)*

Type: EU policy

EU legislation	National Implementation	Start date
Directive 2004/42/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products	Federal Law Gazette II No. 398/2005	2005
	Federal Law Gazette II No. 25/2013 (Amendment)	2013

The Solvents Ordinance aims at limiting emissions of volatile organic compounds from the use of organic solvents in certain paints and varnishes and vehicle refinishing products. In order to reduce concentrations of ground-level ozone in ambient air the content of VOC is reduced in these products.

Limitation of VOC emissions from the use of organic solvents in industrial installations (Begrenzung der Emissionen bei der Verwendung organischer Lösungsmittel in gewerblichen Betriebsanlagen)

Type: EU and national policy

EU legislation	National Implementation	Start date
Industrial Emissions Directive 1999/13/EC	Federal Law Gazette II No. 301/2002	2002
	Federal Law Gazette II No. 42/2005 (Amendment)	2005
	Federal Law Gazette II No. 77/2010 (Amendment)	2010

Emissions of volatile organic compounds from the use of organic solvents in certain industrial installations and commercial enterprises fall within the scope of the Industrial Emissions Directive. The operators are obliged to comply with regulations concerning emission limits. For this reason regular measurements and reporting is necessary. An annual solvent report has to be submitted to the district authorities.

The Austrian Ordinance on VOC emissions further includes guidelines for the reduction of emissions.

4.8.2 WAM measures for industrial processes and solvent use

The quantification of WAM measures listed below concerns F-gases only.

4.8.2.1 PaM N°19: Further minimisation of F-gas emissions

Another instrument which was implemented on 1 January 2015 was taken into account for the WAM scenario.

GHG affected: HFC, PFC, SF_6, NF_3

Type of policy: regulatory

Implementing entity: federal government

Mitigation impact: not available

The instrument listed below has been taken into account in the current scenario.

Quota system fkor production and import of F-gases *(Umsetzung der EU-F-Gas-Verordnung 2014)*

Type: EU policy (EU Regulation No 517/2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006)

The EU Regulation aims at reducing F-gases by prohibiting certain F-gases, and at controlling the production and imports of other F-gases into the European Union. Aspects regarding the reduction of leakage rates and the training of staff were adopted from Regulation No 842/2006 (as described above (WEM)). The amendment also deals with the placing on the market of F-gases and control of use: from 1 January 2020 onwards the use of fluorinated gases with a global warming potential of 2 500 or more to service or maintain refrigeration equipment with a charge size of 40 tonnes of CO_2 equivalents or more will be prohibited (for certain categories, this rule will not apply before 2030, recycled uses will be permitted). For the placing on the market, as well as imports and production, a quota system will be applied. The maximum quantity of F-gases imported or produced in the EU will be controlled by applying the following percentages (to the annual average of the total quantity placed on the market in the European Union) from 2009–2012 (expressed in t of CO_2 equivalent): 2015: 100%; 2016–17: 63%; 2018–20: 63%; 2021–23: 45%; 2024–26: 31%; 2027–29: 24%; 2030: 21%. Only certain uses, e.g. for military equipment, etching for semiconductor material, and medical aerosols, will qualify for an exemption.

Quantification/Projected GHG emissions/removals:

The quantification of the GHG reduction potential has been considered in the WAM scenario. The scenario leads to a reduction of 850 kt CO_2 eq.

4.9 Agriculture (CRF Source Category 3)

4.9.1 WEM measures for agriculture

4.9.1.1 PaM N°20: Implementation of EU agricultural policies

The European agricultural policy pursues several goals, e.g. safe and affordable food supplies, the protection of the living standards of farmers in the face of modernisation and new developments in agriculture, and the preservation of agriculture in all regions of the European Union.

One of the main agricultural policy priorities in Austria is to promote environmentally sound farming practices for Austria’s small-structured agricultural system, especially in the ‘mountain’ and ‘other’ less favoured areas.

GHG affected: CH_4, N_2O,

Type of policy: regulatory, economic

Implementing entity: federal government, regional entities

Mitigation impact: not available

The instruments listed below have been taken into account in the current scenario.

Programme for rural development 2007–2013 (Österr. Programm für die Entwicklung des Ländlichen Raums 2007–2013)

Type: EU policy

EU legislation	National Implementation	Start
Council Regulation (EC) No. 1698/2005.	Österr. Programm für die Entwicklung des Ländlichen Raums 2007–2013	2007–2013

Measures have already been implemented in the context of the Austrian Agri-Environmental Programme 2007–2013 and will continue to be effective in the following programming period (2014–2020).

The Austrian Agri-Environmental Programme 2007–2013 includes several measures that are designed to reduce GHG emissions from the agricultural sector, e.g.:

- Renunciation of yield-increasing inputs on arable lands and grasslands
- Mulching of arable land and direct seeding
- Low-loss application of liquid manure and biogas slurry
- Promotion of organic farming
- Promotion of grazing
- Reduced usage of mineral fertilisers.

Common agricultural policy (CAP) (Gemeinsame Europäische Agrarpolitik)

Type: EU policy

EU legislation	National Implementation	Start
Common Agricultural Policy related regulations	implemented	2013

The following provisions of the CAP are taken into account:

- Implementation of the CAP 2013 reform (in particular abolition of sugar quota and suckling cow premiums)
- Internal convergence of direct payments ("regional premium" scheme instead of historic payments)
- Land is maintained in good agricultural and ecological condition ("cross compliance" and the requirements for “greening” (in particular crop rotation requirement) are met;
- The programme for rural development 2014–2020 is maintained in a modified way with different premiums (in particular for less favoured areas and organic farms) and measures.

4.9.2 WAM measures for agriculture

4.9.2.1 PaM N°21: Emission reduction through livestock und feeding management

GHG emissions from Austrian livestock can be reduced by promoting climate-friendly animal husbandry including feeding measures, grazing and the systematic breeding of animals. *GHG affected:* CH_4, N_2O

Type of policy: regulatory, economic

Implementing entity: federal government, regional entities

Mitigation impact: not available

The instruments listed below have been taken into account in the current scenario.

Increase the lactation performance of dairy cows (Erhöhung der Lebensleistung von Milchkühen) and increase of efficiency of other livestock (Zuchtfortschritt und Herdenmanagement)

Type: national policy

- Dairy cattle: In dairy cattle breeding an increased number of lactations per cow will be encouraged. This will result in a reduced demand of heifers for replacements.
- *Assumption:* It is assumed that the lactation performance of milk cows will increase by 10% in 2020 and by 20% in 2035.
- Other livestock: Systematic breeding and better (herd) management is expected to result in increased yields of livestock products but does not require additional feed demand and costs. Increased efficiency is expected to lead to a lower GHG intensity of agricultural production.

  Assumptions: It is assumed that the efficiency of livestock will increases by 2.5% in 2020 and by 5.0% in 2030.

Feeding measures cattle and pigs (Fütterungsmaßnahmen für Rinder und Schweine)

Type: national policy

- Cattle: Increase of quality grassland/silage (*Erhöhung Grundfutterqualität)*

  Increased protein and energy content of all forage products, i.e. forage resources on permanent and temporary grasslands and silage maize. Assumed to be the result of improved crops and better management.

  Assumptions: It is assumed that the quality of feed will increase by 2.5% in 2020 and by 5.0% in 2030.
- Pigs: Increase feed efficiency pig farming (*N-angepasste Fütterung von Schweinen)*

The protein demand of pig depends on the growth stages of pigs. In the juvenile phase the supply of digestible protein should be higher than in later phases. Technically, phase feeding can be planned and usually entails financial benefits. Reduced nitrogen excretion in pig manure causes reduced emissions of N_2O. Advisory activities could help increase the application rate of phase feeding.

Assumptions: It is assumed that feeding efficiency of pigs will increase by 2.5% in 2020 and 5.0% in 2030.

Promotion of grazing (Forcierung Weidehaltung)

Type: national policy

Cattle grazing causes lower GHG emissions than indoor husbandry. Through counselling and financial support the share of pasture management shall be increased or at least maintained. In suckling cow husbandry the outdoor share could be increased, while this seems difficult to achieve in dairy farming.

Assumptions: Currently the share of manure excreted on pastures in suckling cow husbandry is 14.3%, according to the Austrian GHG Inventory. This percentage is expected to increase by 5% from 2020 onwards (to 19.3%).

4.9.2.2 PaM N°22: Sustainable N management

Sustainable N management is linked to technical improvements as well as a heightened awareness, leading to higher efficiency and reduced N losses.

GHG affected: N_2O, CH_4

Type of policy: regulatory, economic

Implementing entity: federal government, regional entities

Mitigation impact: not available

The instruments listed below have been taken into account in the current scenario.

Anaerobic fermentation of animal manure (Güllevergärung)

Type: national policy

At present, animal manure is fermented only to a small extent, because compared to corn silage the energy density is low. Under current conditions, fermentation plants based on liquid manure are not profitable. Profitability could be ensured with a feed-in tariff of about 25 cents per kWh. The manure share in the fermentation substrate should be at least 70%.

Assumptions

It is assumed that 10% of cattle, swine and chicken manure will be anaerobically treated in 2020. It is assumed that this share will have increased to 25% in 2035.

Sustainable N management (Nachhaltiges Stickstoffmanagement)

Type: national policy

This measure consists of a multitude of individual sub-measures which usually do not occur independently, e.g. an efficiency increase in organic fertiliser use through customised manure storage or the establishment of manure exchanges. The sub-measures included are: the covering of slurry tanks, low ammonia application techniques, rapid incorporation, timely application, forced cultivation of legumes etc.

Additionally, a higher efficiency of mineral fertilisers through better management practices and spreading equipment, supported by the Austrian Agri-Environmental Programme ÖPUL, will result in a reduced amount of mineral fertilisers being used. All these aspects have to be taken into account when planning fertiliser use.

Assumption:

A more efficient usage of organic and mineral fertilisers through better management practices results in reduced losses of nitrogen. The following assumptions have been made: N losses will be reduced by 5% in 2020 and by 20% in 2030. As a consequence, the model results show a significantly reduced demand for mineral fertilisers.

Organic farming (Biologischer Landbau)

Type: national policy

The efficient "organic farming" ÖPUL measure, implemented through systematic closed nutrient cycle management, avoids the use of mineral fertilisers. Currently, about 414 000 hectares of agricultural land are managed using organic farming practices. An increase of organically farmed land is deemed feasible.

Assumption:

Measures to further stimulate organic farming and other incentives to reduce mineral inputs (e.g. granting higher subsidies) have been assumed.

4.10 Land use, Land-Use Change and Forestry (CRF Source Category 4)

The projections for LULUCF are currently being updated. Therefore, a definition of specific policies and measures is still pending.

No specific policies and measures in the LULUCF sector can be mentioned, although there are several measures listed in the sections above which are also of relevance for the LULUCF sector, because they aim at increasing the share of renewable energy sources such as biomass and switching to fuels with a lower (fossil) carbon content, or they are part of rural development measures. No quantifications can be given of the programmes or initiatives listed below due to a lack of data and because of overlapping objectives.

4.11 Waste (CRF Source Category 5)

In the WEM scenario for waste the amount of waste (and the carbon content respectively) being deposited is assumed to have strongly decreased, mainly as a result of the requirements of the Landfill Ordinance, but also because waste incineration and other forms of treatment are becoming more important. This trend is also shown by the indicator "annually deposited waste/CH_4 emissions" (see the Figure 38 below).

