



OFFICE OF ENVIRONMENT  
PRINCIPALITY OF LIECHTENSTEIN

# ***Liechtenstein's Biennial Report 4***

January 2020



## **Imprint**

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## 1. Introduction

With the adoption of the Paris agreement in December 2015, Parties to the UNFCCC have agreed on a clear response towards climate change including a unified system for transparency. That transparency system has to be built on the existing framework for monitoring and reporting. The Government of Liechtenstein is pleased to present its Fourth Biennial Report (BR4). This reporting obligation has been introduced in 2010 at the 16. Conference of the Parties to the United Nations Framework Convention on Climate Change (COP) 2010 in Cancun, Mexico.

The Biennial Report complements the existing national reports "National Inventory Report" (GHG inventory) and "National Communication", especially by putting a focus on achieved progress with regard to pledged reduction targets of Annex I parties within a 2-year time frequency. Liechtenstein's fourth Biennial Report follows the UNFCCC biennial reporting guidelines for developed country Parties as agreed at COP 17 in 2011 in Durban, South Africa (FCCC/CP/2011/9/Add.1, Annex I). The report provides information on Liechtenstein's

- Greenhouse gas emission and trends,
- quantified economy-wide emission reduction target (QEWER),
- progress in achievement of quantified economy-wide emission reduction targets and relevant information,
- projections,
- provisions of financial, technological and capacity-building support to developing country Parties.

Liechtenstein's latest Biennial Report (BR3) was prepared as an Annex to Liechtenstein's Seventh National Communication (NC7). Due to the fact that both reports have to be submitted by January 1 and considering the overlap of some information to be reported according to the respective guidelines, Liechtenstein decided to refer in its BR3 to the respective section of its NC7 where such an overlap would occur.<sup>1</sup> This approach is adjusted for Liechtenstein's Fourth Biennial Report, which is submitted as an independent report.

Liechtenstein's Fourth Biennial Report has been prepared by:

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<sup>1</sup> Liechtenstein qualifies this approach as justified, since it corresponds to the UNFCCC Guidelines for the technical review of biennial reports from Parties included in Annex I to the Convention (Part IV), especially under paragraph 63 (d): "The individual review will (...) serve as part of the review of the NC, where there is an overlap between the content of the BR and that of the NC."

## 2. Information on GHG emissions and trends

### Summary from Liechtenstein's latest greenhouse gas inventory

Liechtenstein's greenhouse gas emissions in the year 2017 amount to 193.6 kt CO<sub>2</sub> equivalent (CO<sub>2</sub>eq) excluding LULUCF sources or sinks (including LULUCF: 204.2 kt CO<sub>2</sub>eq). This refers to 5.12 t CO<sub>2</sub>eq per capita. Total emissions (excl. LULUCF) have declined by 15.4% compared to 1990, but they have increased by 3.2% compared to 2016. The decrease 1990-2017 is less pronounced when including LULUCF (13.5%).

Over the period 1990-2017, the share of CO<sub>2</sub> (excl. LULUCF categories) fluctuated between 86.9% (1990) and 80.1% (2017) with minimum of 79.3% in 2016 and maximum 88.2% in 1993. The share of CH<sub>4</sub> increased from 8.3% in 1990 to 9.3% in 2017. Simultaneously, the share of N<sub>2</sub>O slightly increased from 4.8% (1990) to 5.0% (2017) and the share of F-gases clearly increased from 0.0% (1990) to 5.6% (2017).

Sector 1 Energy is the largest source of national emissions, contributing to 81.3% of the emissions (excluding LULUCF) in 2017. Emissions caused within the energy sector decreased by 21.7% over the period 1990-2017. The emissions from sector 2 Industrial processes and product use increased by a factor of about 17 due to a more frequent use of F-gases. Compared to total emissions, F-gas emissions still are of a minor importance. In sector 3 Agriculture, emissions are 8.0% below the level of 1990. Emissions and removals in the sector 4 LULUCF form a net source in 2017 and show an increase of 51.7% compared to 1990. The emissions from sector 5 Waste have decreased since 1990. They encompass only a small amount of emissions because municipal solid waste is exported to a Swiss incineration plant.

### National Inventory Arrangements

The Government of the Principality of Liechtenstein bears the overall responsibility for Liechtenstein's National Inventory System (NIS). By Liechtenstein's Emission Trading Act (Emissionshandelsgesetz, Government 2012), the Office of Environment (OE) is in charge of establishing emission inventories and is therefore also responsible for all aspects concerning the establishing of the National Inventory System (NIS) under the Kyoto Protocol. The responsibility of the OE for establishing the NIS is also described in the report of the Government to the parliament for ratifying the Kyoto Protocol. The Government mandated the realization of the NIS to its Office of Environment (OE). Please note that the Office of Environment was reorganized in 2013. The Office of Agriculture (OA), the Office of Forest, Nature and Land Management (OFNLM) and the Office of Environmental Protection (OEP) have been merged to the Office of Environment (OE). The former Office of Land Use Planning (SLP) was reorganized in 2013 and the Local Land Use Planning Bureau has been incorporated into the Office of Construction and Infrastructure (OCI).