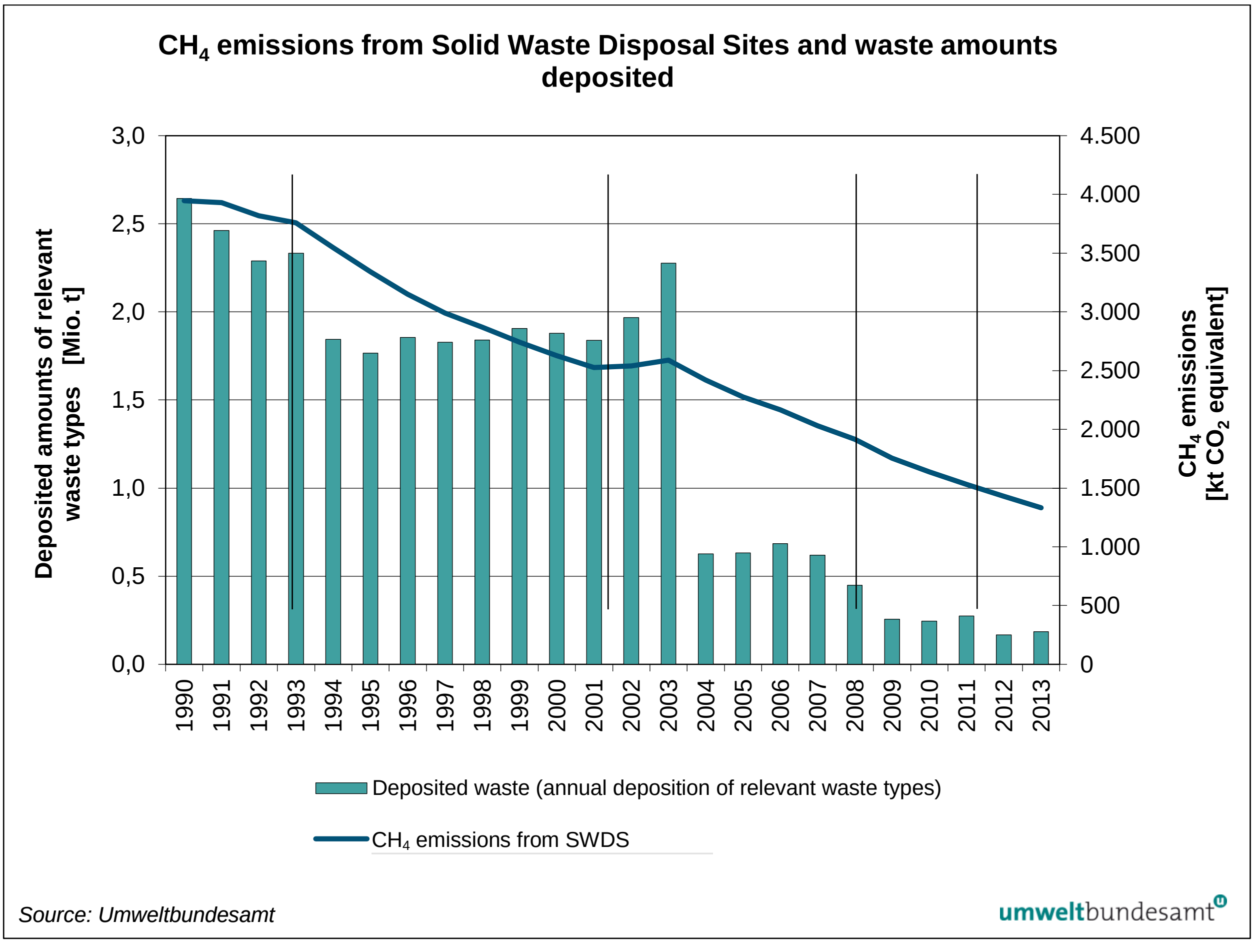

Figure 38: Methane emissions from landfills and annually deposited waste with relevant organic carbon content

4.11.1 WEM measures for waste

In the waste sector only two measures are relevant for the WEM scenario.

4.11.1.1 PaM N°23: Reduce emissions from waste treatment

The dominant sector within CRF 5 Waste causing GHG emissions is Solid Waste Disposal, and the most important and effective instrument is the implementation of the Austrian Landfill Ordinance.[14] According to this Ordinance, no untreated biodegradable waste has been allowed to be deposited on landfills since 2004, with no exemptions permitted since 2008, and landfill gas has to be recovered. Methane emissions from landfills are thus expected to decrease continuously, due to reduced amounts and a reduced carbon content of waste being deposited.

Currently waste incineration and the mechanical-biological treatment of waste are (pre-)treatment options which play an important role in reducing the carbon content of deposited solid waste. However, the importance of mechanical-biological treatment is expected to decrease in the future. Emission limits and technical requirements as specified in the Reference Document on Best Available Techniques ("BREF-Document") will probably lead to further plant closures and/or restructuring.

GHG affected: CH_4, N_2O

Type of policy: regulatory, negotiated agreement

Implementing entity: federal provinces, district authorities

Mitigation impact: see details below

The instruments listed below have been taken into account in the current scenario.

Landfill Ordinance (*Deponieverordnung)*

Type: EU policy, national policy

EU legislation	National Implementation	Start
Landfill Directive 1999/31/EC	Federal Law Gazette No. 164/1996, Federal Law Gazette II No. 39/2008	1997/NA

The implementation of the Landfill Directive is still ongoing and in the coming years, it will focus on (1) managing the water balance and the aerobic in-situ stabilisation of closed landfills and (2) increasing efforts to collect landfill gas (e.g. through detection of leakages, examination of gas collection systems) (Landfill Ordinance 2008).

[14] 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 waste.

Quantification/Projected GHG emissions/removals:

The Landfill Ordinance is still the most effective instrument for reducing emissions in the waste sector, affecting future amounts of deposited waste in the WEM scenario. Emissions are expected to decrease from 1 333 kt CO_2 equivalents in 2013 to 402 kt CO_2 equivalents in 2035.

Further provisions as stipulated in the Landfill Ordinance 2008 (water balance management, in-situ stabilisation) and an improvements in the practical implementation of the Ordinance could enhance the reduction effect. For a quantification of this instrument, however, several assumptions need to be made, leading to a high level of uncertainty. A survey of gas collection systems conducted in 2014 showed that the measures described can lead to higher amounts of landfill gas collected at least at some landfills. However, no future trend for gas collection rates can be derived from that study.

Emission reduction from mechanical biological treatment plants *(Emissionsreduktion aus MBA)*

Type: EU policy

The mechanical biological treatment (MBT) of biodegradable wastes prior to landfilling reduces the gas formation potential. The Reference Document on Best Available Techniques (in short: "BREF document") of the European Commission for the Waste Treatment Industries contains emission limits and technical specifications, which are going to be revised in an upcoming version in 2015. The Document is relevant for 7 out of 13 Austrian MBT plants (as of December 2013). The importance of the BREF document will increase in any case as the recommendations on best available technology will be mandatory requirements for treatment plants and a central element in the procedure for granting operating licences. The requirements set out in the BREF will impact on the cost effectiveness of the MB treatment plants.

Besides the BREF, MB treatment has become and is expected to become even more diverse, especially with respect to the biological treatment step, which is sometimes only used for biological drying as pre-treatment for combustion. Sometimes MB treatment consists of mechanical treatment only.

The BREF and the developments in MB-treatment technology (with different aims for the pre-treatment) will lead to a smaller amount of MB-treated waste and, in consequence, to fewer residues from this type of treatment that are disposed of in landfills (thus affecting emissions from Biological Treatment and Solid Waste Disposal as well).

Quantification/Projected GHG emissions/removals:

A quantification of projected GHG emissions is associated with a high level of uncertainty. The future requirements for MB-treatment plants, as stipulated in the BREF document, are still pending. Further, the development of MB-treatment plants (biological drying, mechanical treatment only, etc.) is uncertain. Nevertheless, an estimation of the expected effect of mechanical-biological treatment plants on the stock of plants and activities (waste input amounts) has been taken into account in the WEM scenario (in the Solid Waste Disposal and Biological

Treatment of Solid Waste sectors), as closures and reconstructions can be expected as the technical requirements set out in the BREF document will become mandatory in a few years' time.

4.11.2 WAM measures for waste

4.11.2.1 PaM N°24: Enhanced reduction of emissions from waste treatment

Advanced waste water treatment plants, i.e. plants with a nitrification treatment step only, or with both nitrification and denitrification, are a significant source of N_2O emissions. Higher removal rates of N loads from waste water, however, can reduce emissions. N removal and, therefore, N_2O emissions can easily be influenced by the way the plants are operated (aeration, Chemical Oxidation Demand available, favourable denitrification conditions, etc.).

N removal reduces the risk of eutrophication of surface waters and is compulsory in Austria for municipal waste water treatment plants. The waste water emission ordinance for municipal wastewater treatment plants with an organic design capacity larger than 5 000 population equivalents prescribes a minimum reduction rate of 70% of total nitrogen. Most Austrian waste water treatment plants meet or exceed this target. Higher N removal rates are technically relatively easy to achieve – by adaptating emission control techniques – and should be promoted by additional measures.

GHG affected: N_2O

Type of policy: regulatory

Implementing entity: federal government

Mitigation impact: 35 kt CO_2 equ. in 2030

The instrument listed below has been taken into account in the current scenario.

Emission reductions from waste water treatment plants
(Emissionsreduktion bei Kläranlagen)

Type: national policy

Currently, the average N removal rate in most Austrian waste water treatment plants (WWTP) is 80%. There are still, however, several plants in Austria where the N removal rate is below that level. A higher removal rate due to improved modes of operation at plants could lead to less N_2O emissions. A higher N removal rate could for example be achieved by more ambitious removal targets or economic incentives for plant operators.

Quantification/Projected GHG emissions/removals:

For the purpose of quantification it has been assumed that all plants with an N removal rate lower than 80% in 2013 will increase their N removal rate to at least 80%. In the WAM scenario it is assumed that this will be achieved by 2030. A N removal rate of 80% is 10% higher than the current legal requirement (Austrian Wastewater Emission Ordinance No 210/1996).

Based on 2013 emissions, this measure would lead to a decrease in emissions from plants by 2030 by at least 35 kt CO_2 equivalents.

Considering additionally the increase in the population over this period, the emissions from waste water treatment plants are assumed to decrease by 2030 by only 23 kt CO_2 equivalents (WAM scenario for wastewater treatment plants). Without these additional N reduction efforts, emissions from the Austrian wastewater treatment plants are expected to increase by 10 kt CO_2 equivalents until 2030 (WEM scenario for wastewater treatment plants).

5 SCENARIO DEFINITION

5.1 Definition of the scenarios and summary of relevant policies & measures

Both scenarios – the "with existing measures" (WEM) and the "with additional measures" (WAM) – contain a combination of all measures described. The effects of the measures are presented in Annex 1.

The scenario "with existing measures" includes measures implemented before 1 May 2014. The scenario definition table lists all the measures described above.

The scenario "with additional measures" additionally takes into account policies and measures which are planned and have a realistic chance of being adopted and implemented in time to influence emissions. One exception is the implementation of the Energy Efficiency Directive: It was implemented in Austria by adopting the Federal Energy Efficiency Act – „Bundes-Energieeffizienzgesetz" (Federal Law Gazette I No 74/2014) in July 2014, which was too late for it to be considered in the WEM scenario. Therefore measures related to energy efficiency are included in the WAM scenario, although its status has changed in the meantime from planned to adopted.

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.

Austrian policies and measures are in general intended to reduce emissions not only for a defined commitment period but also in the long-term, so that they have a lasting effect on GHG emissions. Thus most policies and measures should contribute to achieving the targets of a low-carbon strategy.

The following tables present an overview of policies and measures for both scenarios. Details are provided in the reporting table according to Art. 22 of Implementing Regulation (EU) No 749/2014 which has been submitted together with this report.

5.2 Scenario "with existing measures"

Table 23: PAMs included in the scenario "with existing measures" and their main contents

CRF	Policies & Measures
Cross-cutting	No. 1. EU Emission Trading Scheme (ETS)
	No. 2. Domestic Environmental Support Scheme
	No. 3 Austrian Climate and Energy Fund (KLI.EN)
1.A.1 Energy industries	No. 4. Increase the share of renewable energy in energy supply and district heating
and	• Green Electricity Act 2012 and Feed-In tariff ordinance
1.A.2 Manufacturing Industries and Construction	No. 5. Increase energy efficiency in energy and manufacturing industries
	• Implementation of the National Energy Efficiency Action Plan 2011
	• Promotion of combined heat and power (CHP)

CRF	Policies & Measures
1.A.3 Transport	No. 8. Increase share of clean energy sources in road transport • Implementation Plan for electric mobility • Implementation of the Directive 2009/28/EC on the promotion of the use of energy from renewable sources No. 9. Increase fuel efficiency in road transport • Fuel tax increase in 2011 („Klimabeitrag“) • Greening the truck toll (Directive 2006/38/EC) • Mobility management and awareness raising • Air quality induced speed limits No. 10. Modal shift to environmentally friendly transport modes • Mobility management and awareness: klimaaktiv mobil initiative • Promotion of corporate rail connections for freight transport
1.A.4 & 1.A.5 Other Sectors (Residential, Commercial, Agriculture and Other)	No. 14. Increased energy efficiency in buildings • OIB guidelines 6 – Energy savings and thermal insulation • Building renovation initiative for private buildings to improve the energy performance • Building renovation initiative for commercial and industrial buildings to improve the energy performance • Recast of the Energy Performance of Buildings Directive No. 15. Increased share of renewable energy for space heating • Stepping up the replacement of heating systems • District heating and district cooling Act • Funding for wood heating systems and solar heating systems No. 16. Increased energy efficiency in residential electricity demand • Ecodesign requirements for energy using products • End-use efficiency and energy services • Energy labelling of household appliances
1.B Fugitive Emissions from fuels	No policies and measures.
2 Industrial Processes and solvent use	No. 18. Decrease emissions from F-gases and other product use • Prohibition and restriction of the use of (partly) fluorinated hydrocarbons and SF6 • Implementation of the EU F-gas regulation • Reducing HFC emissions from air conditioning in motor vehicles • Solvent Ordinance to reduce VOC emissions from paints and varnishes • Limitation of VOC emissions by use of organic solvents in industrial installations
3 Agriculture	No. 20. Implementation of EU agricultural policies • Programme for rural development 2007–2013 • Common agricultural policy
4 LULUCF	Currently, there are no specific LULUCF measures defined. This sector is currently under revision.
5 Waste	No. 23. Reduce emissions from waste treatment • Landfill Ordinance • Emission reduction from mechanical biological treatment plants

5.3 Scenario "with additional measures"

Table 24: PAMs included in the scenario "with additional measures" and their main contents.

CRF	Measures
1.A.1 Energy Industries and 1.A.2 Manufacturing Industries and Construction	No. 6. Further enhancement of renewable energy in energy supply • Green Electricity Act – beyond 2020 No. 7. Further enhancement of energy efficiency in energy and manufacturing industries • Energy Efficiency Act
1.A.3 Transport	No. 11. Further enhancement of clean energy sources for transport • Promotion of alternative and biofuels • Promoting electric vehicles No. 12. Further enhancement of fuel efficiency of road transport • Fuel tax increase in 2016 and 2019 • Implementation of Energy Efficiency Directive (2012/27/EC) • Implementation of the Road Infrastructure Charging Directive (2011/76/EC) No. 13. Further modal shift to environmentally friendly transport modes • Promoting mobility management including a Bicycle Masterplan & a Pedestrian Master Plan • Incentives for increased use of public transport • Implementation of National Action Plan Danube Navigation (NAP)
1.A.4 & 1.A.5 Other Sectors (Residential, Commercial, Agriculture and Other)	No. 17. Further enhancement of energy efficiency of buildings • Adaptation of existing funding programmes • Effect of Energy Efficiency Directive (2012/27/EU) • National plan for non-residential buildings
1.B Fugitive Emissions	There are no additional sector-specific measures
2 Industrial Processes and product use	No. 19. Further minimisation of F-gas emissions • Quota system for production and import of F-gases
3 Agriculture	No. 21. Emission reduction through livestock und feeding management • Increase the lactations performance of dairy cows and increase of efficiency of other livestock • Feeding measures for cattle and pigs • Promotion of grazing No. 22. Sustainable N management • Anaerobic fermentation of animal manure • Sustainable N management • Organic farming
4 LULUCF	There are no additional measures foreseen.
5 Waste	No. 24. Enhanced reduction of emissions from waste treatment • Emission reduction from waste water treatment plants

6 CHANGES WITH RESPECT TO THE SUBMISSION OF 2013

Changes with respect to the last GHG emission projections of 2013 (UMWELTBUNDESAMT 2013) are presented in this chapter. In general, there are four main factors influencing these changes:

1. The switch to the new IPCC Guidelines 2006 for the GHG inventory which implied methodical changes and the use of new GWPs for CH_4, N_2O and F-Gases according to Decision 4/CMP.7 (based on 4th Assessment Report of IPCC) also led to partly considerable sectoral recalculations of the emission projections, as the methods have to be applied consistently for the calculation of past trends and scenarios emissions.
2. Assumptions for activity scenarios have changed. These changes can be triggered by revised economic or technical scenarios, additional policies and measures considered, and revisions of policies or measures due to amendments to legal texts.
3. Changes of the models used for activity or emission scenarios.
4. A change in the implementation of additional polices and measures.

The following table shows a comparison of the past trends and scenarios for national emission totals.

Table 25: Comparison of projections 2011, 2013 and 2015 – national Totals (in kt CO_2e).

Total – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2011	78 171	92 916	85 237	86 096	87 333	89 098	90 847
Projections 2013	78 162	92 880	84 594	82 444	81 640	82 764	84 039
Projections 2015	78.683	92.496	84.788	79.737	79.067	76.779	75.957
Difference 2015/13	521	–384	194	–2.707	–2.573	–5.984	–8.082
Total – WAM							
Projections 2011	78 171	92 916	84 594	80 447	78 911	76 552	77 395
Projections 2013	78 162	92 880	84 594	80 105	77 506	77 622	78 068
Projections 2015	78.683	92.496	84.788	79.066	73.293	68.998	66.619
Difference 2015/13	521	–384	194	–1.040	–4.214	–8.623	–11.450

The following tables present the changes of past trends and scenario emissions by sector.

6.1.1 Energy Industries (1.A.1)

Table 26: Comparison of projections 2011, 2013 and 2015 – Energy Industries (in kt CO_2e).

1.A.1 – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2011	13 842	16 184	12 605	10 671	10 910	12 005	12 842
Projections 2013	13 842	16 359	14 293	12 301	11 416	12 155	12 815
Projections 2015	13 842	16 364	14 150	10 362	9 896	8 635	8 348
Difference 2015/13	0	5	–143	–1 939	–1 520	–3 520	–4 467
1.A.1 – WAM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2011	13 842	16 184	11 998	10 072	9 439	10 026	11 233
Projections 2013	13 842	16 359	14 293	12 238	11 137	11 367	11 826
Projections 2015	13 842	16 364	14 150	10 415	9 631	8 177	8 360
Difference 2015/13	0	5	–143	–1 823	–1 506	–3 190	–3 466

Revisions up to 2010 are mainly due to updates of the national energy balance The energy balance with data up to 2012 was used. Revisions thereafter are due to a revised growth in industrial electricity consumption, to recent developments on European electricity markets leading to a reduced profitability of gas and coal power plants and to a drastic change in the profitability of photovoltaic installations in the last couple of years.

6.1.2 Manufacturing Industries and Construction (1.A.2) & Industrial Processes (2)

Table 27: Comparison of projections 2011, 2013 and 2015 – Manufacturing Industries and Construction & Industrial Processes (in kt CO_2e).

1.A.2 & 2 – WEM	**1990**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Projections 2011	23 395	27 156	27 436	29 910	32 040	34 189	36 536
Projections 2013	23 394	27 536	26 626	26 214	27 284	28 747	30 426
Projections 2015	23 475	27 458	27 386	26 966	27 786	28 284	29 072
Difference 2015/13	81	– 78	760	751	503	– 462	– 1 354
1.A.2 & 2– WAM							
Projections 2011	23 395	27 156	27 423	29 474	31 068	32 841	34 880
Projections 2013	23 394	27 536	26 626	25 914	26 619	27 743	28 991
Projections 2015	23 475	27 458	27 386	26 645	27 223	27 198	27 233
Difference 2015/13	81	– 78	760	731	604	– 545	– 1 758

1A2 & 2 Processes

For the projections in 2015 the new energy balance has been used for the calculations. Hence, the energy demand and thus the emissions are different in the current projections.

The differences in the process emissions are mainly due to different energy data and corresponding assumptions for production.

For the WAM scenario the new version of the national Energy Efficiency Law has been taken into account. This law entered into force late in 2014 and was significantly different from the draft used for the 2013 projections.

2 F-gases

The differences in F-gas emissions are due to updates of chapter 2.F of the National Inventory on Greenhouse Gases (see UMWELTBUNDESAMT 2015a for further explanations), and an improvement of the calculation model, as well as new GWPs. The difference between WAM 2013 and 2015 results from the implementation of the EU F-Gas Regulation, which was not available at the time of the last submission.

2 D Solvents

For the sector 2 D the implementation of the current inventory until 2013 has led to a minor update of the trend until 2035. The difference with respect to the last submission is approximately 20 kt CO_2 equivalents in 2030.

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

Table 28: Comparison of projections 2011, 2013 and 2015 – Transport (in kt CO_2e).

1.A.3 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2011	14 010	24 981	23 308	24 850	24 872	24 684	24 513
Projections 2013	14 030	25 040	22 452	23 695	23 800	23 931	23 965
Projections 2015	13 974	24 939	22 379	23 169	23 267	23 261	23 042
Difference 2015/13	– 56	– 101	– 72	– 526	– 534	– 670	– 923
1.A.3 – WAM							
Projections 2011	14 010	24 981	23 316	20 684	19 927	16 976	16 101
Projections 2013	14 030	25 040	22 452	21 914	21 111	21 244	21 247
Projections 2015	13 974	24 939	22 379	22 837	18 831	17 905	16 597
Difference 2015/13	– 56	– 101	– 72	924	– 2 281	– 3 340	– 4 650

It can be seen that the GHG emissions for both scenarios (WEM and WAM) of the 2015 submission are lower compared to the 2013 submission, for several reasons:

- The implementation of the new emission calculation model (NEMO) resulted in a more precise estimation of fuel consumption. This model change showed that the last WEM scenario which was calculated with the GLOBEMI model was overestimated. Combined with a whole updated set of emission factors taken from HBEFA V3.2 the current scenarios are lower than before.
- Emission levels for the whole past time series have been revised downwards which has an emission reducing effect on the whole future trend.
- Fuel prices in Austria and its neighbouring countries, as well as assumptions concerning their development, have been adapted with the consumer price index.
- In WAM 2015 emission levels are higher, because the actual 2013 data has been implemented which shows a strongly increasing fuel consumption in transport. This brings about an upward change in the further trend.
- The WAM scenario in the 2015 submission is very optimistic. New measures were implemented in the WAM scenario, particularly the implementation of the Energy Efficiency Directive (2012/27/EU), with the aim to decrease energy consumption in transport by 16 PJ in 2020 and by 32 PJ in 2030 and GHG emissions in the following.

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

Table 29: Comparison of projections 2011, 2013 and 2015 – Other Energy Sectors (in kt CO_2e).

1.A.4 & 1.A.5 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2011	14 468	14 435	12 089	11 173	10 244	9 161	8 067
Projections 2013	14 441	13 748	11 448	10 648	9 710	8 678	7 705
Projections 2015	14.507	13.742	11.506	10.292	9.305	7.966	7.095
Difference 2015/13	66	–5	57	–356	–405	–712	–610
1.A.4 & 1.A.5 – WAM							
Projections 2011	14 468	14 435	12 059	10 742	9 257	7 676	6 297
Projections 2013	14 441	13 748	11 448	10 582	9 480	8 277	7 134
Projections 2015	14.507	13.742	11.506	10.242	8.877	7.204	6.191
Difference 2015/13	66	–5	57	–341	–603	–1.073	–943

The difference to the last projections (2013) from around 2015 is due to emerging trends in activity data (energy consumption) for the recent inventory data years, in particular fossil fuel use, which form the basis for the projections (and the model calibration).

With regards to WAM scenario, the implementation of the Federal Energy Efficiency Law (Federal Law Gazette I No. 72/2014) according to policy '09_B: Effect of Energy Efficiency Directive (2012/27/EU)' results an upper estimate of the possible emission reduction potential which surpasses the measures assumed for the WAM scenario 2013.

6.1.5 Fugitive Emissions from Fuels (1.B)

Table 30: Comparison of projections 2011, 2013 and 2015 – Fugitive emissions (in kt CO_2e).

1.B – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2011	312	440	448	444	431	409	388
Projections 2013	311	441	516	539	570	582	594
Projections 2015	702	482	521	560	574	589	604
Difference 2015/13	391	41	5	21	4	7	9

The differences can be seen in the historical and in the scenario data; more substantial changes since the 2011 projections are due to methodological improvements to the inventory, especially with regard to the use of country specific emission factors. The difference of the 2015 projections with respect to 2013 is mainly due to the change in GWPs for CH_4 and the different base years (2013 vs. 2010) used for the emission calculations. The activity data taken from different energy projections only have a minor influence on the total 1.B. emissions.

6.1.6 Agriculture (3)

Table 31: Comparison of projections 2011, 2013 and 2015 – Agriculture (in kt CO_2e).

3 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2011	8 558	7 399	7 534	7 625	7 693	7 687	7 663
Projections 2013	8 558	7 412	7 453	7 654	7 733	7 711	7 687
Projections 2015	7 959	6 878	6 852	6 874	7 044	7 052	7 063
Difference 2015/13	– 599	– 534	– 600	– 780	– 689	– 658	– 624
3 – WAM							
Projections 2011	8 558	7 399	7 534	7 608	7 645	7 661	7 659
Projections 2013	8 558	7 412	7 453	7 526	7 461	7 447	7 430
Projections 2015	7 959	6 878	6 852	6 852	6 965	6 950	6 935
Difference 2015/13	– 599	– 534	– 600	– 674	– 496	– 497	– 495

The differences can be seen in the historical and in the scenario data; they are due to:

- Methodological improvements to the inventory due to a revision of the Austrian inventory model for the Agriculture sector according to the 2006 IPCC GL. Both the new global warming potentials (GWPs) and the new emission factors have led to lower sectoral emissions overall in the entire time series.
- Revised activity data scenarios as a result of the implementation of new PASMA model results (WIFO & BOKU 2015). In contrast to the data used in the previous projections (SINABELL et al. 2011a), the results obtained from the new model indicate that milk production will expand more than expected in the 2013 submission. The number of cows is expected to be significantly larger. This result is driven by better prospects for milk production in the coming years. Furthermore, according to the recent outlook, pork production will increase while poultry production will decline. The difference can be explained by different price assumptions. Austrian poultry and egg production has to cope with considerably higher costs than producers in other countries.