## 2.1 Summary Tables

Summary tables of the national greenhouse gas inventory in the common reporting format are provided in Annex I.

## 2.2 Trends in greenhouse gas emissions and removals (1990-2017)

### 2.2.1 Aggregated greenhouse gas emissions 2017

Liechtenstein's greenhouse gas emissions in the year 2017 amount to 193.6 kt CO<sub>2</sub> equivalent (CO<sub>2</sub>eq) excluding LULUCF sources or sinks (including LULUCF: 204.2 kt CO<sub>2</sub>eq). This refers to 5.12 t CO<sub>2</sub>eq per capita. Total emissions (excl. LULUCF) have declined by 15.4% compared to 1990, but they have increased by 3.2% compared to 2016. This decrease is less pronounced when including LULUCF (13.5% for 1990-2017).

Among the different greenhouse gases, CO<sub>2</sub> accounts for the largest share of total emissions. Table 2-1 shows the emissions for individual gases and sectors in Liechtenstein for the year 2017. The most important emission sources are fuel combustion activities in the Energy sector. Emissions of CH<sub>4</sub> and N<sub>2</sub>O mainly originate from the sector Agriculture, and F-gas emissions stem from the sector 2 Industrial processes and product use (IPPU) by definition. The table also provides information about international bunkers.

Table 2-1 Summary of Liechtenstein's GHG emissions by gas and sector in CO<sub>2</sub> equivalent (kt). Numbers may not add to totals due to rounding.

Emissions 2017	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	Total
	CO <sub>2</sub> equivalent (kt)						
1 Energy	154.9	1.65	0.87	-	-	-	157.5
2 IPPU	0.14	NO	0.21	10.7	0.02	0.05	11.1
3 Agriculture	0.04	15.51	7.93	-	-	-	23.5
5 Waste	0.01	0.85	0.72	-	-	-	1.58
<b>Total (excluding LULUCF)</b>	<b>155.1</b>	<b>18.0</b>	<b>9.73</b>	<b>10.7</b>	<b>0.02</b>	<b>0.05</b>	<b>193.6</b>
4 LULUCF	10.1	-	0.42	-	-	-	10.5
<b>Total (including LULUCF)</b>	<b>165.3</b>	<b>18.0</b>	<b>10.1</b>	<b>10.7</b>	<b>0.02</b>	<b>0.05</b>	<b>204.2</b>
<i>International Bunkers</i>	<i>0.86</i>	<i>0.0001</i>	<i>0.01</i>	-	-	-	<i>0.86</i>

A breakdown of Liechtenstein's total emissions by gas is shown in Figure 2-1 below. Figure 2-2 shows the contributions of each sector to the different greenhouse gases.

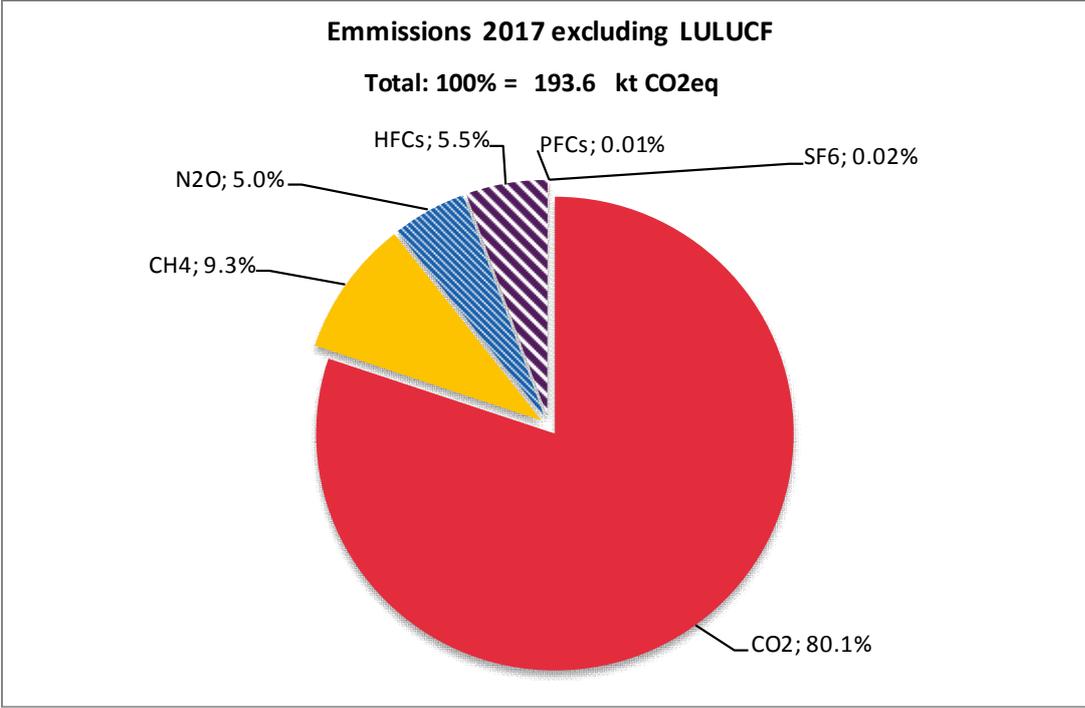


Figure 2-1 Liechtenstein's GHG emissions by gases excluding LULUCF emissions.