6.1.7 LULUCF (CRF Source Category 4)

Table 32: Comparison of GHG projections 2011, 2013 and 2015 – LULUCF (in kt CO_2e).

4 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2011	– 13 139	– 17 332	– 4 773	– 3 493	– 1 823	– 1 823	– 1 823
Projections 2013	– 10 023	– 7 395	– 3 611	3 533	5 031	5 031	5 031
Projections 2015	– 9 878	– 7 626	– 3 894	3 508	5 005	5 005	5 005
Difference 2015/13	145	– 231	– 283	– 26	– 26	– 26	– 26

The revisions with respect to the projections 2013 are due to:

The following recalculations of historical emissions/removals were carried out for other subcategories in sector 4.

More recent land use change areas (changes to and from forests) and the emissions/removals of these subcategories were updated on the basis of the ARD assessment 2011/13.

For area consistency reasons this has also led to an update of land use changes and emissions/removals in some other subcategories.

The conversion rates between annual and perennial cropland and grassland of the last few years were updated on the basis of the most recent data from the national inventory IACS. Furthermore, mistakes in the upscaling factors of the cropland vs. grassland conversion rates (subsample ➔ country-wide data) were identified and corrected for the 2014 submission (compared to previous submissions).

Therefore, with respect to the 2011 report on projections, the time series for these sector 4 subcategories (where historical values are reported for future years) has also been changed.

6.1.8 Waste (CRF Source Category 5)

Table 33: Comparison of projections 2011, 2013 and 2015 – Waste (in kt CO_2e).

6 – WEM	1990	2005	2010	2015	2020	2025	2030
Projections 2011	3 586	2 322	1 815	1 423	1 144	964	838
Projections 2013	3 587	2 345	1 806	1 392	1 128	961	847
Projections 2015	4 226	2 632	1 993	1 515	1 195	992	856
Difference 2015/13	638	287	187	123	67	31	9
6 – WAM							
Projections 2011	3 586	2 322	1 815	1 423	1 144	964	838
Projections 2013	3 587	2 345	1 806	1 392	1 128	961	847
Projections 2015	4 226	2 632	1 993	1 514	1 192	975	823
Difference 2015/13	638	287	187	122	64	15	– 23

Revisions (CO_2 equivalents) in the Waste sector are mainly due to the new GWP, especially the higher GWP of CH_4, and are thus mainly affected by 5.A Solid Waste Disposal as the dominant sub-category. Furthermore, some methodological improvements have been carried out:

In 5.A Solid Waste Disposal new data on landfill gas recovery became available since the last projection in 2013, leading to revised (slightly higher) CH_4 emissions 2008–2011. Moreover, for the current projection a decreasing share of recovered methane has been assumed; in the previous projection this share was kept constant at the 2008 level. In 5.B Biological Treatment of Solid Waste revisions are due to slightly revised (historical) activity data and updated assumptions made for projected mechanical-biologically treated waste amounts in view of the expected update of the BREF document for waste treatment industries.

The largest methodological changes were made in 5.D Waste Water Treatment and Discharge. Methodological refinements to better comply with the IPCC 2006 GL as well as the use of country-specific data (nitrogen flows, EF) have resulted in considerably lower N_2O emissions over the whole time series. Emissions from centralised wastewater treatment plants have been estimated using a country-specific approach and applying a country-specific EF based on measurements at Austrian wastewater treatment plants (BMLFUW 2015). Based on the findings of this measuring programme, an estimate of the reduction potential was made, which is included in the WAM scenario. To a minor extent, also updates of the connection rates (treatment plants, cesspools) have contributed to revisions of the emissions (N_2O, CH_4).

7 ABBREVIATIONS

AEA .... Austrian Energy Agency

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

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

BMUJF .... Bundesministerium für Umwelt, Jugend und Familie
Federal Ministry for Environment, Youth and Family
(before 2000, Environment now included with: BMLFUW)

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

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

BMWFW .... Bundesministerium für Wissenschaft, Forschung und Wirtschaft (formerly called BMWFJ)

CHP.................... Combined Heat and Power

CRF .... Common Reporting Format

EEG.................... Energy Economics Group

EU .... European Union

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

GWP................... Global Warming Potential

IPCC................... Intergovernmental Panel on Climate Change

LEAP .... Long-range Energy Alternatives Planning System

LTO .... Landing/Take-Off cycle

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

NFI...................... National Forest Inventory

NIR .... National Inventory Report

Mt .... Megatonne

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

PAM.................... Policies and Measures

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

QMS .... Quality Management System

SNAP .... Selected Nomenclature on Air Pollutants
SVO .... Straight Vegetable Oil
Tg....................... Teragramme
UFI .... Umweltförderung im Inland (domestic environmental support scheme)
UNFCCC............ United Nations Framework Convention on Climate Change
WAM .... scenario “with additional measures”
WEM .... scenario “with existing measures”
WIFO.................. Österreichisches Wirtschaftsforschungsinstitut (Austrian Institute of Economic Research)

Greenhouse gases

CH_4..................... methane
CO_2 .... carbon dioxide
N_2O .... nitrous oxide
HFC.................... hydrofluorocarbons
PFC.................... perfluorocarbons
SF_6 .... sulphur hexafluoride
NF_3..................... nitrogen trifluoride

Notation Keys

According to UNFCCC guidelines on reporting and review (FCCC/CP/2002/8)

“NO“ (not occurring)	for activities or processes in a particular source or sink category that do not occur within a country;
“NE“ (not estimated)	for existing emissions by sources and removals by sinks of greenhouse gases which have not been estimated. Where “NE” is used in an inventory for emissions or removals of CO_2, CH_4, N_2O, HFCs, PFCs, or SF_6, the Party should indicate in both the NIR and the CRF completeness table why emissions or removals have not been estimated
“NA“ (not applicable)	for activities in a given source/sink category that do not result in emissions or removals of a specific gas. If categories in the CRF for which “NA” is applicable are shaded, they do not need to be filled in
“IE“ (included elsewhere)	for emissions by sources and removals by sinks of greenhouse gases estimated but included elsewhere in the inventory instead of the expected source/sink category. Where “IE” is used in an inventory, the Annex I Party should indicate, using the CRF completeness table, where in the inventory the emissions or removals from the displaced source/sink category have been included and the Annex I Party should explain such a deviation from the expected category
“C“ (confidential)	for emissions by sources and removals by sinks of greenhouse gases which could lead to the disclosure of confidential information, given the provisions of paragraph 27 as mentioned above

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ANNEX 1: INFORMATION EXTRACTED FROM THE REPORTING TEMPLATE

Emission Projections – scenario “with existing measures“

Table 34: CO_2 emissions in 2013 and projections 2015–2035, scenario “with existing measures”.

CO_2 [kt]	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Total excluding LULUCF	**67.768**	**67.940**	**67.252**	**65.534**	**65.156**	**64.870**
Total including LULUCF	**66.353**	**71.424**	**72.233**	**70.515**	**70.137**	**69.851**
1. Energy	**53.917**	**53.771**	**52.767**	**50.684**	**49.921**	**49.749**
A. Fuel Combustion	53.666	53.512	52.501	50.411	49.641	49.469
1. Energy Industries	11.205	10.246	9.771	8.515	8.230	9.254
a. Public Electricity and Heat production	8.092	7.000	6.512	5.243	4.945	5.958
b. Petroleum Refining	2.827	2.776	2.776	2.776	2.776	2.776
c. Manufacture of Solid Fuels and Other Energy Industries	286	470	483	495	508	521
2. Manufacturing Industries and Construction	11.002	10.406	10.743	11.230	11.828	11.775
3. Transport	22.603	22.959	23.041	23.018	22.780	22.315
a. Domestic Aviation	55	60	69	79	89	96
b. Road Transportation	21.815	22.317	22.435	22.404	22.171	21.718
c. Railways	114	117	121	125	129	126
d. Domestic Navigation	12	12	12	11	11	11
e. Other Transportation	607	453	404	399	380	363
4. Other Sectors	8.807	9.849	8.886	7.581	6.727	6.042
a. Commercial/Institutional	1.016	2.531	2.225	1.801	1.539	1.292
b. Residential	6.977	6.485	5.810	4.915	4.309	3.846
c. Agriculture/Forestry/Fisheries	814	833	851	865	879	904
5. Other	48	52	60	68	76	82
B. Fugitive Emissions from Fuels	251	259	266	273	279	279
1. Solid Fuels	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	251	259	266	273	279	279
2. Industrial Processes	13.741	14.061	14.380	14.752	15.142	15.032
A. Mineral Products	2.720	2.782	2.883	3.040	3.237	3.114
B. Chemical Industry	599	647	647	647	647	646
C. Metal Production	10.223	10.427	10.645	10.863	11.065	11.089
D. Non-energy products from fuels and solvent use	176	179	170	161	152	143
E. Electronics industry	NO	0	0	0	0	0
F. Product uses as substitutes for ODS	NO	0	0	0	0	0
G. Other product manufacture and use	23	27	36	40	41	40
3. Agriculture	**108**	**106**	**103**	**97**	**91**	**87**
4. Land Use, Land-Use Change and Forestry	**–1.415**	**3.483**	**4.981**	**4.981**	**4.981**	**4.981**
5. Waste	**2**	**2**	**2**	**2**	**2**	**2**
C. Incineration and open burning of waste	2	2	2	2	2	2

Table 35: CH_4 emissions in 2013 and projections 2015–2035, scenario "with existing measures".

CH_4 [kt]	2013	2015	2020	2025	2030	2035
Total excluding LULUCF	261.21	255.65	247.55	240.54	236.82	239.77
Total including LULUCF	261.22	255.66	247.56	240.55	236.83	239.78
1. Energy	22.40	21.73	21.35	20.50	20.17	19.94
A. Fuel Combustion Activities	11.18	9.72	9.02	7.86	7.21	6.82
1. Energy Industries	0.50	0.57	0.62	0.63	0.62	0.60
2. Manufacturing Industries and Construction	0.56	0.54	0.54	0.55	0.57	0.57
3. Transport	0.46	0.17	0.14	0.13	0.12	0.11
4. Other Sectors	9.66	8.44	7.72	6.55	5.89	5.54
5. Other	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	11.22	12.02	12.33	12.65	12.97	13.12
2. Industrial Processes	**1.96**	**1.89**	**1.89**	**1.89**	**1.89**	**1.89**
B. Chemical Industry	1.96	1.89	1.89	1.89	1.89	1.89
3. Agriculture	**180.02**	**182.06**	**187.23**	**189.38**	**191.58**	**198.29**
A. Enteric Fermentation	164.13	165.46	168.79	170.17	171.55	177.15
1. Cattle	154.43	155.73	158.96	160.51	162.06	167.62
2. Sheep	2.86	2.79	2.63	2.33	2.03	2.02
3. Swine	4.34	4.48	4.80	5.10	5.39	5.45
4. Other	2.49	2.47	2.40	2.23	2.06	2.05
B. Manure Management	15.87	16.60	18.41	19.21	20.01	21.11
1. CH_4 Emissions	15.87	16.60	18.41	19.21	20.01	21.11
1. Cattle	11.81	12.43	13.97	14.58	15.20	16.27
2. Sheep	0.07	0.07	0.06	0.06	0.05	0.05
3. Swine	3.46	3.58	3.87	4.12	4.37	4.42
4. Other	0.53	0.52	0.50	0.45	0.39	0.37
5. Waste	**56.82**	**49.97**	**37.08**	**28.77**	**23.18**	**19.66**
A. Solid Waste Disposal	53.31	46.48	33.64	25.28	19.65	16.08
B. Biological Treatment of Solid Waste	2.50	2.51	2.50	2.53	2.56	2.59
C. Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste Water Treatment and Discharge	1.01	0.99	0.94	0.96	0.98	0.99

Table 36: N_2O emissions in 2013 and projections 2015–2035, scenario "with existing measures".

N_2O [kt]	**2013**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Total excluding LULUCF	**10.95**	**10.97**	**11.15**	**11.05**	**10.99**	**10.89**	**10.95**
Total including LULUCF	**11.03**	**11.06**	**11.23**	**11.13**	**11.07**	**10.97**	**11.03**
1. Energy	**2.07**	**2.03**	**2.05**	**2.06**	**2.12**	**2.12**	**2.07**
A. Fuel Combustion Activities	2.07	2.03	2.05	2.06	2.12	2.12	2.07
1. Energy Industries	0.34	0.34	0.37	0.35	0.35	0.31	0.34
2. Manufacturing Industries and Construction	0.44	0.40	0.38	0.39	0.42	0.42	0.44
3. Transport	0.65	0.69	0.74	0.81	0.87	0.93	0.65
4. Other Sectors	0.64	0.60	0.55	0.51	0.48	0.46	0.64
5. Other	0.00	0.00	0.00	0.00	0.00	0.01	0.00
2. Industrial Processes	**0.62**	**0.62**	**0.63**	**0.63**	**0.63**	**0.63**	**0.62**
B. Chemical Industry	0.16	0.16	0.16	0.17	0.17	0.17	0.16
G. Other Product Manufacture and Use	0.46	0.46	0.46	0.46	0.46	0.46	0.46
3. Agriculture	**7.38**	**7.44**	**7.58**	**7.45**	**7.32**	**7.21**	**7.38**
B. Manure Management	1.49	1.50	1.50	1.49	1.49	1.52	1.49
2. N_2O Emissions	1.49	1.50	1.50	1.49	1.49	1.52	1.49
1. Cattle	0.89	0.87	0.84	0.84	0.83	0.85	0.89
2. Sheep	0.02	0.02	0.02	0.01	0.01	0.01	0.02
3. Swine	0.13	0.14	0.15	0.16	0.17	0.17	0.13
4. Other	0.09	0.09	0.08	0.07	0.07	0.06	0.09
5. Indirect N_2O Emissions	0.37	0.38	0.41	0.41	0.42	0.42	0.37
D. Agricultural Soils	5.88	5.94	6.09	5.96	5.83	5.69	5.88
1. Direct N_2O Emissions from Managed Soils	4.87	4.91	5.01	4.90	4.79	4.66	4.87
2. Indirect N2O emissions from Managed Soils	1.01	1.03	1.08	1.06	1.05	1.04	1.01
5. Waste	**0.88**	**0.88**	**0.89**	**0.91**	**0.92**	**0.93**	**0.88**
B. Biological Treatment of Solid Waste	0.34	0.34	0.34	0.34	0.35	0.35	0.34
C. Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste Water Treatment and Discharge	0.54	0.54	0.55	0.56	0.57	0.58	0.54

Table 37: HFC, PFC and SF_6 emissions in 2013 and projections 2015–2035, scenario "with existing measures".

HFC [kt CO_2e]	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Total	**1 674**	**1 782**	**1 804**	**1 659**	**1 484**	**1 446**
2. Industrial Processes	**1 674**	**1 782**	**1 804**	**1 659**	**1 484**	**1 446**
E. Electronics Industry	2	2	2	2	2	2
F. Consumption of Halocarbons and SF_6	1 672	1 779	1 802	1 656	1 482	1 444
PFC [kt CO_2e]						
Total	**49**	**49**	**49**	**49**	**49**	**49**
2. Industrial Processes	**49**	**49**	**49**	**49**	**49**	**49**
E. Electronics Industry	49	49	49	49	49	49
SF_6 [kt CO_2e]						
Total	**304**	**294**	**439**	**220**	**63**	**63**
2. Industrial Processes	**304**	**294**	**439**	**220**	**63**	**63**
E. Electronics Industry	29	29	29	29	29	29
G. Other Product Manufacture and Use	266	262	410	191	34	34
NF_3 [kt CO_2e]						
Total	**10**	**10**	**10**	**10**	**10**	**10**
2. Industrial Processes	**10**	**10**	**10**	**10**	**10**	**10**
E. Electronics Industry	10	10	10	10	10	10

Emission Projections – scenario "with additional measures"

Table 38: CO_2 emissions in 2013 and projections 2015–2030, scenario "with additional measures".

CO_2 [kt]	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Total excluding LULUCF	**67.768**	**67.315**	**61.602**	**58.203**	**56.783**	**56.078**
Total including LULUCF	**66.353**	**70.798**	**66.583**	**63.184**	**61.764**	**61.059**
1. Energy	**53.917**	**53.259**	**47.336**	**43.657**	**41.914**	**41.344**
A. Fuel Combustion	53.666	53.000	47.071	43.385	41.635	41.064
1. Energy Industries	11.205	10.300	9.505	8.051	8.242	9.297
a. Public Electricity and Heat production	8.092	7.053	6.246	4.780	4.958	6.000
b. Petroleum Refining	2.827	2.776	2.776	2.776	2.776	2.776
c. Manufacture of Solid Fuels and Other Energy Industries	286	470	483	495	508	521
2. Manufacturing Industries and Construction	11.002	10.222	10.406	10.729	11.086	11.001
3. Transport	22.603	22.626	18.626	17.689	16.372	15.443
a. Domestic Aviation	55	60	69	79	89	96
b. Road Transportation	21.815	21.984	18.020	17.075	15.763	14.847
c. Railways	114	117	121	124	128	125
d. Domestic Navigation	12	12	12	12	12	12
e. Other Transportation	607	453	404	399	380	363
4. Other Sectors	8.807	9.800	8.474	6.848	5.859	5.242
a. Commercial/Institutional	1.016	2.524	2.133	1.616	1.325	1.108
b. Residential	6.977	6.445	5.503	4.382	3.673	3.250
c. Agriculture/Forestry/Fisheries	814	831	839	849	860	883
5. Other	48	52	60	68	76	82
B. Fugitive Emissions from Fuels	251	259	266	273	279	279
1. Solid Fuels	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	251	259	266	273	279	279
2. Industrial Processes	13.741	13.950	14.171	14.460	14.793	14.660
A. Mineral Products	2.720	2.769	2.861	3.010	3.194	3.074
B. Chemical Industry	599	645	643	640	638	635
C. Metal Production	10.223	10.330	10.464	10.612	10.773	10.773
D. Non-energy products from fuels and solvent use	176	179	170	161	152	143
E. Electronics industry	NO	0	0	0	0	0
F. Product uses as substitutes for ODS	NO	0	0	0	0	0
G. Other product manufacture and use	23	27	32	36	37	35
3. Agriculture	**108**	**104**	**93**	**83**	**74**	**72**
4. Land Use, Land-Use Change and Forestry	**–1.415**	**3.483**	**4.981**	**4.981**	**4.981**	**4.981**
5. Waste	**2**	**2**	**2**	**2**	**2**	**2**
C. Incineration and open burning of waste	2	2	2	2	2	2

Table 39: CH_4 emissions in 2013 and projections 2015–2030, scenario “with additional measures”.

CH_4 [kt]	2013	2015	2020	2025	2030	2035
Total excluding LULUCF	**261.21**	**255.44**	**246.42**	**238.94**	**234.86**	**236.63**
Total including LULUCF	**261.22**	**255.44**	**246.43**	**238.95**	**234.87**	**236.64**
1. Energy	**22.40**	**21.70**	**20.96**	**19.78**	**19.29**	**19.08**
A. Fuel Combustion Activities	11.18	9.68	8.63	7.13	6.32	5.96
1. Energy Industries	0.50	0.57	0.62	0.64	0.62	0.62
2. Manufacturing Industries and Construction	0.56	0.53	0.52	0.53	0.54	0.54
3. Transport	0.46	0.16	0.13	0.12	0.11	0.10
4. Other Sectors	9.66	8.42	7.35	5.85	5.06	4.71
5. Other	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	11.22	12.02	12.33	12.65	12.97	13.12
2. Industrial Processes	**1.96**	**1.89**	**1.89**	**1.89**	**1.89**	**1.89**
B. Chemical Industry	1.96	1.89	1.89	1.89	1.89	1.89
3. Agriculture	**180.02**	**181.87**	**186.49**	**188.50**	**190.51**	**196.00**
A. Enteric Fermentation	164.13	165.52	169.02	170.80	172.59	177.81
1. Cattle	154.43	155.79	159.17	161.09	163.01	168.18
2. Sheep	2.86	2.79	2.63	2.33	2.04	2.04
3. Swine	4.34	4.48	4.82	5.16	5.49	5.56
4. Other	2.49	2.46	2.40	2.22	2.04	2.03
B. Manure Management	15.87	16.32	17.46	17.68	17.90	18.17
1. CH_4 Emissions	15.87	16.32	17.46	17.68	17.90	18.17
1. Cattle	11.81	12.17	13.08	13.15	13.23	13.54
2. Sheep	0.07	0.07	0.06	0.06	0.05	0.05
3. Swine	3.46	3.57	3.83	4.04	4.26	4.25
4. Other	0.53	0.52	0.49	0.42	0.36	0.33
5. Waste	**56.82**	**49.97**	**37.08**	**28.77**	**23.18**	**19.66**
A. Solid Waste Disposal	53.31	46.48	33.64	25.28	19.65	16.08
B. Biological Treatment of Solid Waste	2.50	2.51	2.50	2.53	2.56	2.59
C. Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste Water Treatment and Discharge	1.01	0.99	0.94	0.96	0.98	0.99

Table 40: N_2O emissions in 2013 and projections 2015–2030, scenario "with additional measures".

N_2O [kt]	2013	2010	2015	2020	2025	2030	2035
Total excluding LULUCF	**10.95**	**10.92**	**10.87**	**10.64**	**10.39**	**10.10**	**10.95**
Total including LULUCF	**11.03**	**11.00**	**10.95**	**10.72**	**10.47**	**10.19**	**11.03**
1. Energy	**2.07**	**2.02**	**1.94**	**1.93**	**1.90**	**1.91**	**2.07**
A. Fuel Combustion Activities	2.07	2.02	1.94	1.93	1.90	1.91	2.07
1. Energy Industries	0.34	0.34	0.37	0.37	0.34	0.33	0.34
2. Manufacturing Industries and Construction	0.44	0.39	0.36	0.37	0.38	0.38	0.44
3. Transport	0.65	0.70	0.68	0.71	0.75	0.78	0.65
4. Other Sectors	0.64	0.60	0.53	0.47	0.43	0.41	0.64
5. Other	0.00	0.00	0.00	0.00	0.00	0.01	0.00
2. Industrial Processes	**0.62**	**0.62**	**0.63**	**0.63**	**0.63**	**0.63**	**0.62**
B. Chemical Industry	0.16	0.16	0.16	0.17	0.17	0.17	0.16
G. Other Product Manufacture and Use	0.46	0.46	0.46	0.46	0.46	0.46	0.46
3. Agriculture	**7.38**	**7.39**	**7.42**	**7.23**	**7.04**	**6.75**	**7.38**
B. Manure Management	1.49	1.45	1.35	1.33	1.30	1.25	1.49
2. N_2O Emissions	1.49	1.45	1.35	1.33	1.30	1.25	1.49
1. Cattle	0.89	0.86	0.78	0.77	0.75	0.70	0.89
2. Sheep	0.02	0.02	0.02	0.02	0.01	0.01	0.02
3. Swine	0.13	0.11	0.06	0.07	0.07	0.07	0.13
4. Other	0.09	0.08	0.08	0.07	0.06	0.06	0.09
5. Indirect N_2O Emissions	0.37	0.38	0.41	0.40	0.40	0.40	0.37
D. Agricultural Soils	5.88	5.93	6.06	5.90	5.74	5.50	5.88
1. Direct N_2O Emissions from Managed Soils	4.87	4.91	5.01	4.88	4.74	4.53	4.87
2. Indirect N2O emissions from Managed Soils	1.01	1.02	1.05	1.02	1.00	0.97	1.01
5. Waste	**0.88**	**0.88**	**0.88**	**0.85**	**0.81**	**0.82**	**0.88**
B. Biological Treatment of Solid Waste	0.34	0.34	0.34	0.34	0.35	0.35	0.34
C. Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste Water Treatment and Discharge	0.54	0.54	0.54	0.51	0.46	0.47	0.54

Table 41: HFC, PFC and SF_6 emissions in 2013 and projections 2015–2035, scenario "with additional measures".

HFC [kt CO_2e]	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
Total	**1 674**	**1 759**	**1 792**	**1 373**	**747**	**677**
2. Industrial Processes	**1 674**	**1 759**	**1 792**	**1 373**	**747**	**677**
E. Electronics Industry	2	2	2	2	2	0
F. Consumption of Halocarbons and SF_6	1 672	1 757	1 791	1 371	745	677
PFC [kt CO_2e]						
Total	**49**	**49**	**49**	**49**	**49**	**49**
2. Industrial Processes	**49**	**49**	**49**	**49**	**49**	**49**
E. Electronics Industry	49	49	49	49	49	49
SF_6 [kt CO_2e]						
Total	**304**	**294**	**439**	**220**	**63**	**63**
2. Industrial Processes	**304**	**294**	**439**	**220**	**63**	**63**
E. Electronics Industry	29	29	29	29	29	29
G. Other Product Manufacture and Use	266	262	410	191	34	34
NF_3 [kt CO_2e]						
Total	**10**	**10**	**10**	**10**	**10**	**10**
2. Industrial Processes	**10**	**10**	**10**	**10**	**10**	**10**
E. Electronics Industry	10	10	10	10	10	10

List of parameters for projections

(according to Annex XII (Table 3) of the Commission Implementing Regulation (EU) No 749/2014)

Table 42: General parameters for projections – scenarios "with existing measures" and "with additional measures".

		2010	2015	2020	2025	2035	2035
Population	1 000	8 382	8 555	8 733	8 889	9 034	9 162
Gross domestic product (GDP): Real growth rate	%	1.5	1.5	1.5	1.5	1.5	1.3
Gross domestic product (GDP): Constant prices	constant EUR million (2010 = t-10)	285 165	305 947	329 592	355 064	382 505	408 023
Gross value added (GVA) total industry	constant EUR million (2010 = t-10)	59 661	64 009	68 956	74 285	80 026	85 365
Exchange rates US DOLLAR, if applicable	USD/ currency	1.3	1.3	1.3	1.3	1.3	1.3
EU ETS carbon price	EUR/EUA	13	15	20	25	30	57
International (wholesale) fuel import prices: Electricity Coal	EUR/GJ	4	4	4	4	4	5
International (wholesale) fuel import prices: Crude Oil	EUR/GJ	14	19	21	22	23	24
International (wholesale) fuel import prices: Natural gas	EUR/GJ	7	9	10	11	12	12
Number of heating degree days (HDD)	Count	3 252	3 228	3 204	3 161	3 118	3 065
Number of cooling degree days (CDD)	Count	153	153	153	157	162	170
National retail fuel prices (with taxes included)							
Coal, industry	EUR/GJ	6.4	6.7	7.0	7.3	7.4	8.8
Coal, households	EUR/GJ	10.2	10.0	11.0	11.8	12.6	12.8
Heating oil, industry	EUR/GJ	16.8	17.7	19.7	21.2	22.4	22.9
Heating oil, households	EUR/GJ	20.8	25.0	26.5	27.6	28.4	28.8
Transport, gasoline	EUR/GJ	43.0	46.0	46.3	46.4	46.2	45.5
Transport, diesel	EUR/GJ	36.3	39.4	39.9	40.2	40.3	39.8
Natural gas, industry	EUR/GJ	6.4	7.2	7.7	8.1	8.5	8.9
Natural gas, households	EUR/GJ	18.9	20.6	21.2	21.6	21.8	22.2
National retail electricity prices (with taxes included)							
Industry	EUR/kWh	0.14	0.14	0.16	0.17	0.18	0.19
Households	EUR/kWh	0.19	0.20	0.20	0.20	0.21	0.21
Buildings parameters							
Number of households	1 000	3 638	3 818	3 957	4 069	4 166	4 245
Household size	inhabitants/househol d	2.30	2.24	2.21	2.18	2.17	2.16
Waste parameters							
Municipal solid waste (MSW) going to landfills	tonne MSW	185 156	173 006	137 887	137 887	137 887	137 887
Share of CH_4 recovery in total CH_4 generation from landfills	%	9	8	6	5	3	9

Table 43: Parameters for projections – Energy sector: inland consumption, electricity generation and final energy consumption, scenario "with existing measures".

	2010	2015	2020	2025	2030	2035
Gross inland (primary energy) consumption [PJ]	**1 445**	**1 429**	**1 480**	**1 498**	**1 520**	**1 528**
Coal	141	126	122	106	108	107
Oil	549	542	544	541	542	535
Natural gas	344	313	312	320	318	331
Renewables	394	418	469	497	516	518
Nuclear	NO	NO	NO	NO	NO	NO
Other	28	29	32	34	36	36
Gross electricity production [TWh]	**67.9**	**64.1**	**71.7**	**73.8**	**76.5**	**83.4**
Coal	6.7	4.8	4.3	2.5	2.5	2.5
Oil	1.3	0.0	0.0	0.0	0.0	0.0
Natural gas	14.4	8.3	8.1	8.4	7.9	10.8
Renewables	45.0	49.9	58.2	61.8	64.9	68.9
Nuclear	NO	NO	NO	NO	NO	NO
Other	0.6	1.0	1.1	1.1	1.1	1.1
Total net electricity imports	2.3	6.6	0.3	3.8	9.4	9.1
Final energy consumption [PJ]	**1 135**	**1 131**	**1 149**	**1 177**	**1 213**	**1 216**
Gross final energy consumption	1 204	1 195	1 215	1 247	1 285	1 289
Industry	329	323	342	373	411	423
Transport	367	410	417	426	434	437
Residential	287	254	248	240	232	225
Agriculture/Forestry	24	13	14	14	14	15
Services	128	130	129	125	121	118
Other	NO	NO	NO	NO	NO	NO

Table 44: Parameters for projections – Energy sector: inland consumption, electricity generation and final energy consumption, scenario "with additional measures".

	2010	2015	2020	2025	2030	2035
Gross inland (primary energy) consumption [PJ]	**1 457**	**1 422**	**1 389**	**1 387**	**1 386**	**1 392**
Coal	141	125	120	103	104	103
Oil	549	543	477	458	442	428
Natural gas	344	307	298	297	297	311
Renewables	394	417	462	496	508	515
Nuclear	NO	NO	NO	NO	NO	NO
Other	28	29	32	33	34	34
Gross electricity production [TWh]	**67.9**	**64.4**	**72.2**	**76.9**	**82.2**	**89.3**
Coal	6.7	4.7	4.2	2.4	2.4	2.4
Oil	1.3	0.0	0.0	0.0	0.0	0.0
Natural gas	14.4	8.5	8.1	8.2	8.0	11.1
Renewables	45.0	49.9	58.5	65.0	70.4	74.4
Nuclear	NO	NO	NO	NO	NO	NO
Other	0.6	1.2	1.3	1.3	1.3	1.3
Total net electricity imports	2.3	5.5	-2.5	-2.6	-1.0	-1.5
Final energy consumption [PJ]	**1 135**	**1 120**	**1 050**	**1 045**	**1 043**	**1 040**
Gross final energy consumption	1 204	1 184	1 116	1 113	1 113	1 111
Industry	329	315	328	353	381	392
Transport	367	411	351	346	338	333
Residential	287	252	236	219	205	198
Agriculture/Forestry	24	13	13	13	12	13
Services	128	129	122	114	107	104
Other	NO	NO	NO	NO	NO	NO

Table 45: Parameters for projections – transport, scenario "with existing measures" and "with additional measures".

		2010	2015	2020	2025	2030	2035
Assumptions for the Transport sector – "with existing measures"							
Number of passenger-kilometres (all modes)	million pkm	113 883	114 087	118 771	124 379	129 700	135 616
Freight transport tonnes-kilometres (all modes)	million tkm	147 348	172 298	181 111	201 712	227 069	251 189
Final energy demand for road transport	TJ	308 718	326 714	326 987	328 510	328 583	326 170
Assumptions for the Transport sector – "with additional measures"							
Number of passenger-kilometres (all modes)	million pkm	113 883	114 001	109 102	114 595	119 946	126 414
Freight transport tonnes-kilometres (all modes)	million tkm	147 348	172 207	145 857	158 895	171 006	181 930
Final energy demand for road transport	TJ	308 718	326 114	260 909	249 105	233 324	223 587

Table 46: Parameters for projections – agriculture and waste, scenario "with existing measures".

		2013	2015	2020	2025	2030	2035
Assumptions in the agriculture sector – "with existing measures"							
Livestock: Dairy cattle	1000 heads	530	530	531	547	562	587
Livestock: Non-dairy cattle	1000 heads	1 429	1 426	1 418	1 345	1 274	1 301
Livestock: Sheep	1000 heads	357	349	329	289	254	253
Livestock Pig	1000 heads	2 896	2 984	3 203	3 422	3 596	3 635
Livestock: Poultry	1000 heads	14 644	14 299	13 436	11 336	9 408	8 726
Nitrogen input from application of synthetic fertilizers	kt nitrogen	105	105	106	98	90	78
Nitrogen input from application of manure	kt nitrogen	131	132	134	136	138	142
Nitrogen fixed by N-fixing crops	kt nitrogen	IE	IE	IE	IE	IE	IE
Nitrogen in crop residues returned to soils	kt nitrogen	51	52	55	55	54	54
Area of cultivated organic soils	ha	NO	NO	NO	NO	NO	NO
Assumptions in the agriculture sector – "with addtional measures"							
Livestock: Dairy cattle	1000 heads	530	530	532	548	563	587
Livestock: Non-dairy cattle	1000 heads	1 429	1 426	1 420	1 352	1 285	1 311
Livestock: Sheep	1000 heads	357	349	329	290	255	254
Livestock: Pig	1000 heads	2 896	2 986	3 212	3 460	3 662	3 701
Livestock: Poultry	1000 heads	14 644	14 287	13 395	11 134	9 052	8 443
Nitrogen input from application of synthetic fertilizers	kt nitrogen	105	105	106	96	86	70
Nitrogen input from application of manure	kt nitrogen	131	131	133	135	138	141
Nitrogen fixed by N-fixing crops	kt nitrogen	IE	IE	IE	IE	IE	IE
Nitrogen in crop residues returned to soils	kt nitrogen	51	52	55	55	54	54
Area of cultivated organic soils	ha	NO	NO	NO	NO	NO	NO
Assumptions in the waste sector – "with existing measures" & "with additional measures"							
Municipal solid waste (MSW) generation	tonne MSW	NE	NE	NE	NE	NE	NE
Municipal solid waste (MSW) going to landfills	tonne MSW	185 156	173 006	137 887	137 887	137 887	137 887
Share of CH_4 recovery in total CH_4 generation from landfills	%	10	9	8	6	5	3

Policies and Measures

The following three tables are an excerpt of the information required according to Annex XI of the Implementing Regulation 749/2014. The complete table is available as an excel file which has been submitted in conjunction with this report.

Table 47: Policies & Measures I

N°	Name of policy or measure	Sector(s) affected	GHG(s) affected	Type of instrument	Scenario	Reponsible Entity
1	EU Emission Trading Scheme (ETS)	CC, EnS, EnC	CO_2	Reg, Ec	WEM	Ngov, Co
2	Domestic Environmental Support Scheme	CC, EnS, EnC, Tra	CO_2, CH_4, N_2O	Ec	WEM	Ngov
3	Austrian Climate and Energy Fund (KLI.EN)	CC, Tra, EnC	CO_2	Ec, Res	WEM	Ngov
4	Increase the share of renewable energy in power supply and district heating	EnS	CO_2	Ec, Reg	WEM	Ngov
5	Increase energy efficiency in energy and manufacturing industries	EnS, EnC, Tra, IP	CO_2	Pl, Ec, Reg	WEM	Ngov, Reg, Loc, Co
6	Further enhancement of renewable energy in energy supply	EnS	CO_2	Ec, Reg	WAM	Ngov
7	Further enhancement of energy efficiency in energy and manufacturing industries	EnC, EnS, IP	CO_2	Reg	WAM	Ngov, Co
8	Increase share of clean energy sources in road transport	Tra, EnS, EnC	CO_2	Reg, Fi, Ec, Pl, Res	WEM	Ngov, Reg, Loc, Co
9	Increase fuel efficiency in road transport	Tra, EnC	CO_2	Fi, Edu, Inf, Vol, Ec, Reg	WEM	Ngov, Reg, Loc, Co
10	Modal shift to environmentally friendly transport modes	Tra	CO_2	Inf, Ec	WEM	Reg, Loc, Co
11	Further enhancement of clean energy sources for transport	Tra, EnS, EnC	CO_2	Reg, Pl, Fi, Ec, Res	WAM	Reg, Loc, Co
12	Further enhancement of fuel efficiency in road transport	Tra, EnC	CO_2	Fi, Reg, Ec	WAM	Ngov, Reg
13	Further modal shift to environmentally friendly transport modes	Tra	CO_2	Inf, Ec, Edu, Vo, Pl	WAM	Ngov, Reg, Loc, Co
14	Increased energy efficiency of buildings	EnC	CO_2	Reg, Ec, Inf, Vo	WEM	Ngov, Reg
15	Increased share of renewable energy for space heating	EnC, EnS	CO_2	Ec, Reg	WEM	Ngov, Reg
16	Increased energy efficiency in residential electricity demand	EnC	CO_2	Reg, Inf	WEM	Ngov, Reg, Co
17	Further enhancement of energy efficiency of buildings	EnC	CO_2		WAM	Ngov, Reg
18	Decrease emissions from F-gases and other product use	IP	HFC, PFC, SF_6, NF_3, CO_2	Reg, Ec, Inf, Res, Vo	WEM	Ngov
19	Further minimisation of F-gas emissions	IP	HFC, PFC, SF_6, NF_3	Reg	WAM	Ngov
20	Implementation of EU agricultural policies	Ag	CH_4, N_2O, CO_2	Reg, Ec	WEM	Ngov, Reg
21	Emission reduction through livestock und feeding management	Ag	CH_4, N_2O, CO_2	Inf, Ec, Vo, Edu	WAM	Co, Ngov, Res
22	Sustainable N management	Ag	N_2O, CH_4, , CO_2	Inf, Vo, Ec,Edu	WAM	Ngov, Reg, Co
23	Reduce emissions from waste treatment	Wa	CH_4, N_2O	Reg	WEM	Ngov, Reg
24	Enhanced reduction of emissions from waste treatment	Wa	N_2O	Reg	WAM	Ngov, Co

CC = cross-cutting, EnS = Energy Supply, EnC = Energy Consumption, Tra = Transport, IP = Industrial processes and solvent use, Ag = Agriculture, Wa = waste management

WEM = with existing measures, WAM = with additional measures

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

Ngov = National government (responsible ministries / departments), Reg = Regional entities, Loc = Local government, Co = Companies / businesses / industrial associations, Res = Research institutions

Table 48: Policies & Measures II

N°	Name of policy or measure	Objective	Short Description
1	EU Emission Trading Scheme (ETS)	framework policy multi-sectoral policy	The objective is to limit the CO_2 emissions of energy intensive stationary installations and aviation through a trading mechanism for emission certificates.
2	Domestic Environmental Support Scheme	framework policy multi-sectoral policy	Financial support to GHG mitigation projects (energy efficiency, renewables, waste,…)
3	Austrian Climate and Energy Fund (KLI.EN)	framework policy multi-sectoral policy	Financial support to energy-relevant research projects, to climate friendly transport projects and to market launch of new climate friendly technologies.
4	Increase the share of renewable energy in energy supply and district heating	increase in renewable energy	Granting fixed feed-in tariffs for various forms of electricity generation from renewable sources, e.g. biomass, wind power, small hydropower, geothermal energy and photovoltaics
5	Increase energy efficiency and use of renewables in energy industries	efficiency improvement in the energy and transformation sectorswitch to less carbon-intensive fuels	Includes measures to stabilise the final energy consumption at 2005 levels by 2020 and the promotion of cogeneration of heat and power, whereby the subsidies for the latter measure are expired.
6	Further enhancement of renewable energy in energy supply	increase in renewable energy	Supporting green electricity also beyond 2020, especially wind power, biomass and photovoltaic installations
7	Further enhancement of energy efficiency in energy and manufacturuing industries	efficiency improvement in the energy and transformation sector	The Energy Efficiency Act includes among others: • Mandatory external energy audits • Energy suppliers are supposed to deliver yearly savings by themselves or end users amounting to 0.6% of their yearly energy supply. • The federal republic has to fulfil a yearly renovation goal of 3% through re-furbishments or other energy savings. • Energy efficiency action plans including the monitoring of binding goals and measures.
8	Increase share of clean energy sources in road transport	low carbon fuels/electric cars	Promotion of the use of biofuels or other renewable fuels for transport by introducing fuel tax reduction for sustainable biofuels. Promotion of clean and at least partly electrified vehicles for private, public and commercial traffic, as well as the intelligent integration of innovative mobility offers and services
9	Increase fuel efficiency of road transport	demand management/reduction	Reduction of individual motorised transport and a shift towards public transport via fuel tax, charges of heavy goods on federal roads and highways, initiatives to promote fuel saving, immission control systems and consultation of stakeholders
10	Modal shift to environmentally friendly transport modes	demand management/reduction modal shift to public transport or non-motorized transport improved behaviour	This measure includes: • mobility management and awareness initiatives („klimaaktiv mobil"), funding programm for businessm communities and associations in order to develop and implement climate friendly mobility projects • Promotion of corporate rail connections for freight transport
11	Further enhancement of clean energy sources for transport	low carbon fuels/electric cars	Promotion of the use of biofuels or other renewable fuels for transport, which includes fuel tax reduction for sustainable bio fuels, and development and use of clean, and at least partly electrified vehicles for private, public and commercial traffic
12	Further enhancement of fuel efficiency of road transport	• demand management/reduction • efficiency improvements of vehicles • modal shift to public transport or non-motorized transport • low carbon fuels/electric cars • improved behaviour	Reduction of individual motorised transport and a shift towards public transport, increase of energy efficiency. Charging for external effects (e.g. noise, air pollution) together with tolls.

N°	Name of policy or measure	Objective	Short Description
13	Further modal shift to environmentally friendly transport modes	modal shift to public transport or non-motorized transport	This measure includes: • promoting bicycle use and walking (Masterplan Cycling and Masterplan Walking) • creating incentives to reduce existing barriers for using public transport (e.g. country-wide harmonisation of tariff systems) • improvements to freight transport on the Danube
14	Increased energy efficiency of buildings	efficiency improvements of buildings	This measure includes: • construction standards for new buildings • thermal insulation of existing buildings • specific national and funding programs (klimaaktiv, Housing Support Scheme, Domestic Environmental Suport Scheme) • introduction of energy certificates for buildings • implementation of construction guidelines
15	Increased share of renewable energy for space heating	• efficiency improvements of buildings	This measure includes; • Stepping up the replacement of heating systems (exchange of old inefficient boilers) • expansion of district heating in rural areas and construction of district cooling systems (District heating and district cooling Act) • Funding for wood heating systems and solar heating systems
16	Increased energy efficiency in residential electricity demand	• efficiency improvement of appliances • efficiency improvement in services/tertiary sector	This measure includes: • implementation of eco-design requirements for energy using products • reduction of energy consumption on private and public buildings according to Austrian national energy efficiency action plan • energy labelling of households appliances
17	Further enhancement of energy efficiency of buildings	• efficiency improvements of buildings • efficiency improvement in services/tertiary sector	This measures includes • implementation of the Energy Efficiency Directive • increased subsidies for thermal insulation of existing buildings • implementation of National Plan for non-residential buildings
18	Decrease emissions from F-gases and other product use	• reduction of emissions of fluorinated gases • installation of abatement technologies	This measure includes: • Prohibition and restriction of the use of (partly) fluorinated hydrocarbons and SF6 – restriction or banning of F-gas use in certain products • implementation of EU F-gas regulation • Reducing HFC emissions from air conditioning in motor vehicles • limiting emissions of volatile organic compounds due to the use of organic solvents that contain highly volatile halogenated hydrocarbons
19	Further minimisation of F-gas emissions	reduction of emissions of fluorinated gases	Prohibition on F-gases with high GWP, introduction of quota system in 2020 for placing F-gases on the market inside the EU
20	Implementation of EU agricultural policies	• reduction of fertilizer/manure use on cropland • other activities improving cropland management • improved livestock management • improved animal waste management systems • activities improving grazing land or grassland management	Reduction of environmental pollution from agricultural activity and support of regions in agricultural development, considering environmental aspects by implementing the Programme for rural development and the common agricultural policy, which includes measures such as Renunciation of yield-increasing inputs on arable lands and grasslands, Mulching of arable land and direct sewing, Low-loss application of liquid manure and biogas slurry, Promotion of organic farming, Promotion of grazing, Reduced usage of mineral fertilizers
21	Emission reduction through livestock und feeding management	• improved livestock management • activities improving grazing land or grassland management	This measure includes • increase number of lactations per cow, which results in lower number of heifers needed. • better breeding and herd management to increase yields of all livestock products • Feeding measures cattle and pig (increased protein and energy content in forage products through improved crops and better management, adaption of pig feeding to growth sections (results in lower N excretion) support of outdoor husbandry of cattle

N°	Name of policy or measure	Objective	Short Description
22	Sustainable N management	• reduction of fertilizer/manure use on cropland • other activities improving cropland management • improved livestock management • improved animal waste management systems • activities improving grazing land or grassland management	This measure includes: • efficiency increase in organic fertilizer use by customized storage for manure • establishment of manure exchanges • higher efficiency of mineral fertilizers through better management practices and spreading equipment • promotion of covering of slurry tanks, low ammonia application techniques, rapid incorporation, timely application, forced cultivation of legumes, etc. • organic farming
23	Reduce emissions from waste treatment	improved treatment technologies improved landfill management	Deposition of untreated biodegradable waste has been forbidden since 2004 (and without exemptions since 2009), hence the methane emissions from landfills decrease constantly. Landfill gas has to be collected and used or flared. In addition the BREF (Best available technique reference) document has been revised, this could lead to more severe emission limits. It will influence the cost-effectiveness of the plants and probably some of them will cease their activity. Besides the BREF the MBT design becomes more diverse (e.g. biological drying, mechanical treatment only).
24	Enhanced reduction of emissions from waste treatment	improved wastewater management systems	By changing the mode of operation of advanced waste water treatment plants N_2O emissions can be lowered (higher N removal rates cause lower N_2O emissions).

Table 49: Policies & Measures III

N°	Name of policy or measure	Implementation status	Relevant EU Policy
1	EU Emission Trading Scheme (ETS)	implemented	EU ETS Directive 2003/87/EC as amended by Directive 2008/101/EC and Directive 2009/29/EC and implementing legislation, in particular 2010/2/EU, 2011/278/EU and 2011/638/EU
2	Domestic Environmental Support Scheme	implemented	national policy
3	Austrian Climate and Energy Fund (KLI.EN)	implemented	national policy
4	Increase the share of renewable energy in energy supply and district heating	implemented	RES Directive 2009/28/EC
5	Increase energy efficiency and use of renewables in energy industries	implemented	Directive 2006/32/EC on end-use energy efficiency and energy services Cogeneration Directive 2004/8/EC
6	Further enhancement of renewable energy in energy supply	planned	RES Directive 2009/28/EC
7	Further enhancement of energy efficiency in energy and manufacturing industries	planned	Directive 2012/27/EU on energy efficiency
8	Increase share of clean energy sources in road transport	implemented	RES Directive 2009/28/EC
9	Increase fuel efficiency of road transport	implemented	Effort Sharing Decision 406/2009/EC, Eurovignette Directive on road infrastructure charging 2001/76/EU, Transport: Infrastructure charging for heavy goods (revised Eurovignette) 2006/38/EC
10	Modal shift to environmentally friendly transport modes	implemented	national policy
11	Further enhancement of clean energy sources for transport	planned	national policy
12	Further enhancement of fuel efficiency for road transport	planned	Effort Sharing Decision 406/2009/EC Efficiency Directive (2012/27/EC) Eurovignette Directive on road infrastructure charging 2001/76/EU Infrastructure charging for heavy goods (revised Eurovignette) 2006/38/EC
13	Further modal shift to environmentally friendly transport modes	planned	national policy

N°	Name of policy or measure	Implementation status	Relevant EU Policy
14	Increased energy efficiency of buildings	implemented	Recast of the Energy Performance of Buildings Directive (Directive 2010/31/EU) Directive 2006/32/EC on end-use energy efficiency and energy services
15	Increased share of renewable energy for space heating	implemented	national policy
16	Increased energy efficiency in residential electricity demand	implemented	Eco-design framework directive 2005/32/EC and ist implementing regulations, combined with Labelling Directive 2003/66/EC and 2010/30/EC, including implementing measures Directive 2006/32/EC on end-use energy efficiency and energy services
17	Further enhancement of energy efficiency of buildings	planned	Energy Efficiency Directive (2012/27/EU) Recast of the Energy Performance of Buildings Directive (Directive 2010/31/EU)
18	Decrease emissions from F-gases and other product use	implemented	• F-Gas Regulation 2006/842/EC • Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations amended by 2004/42/EC • HFCs in mobile air conditioning Directive 2006/40/EC
19	Further minimisation of F-gas emissions	planned	F-gas regulation (Regulation 517/2014)
20	Implementation of EU agricultural policies	implemented	Common Agricultural Policy (CAP) Reform 2006/144/EC
21	Emission reduction through livestock und feeding management	planned	national policy
22	Sustainable N management	planned	national policy
23	Reduce emissions from waste treatment	implemented	Landfill Directive 1999/31/EC, Non CCPM National Policy Waste Framework Directive (2008/98/EC) amending Directive on waste 2006/12/EE
24	Enhanced reduction of emissions from waste treatment	planned	national policy

ANNEX 2: ADDITIONAL KEY PARAMETERS FOR SECTORAL SCENARIOS

Energy Industries

Scenario "with existing measures"

Table 50: Projected fuel input into power and heat plants – scenario "with existing measures".

Energy [TJ]	2010	2015	2020	2025	2030	2035
Bituminous Coal and Anthracite	59 211	43 319	38 876	22 069	22 404	22 261
Residual Fuel Oil	17 213	8 140	8 140	8 140	8 140	8 143
Natural gas	114 892	83 504	81 004	87 306	82 551	101 300
Waste	13 690	16 670	18 152	18 152	18 152	18 152
Biomass	79 529	88 614	99 528	101 660	101 692	88 762
Hydropower	138 088	140 104	151 025	153 741	153 741	153 741
Wind power	7 430	16 501	22 559	23 534	26 531	31 491
Photovoltaics	320	5 335	17 366	30 021	40 392	51 348
Geothermal	741	1 340	2 010	2 010	2 010	2 010

Scenario "with additional measures"

Table 51: Projected fuel input into power and heat plants – scenario "with additional measures".

Energy [TJ]	2010	2015	2020	2025	2030	2035
Bituminous Coal and Anthracite	59 211	43 168	38 566	21 612	21 837	21 682
Residual Fuel Oil	17 213	10 350	8 140	8 140	8 140	8 143
Natural gas	114 892	81 296	76 114	78 795	82 594	101 880
Waste	13 690	16 670	18 152	18 152	18 152	18 152
Biomass	79 529	88 614	101 142	108 231	100 546	94 061
Hydropower	138 088	140 104	151 025	153 741	153 741	153 741
Wind power	7 430	16 501	22 559	30 134	38 935	42 253
Photovoltaics	320	5 335	17 366	30 021	40 392	51 348
Geothermal	741	1 340	2 050	2 100	2 150	2 150

Manufacturing Industries and Construction

Scenario "with existing measures"

Table 52: Final energy demand of industry – scenario "with existing measures".

Energy [TJ]	2010	2015	2020	2025	2030	2035
Coal without coke	6 474	6 429	6 709	7 110	7 584	7 381
Coke	8 014	8 540	8 965	9 265	9 418	9 405
Light Fuel Oil	3 216	3 028	3 371	3 787	4 270	4 264
Heavy Fuel Oil	7 726	6 644	6 206	5 903	5 674	5 670
Other petr. Products	18 025	16 801	17 738	19 270	21 219	21 161
Natural gas	105 707	110 859	114 862	120 999	128 859	127 934
Derived gas	4 780	4 559	4 586	4 618	4 692	4 707
Waste	13 769	12 737	14 032	15 624	17 511	17 728
Biomass	52 137	53 733	58 068	63 122	68 670	67 934
Electricity	97 319	100 382	107 924	123 869	143 492	157 047
Heat	10 497	12 166	13 230	14 532	16 039	16 310

Scenario "with additional measures"

Table 53: Final energy demand of industry – scenario "with additional measures".

Energy [TJ]	2010	2015	2020	2025	2030	2035
Coal without coke	6 474	6 193	6 291	6 484	6 650	6 435
Coke	8 014	8 396	8 724	8 933	8 968	8 946
Light Fuel Oil	3 216	2 957	3 239	3 578	3 938	3 895
Heavy Fuel Oil	7 726	6 515	6 007	5 643	5 336	5 313
Other Petr. Products	18 025	16 058	16 398	17 215	18 045	17 643
Natural gas	105 707	108 216	110 157	113 914	118 148	116 875
Derived gas	4 780	4 493	4 481	4 480	4 511	4 519
Waste	13 769	12 392	13 392	14 623	15 937	16 064
Biomass	52 137	52 116	55 155	58 735	62 116	61 248
Electricity	97 319	98 265	104 338	118 751	136 188	149 463
Heat	10 497	11 945	12 837	13 944	15 159	15 318

Transport

Scenario "with existing measures"

Table 54: Energy consumption of mobile sources by fuel – scenario "with existing measures".

Energy [TJ]	2010	2015	2020	2025	2030	2035
gasoline fossil	72 889	70 358	68 532	63 536	57 433	50 975
diesel fossil	224 455	263 488	268 460	274 357	278 457	280 003
bioethanol	2 833	1 028	928	833	739	729
biodiesel	14 205	20 540	19 475	19 778	19 914	19 623
vegetable oil	612	395	0	0	0	0
BIO ETBE	1 473	1 600	1 453	1 304	1 157	1 141
LPG	847	676	281	0	0	0
natural gas	276	125	186	243	293	288
biogas	1	0	0	0	0	0
H2	0	0	0	0	0	0
coal	6	5	4	4	3	3
electricity rail	6 473	7 166	7 769	8 372	9 030	9 732
electricity passenger cars	4	45	564	3 191	7 775	11 570
aviation jet fuel	29 544	33 781	38 857	44 105	49 828	53 135

Scenario "with additional measures"

Table 55: Energy consumption of mobile sources by fuel – scenario "with additional measures".

Energy [TJ]	2010	2015	2020	2025	2030	2035
gasoline fossil	72 889	69 626	58 171	50 443	41 196	34 694
diesel fossil	224 455	263 755	213 446	208 507	199 867	193 921
bioethanol	2 833	1 092	914	795	651	551
biodiesel	14 205	21 068	17 919	17 614	17 045	16 734
vegetable oil	612	634	626	617	609	625
BIO ETBE	1 473	1 688	1 410	1 223	999	841
LPG	847	581	186	0	0	0
natural gas	276	131	200	265	325	397
biogas	1	34	52	68	84	102
H2	0	0	1	1	11	112
coal	6	5	4	4	3	3
electricity rail	6 473	7 123	7 715	8 308	8 954	9 231
electricity passenger cars	19	86	734	3 524	7 742	12 120
aviation jet fuel	29 544	33 781	38 857	44 105	49 828	53 135

Residential, Commercial & Other Sectors

Table 56: Assumptions for energy prices –WEM & WAM scenarios

price, real [€/MWh]	2010	2015	2020	2025	2030	2035
natural gas	67.9	74.0	76.3	77.7	78.5	79.9
heating and other gas oil	75.0	90.1	95.4	99.4	102.3	103.7
coal	36.8	35.9	39.8	42.5	45.4	46.1
electricity	193.1	195.3	199.5	204.6	209.8	212.5
wood log and wood briquettes	35.6	36.4	37.5	38.8	40.2	40.6
wood chips	30.8	31.5	32.4	33.6	34.8	35.1
wood pellets	44.6	45.6	47.0	48.6	50.3	50.8
district heat	47.6	48.8	50.5	52.6	54.8	55.3

Table 57: Assumptions on subsidy rates – WEM & WAM scenarios*

subsidy rates [%]	2010	2015	2020	2025	2030	2035
wood log and wood briquettes	20	20	20	20	20	20
wood chips	20	20	20	20	20	20
wood pellets	23	23	23	23	23	23
distr. heat Vienna	15	15	15	15	15	15
distr. heat Other	15	15	15	15	15	15
distr. heat biomass	23	23	23	23	23	23
heat pump	5–15	5–15	5–15	5–15	5–15	5–15
solar heat	20–25	20–25	20–25	20–25	20–25	20–25

** Forced usage of condensing boiler in the WAM scenario for gas and gas oil fuels.*

Table 58: Assumptions for the number and size of buildings, and the number of permanently occupied dwellings –WEM & WAM.scenarios

Number of buildings		**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
residential buildings with one or two apartments	number	1 586	1 662	1 720	1 765	1 805	1 836
residential buildings with more than two apartments	number	183	193	200	206	211	215
commercial buildings	number	151	164	174	180	186	189
Size of buildings		**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
residential buildings with one or two apartments	million m² gross floor area	275	290	301	310	319	325
residential buildings with more than two apartments	million m² gross floor area	163	172	179	185	191	196
commercial buildings	million m³ gross floor volume	146	159	169	175	180	183
Number of dwellings		**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
residential buildings with one or two apartments	number in 1 000	1 830	1 917	1 984	2 037	2 082	2 118
residential buildings with more than two apartments	number in 1 000	1 808	1 901	1 973	2 032	2 084	2 128

Table 59: Heating demand, renovation rates and boiler exchange rates – scenario "with existing measures".

Heating demand (average)*		**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
residential buildings with one or two apartments	[kWh/m².a]	152	139	128	118	109	102
residential buildings with more than two apartments	[kWh/m².a]	122	114	108	102	96	90
commercial buildings	kWh/m².a	173	157	144	131	119	108
renovation rate	**[%]**						
residential buildings with one or two apartments		0.86	0.86	0.77	0.71	0.65	0.57
residential buildings with more than two apartments		0.72	0.72	0.68	0.75	0.77	0.76
commercial buildings		0.60	0.60	0.62	0.58	0.56	0.58
boiler exchange rate in residential buildings		1.19	1.19	3.32	4.47	2.86	1.99

** m² gross floor space*

Table 60: Heating demand, renovation rates and boiler exchange rates – scenario "with additional measures".

Heating demand (average)*		**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
residential buildings with one or two apartments	[kWh/m².a]	152	138	122	107	96	89
residential buildings with more than two apartments	[kWh/m².a]	122	114	102	92	83	79
commercial buildings	kWh/m².a	173	156	136	119	104	94
renovation rate	**[%]**						
residential buildings with one or two apartments		0.86	0.86	0.87	0.86	0.80	0.71
residential buildings with more than two apartments		0.72	0.72	0.76	0.91	0.97	0.95
commercial buildings		0.59	0.59	0.62	0.65	0.65	0.45
boiler exchange rate in residential buildings		1.08	1.08	3.44	4.71	2.68	2.00

** m² gross floor space*

Fugitive Emissions from Fuels

Table 61: Past trend and scenarios activities (2010–2030) for calculation of fugitive emissions.

price, real [€/MWh]	2010	2013	2015	2020	2025	2030	2035
Gas pipeline length [km]	6 798	7 177	7 130	7 385	7 640	7 896	8 151
Gas distribution network [km]	28 733	29 417	29 844	30 913	31 981	33 049	34 118
Natural gas production [million m³]	1 731	1 757	1 775	1 820	1 866	1 913	1 913
Refinery crude oil input [PJ]	336	358	358	358	358	358	358
Natural gas storage capacities [Mio m³]	3 070	5 747	5 700	5 700	5 700	5 700	5 700

Agriculture

Table 62: Livestock population cattle 2010 and scenarios 2015–2030.

	Population size [heads]			
Year	Dairy (WEM)	Non-Dairy (WEM)	Dairy (WAM)	Non-Dairy (WAM)
2010	532 735	1 480 546	532 735	1 480 546
2015	530 095	1 425 617	530 147	1 426 160
2020	531 432	1 417 856	531 613	1 419 754
2025	547 076	1 345 107	547 699	1 351 675
2030	562 453	1 273 909	563 491	1 284 878
2035	586 581	1 301 356	586 587	1 310 979

Table 63: Livestock population other animals 2010 and scenarios 2015–2030 – scenario “with existing measures”.

	Population size [heads]					
Year	Swine	Sheep	Goats	Poultry	Horses	Other
2010	3 134 156	358 415	71 768	14 644 413	81 637	47 575
2015	3 122 017	349 247	68 522	14 299 204	81 416	45 918
2020	3 203 294	328 764	64 598	13 436 181	81 195	44 261
2025	3 399 622	289 368	56 929	11 335 743	77 409	41 499
2030	3 595 950	254 069	49 261	9 407 910	73 623	38 736
2035	3 634 597	253 066	47 758	8 726 141	74 011	38 940

Table 64: Livestock population other animals 2010 and scenarios 2015–2030 – scenario “with additional measures”.

	Population size [heads]					
Year	Swine	Sheep	Goats	Poultry	Horses	Other
2010	3 134 156	358 415	71 768	14 644 413	81 637	47 575
2015	2 986 250	349 175	68 153	14 287 468	81 410	45 915
2020	3 212 272	328 513	64 539	13 395 106	81 183	44 255
2025	3 459 600	289 695	55 732	11 134 480	77 296	41 439
2030	3 661 724	255 010	46 924	9 052 327	73 408	38 623
2035	3 701 292	254 453	45 918	8 442 839	73 766	38 811

Table 65: Milk production 2010 and scenarios (2015–2030).

Ø milk yield per dairy cow (kg/yr)						
year	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
WEM	6 100	6 592	7 051	7 511	7 971	8 048
WAM	6 100	6 592	7 051	7 511	7 971	8 048

Table 66: Mineral fertiliser use 2010 and scenarios(2015–2030)

Mineral fertiliser use (t/year)						
	2010	**2015**	**2020**	**2025**	**2030**	**2035**
WEM	88 465	97 251	106 038	93 686	90 122	77 612
WAM	88 465	97 112	105 759	96 031	86 302	69 983

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This report presents information on projections, policies and measures according to reporting obligations as defined in Regulation 525/2013/EU. It includes greenhouse gas projections for the years up to 2035 and describes policies and measures to reduce emissions by source.
The results include two different scenarios: the scenario "with existing measures" takes into account climate change mitigation measures implemented under the Austrian Climate Strategies 2002 (amended 2007) before 1 May 2014. It shows a 0.5 percent increase in greenhouse gases from 1990 to 2020 and a 3.8 percent decrease from 1990 to 2035. The scenario "with additional measures" also includes planned policies and measures. Here a 6.9 percent decrease is projected for the period from 1990 to 2020 and a 16.4 percent decrease for the period up to 2035.

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