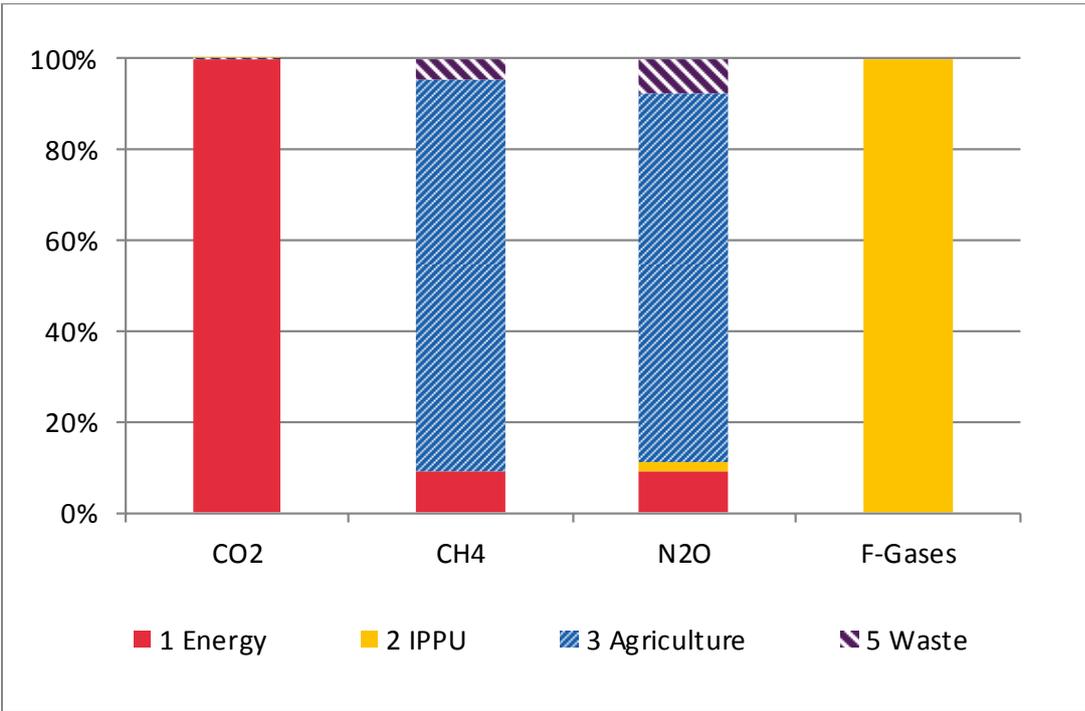


Figure 2-2 Relative contributions of the individual sectors (excluding LULUCF) to GHG emissions in 2017.

## 2.2.2 Emission trends by gas

Emission trends 1990–2017 by gas are summarised in Table 2-2 and in Figure 2-3.

Table 2-2 Summary of Liechtenstein's GHG emissions in CO<sub>2</sub> equivalent (kt) by gas. The last column shows the percentage change in emissions in 2017 as compared to the base year 1990. HFC emissions have increased by about a factor of 100'000 in 2017 compared to 1990.

Greenhouse Gas Emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO <sub>2</sub> equivalent (kt)									
CO <sub>2</sub> emissions incl. net CO <sub>2</sub> from LULUCF	205.6	196.9	208.6	213.4	219.1	208.5	201.8	225.8	228.8	224.9
CO <sub>2</sub> emissions excl. net CO <sub>2</sub> from LULUCF	199.0	206.3	206.9	215.0	201.1	204.2	206.0	218.4	229.2	226.6
CH <sub>4</sub> emissions incl. CH <sub>4</sub> from LULUCF	19.1	19.1	18.6	17.8	17.9	17.9	18.2	18.0	17.8	17.1
CH <sub>4</sub> emissions excl. CH <sub>4</sub> from LULUCF	19.1	19.1	18.6	17.8	17.9	17.9	18.2	18.0	17.8	17.1
N <sub>2</sub> O emissions incl. N <sub>2</sub> O from LULUCF	11.2	11.4	11.3	11.1	11.0	10.9	10.9	10.9	10.6	10.3
N <sub>2</sub> O emissions excl. N <sub>2</sub> O from LULUCF	10.9	11.1	11.0	10.8	10.7	10.6	10.6	10.6	10.3	10.0
HFCs	0.0	0.0	0.1	0.2	0.5	1.4	1.7	2.1	2.7	3.3
PFCs	NO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF <sub>6</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.0
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (including LULUCF)</b>	<b>235.9</b>	<b>227.4</b>	<b>238.7</b>	<b>242.5</b>	<b>248.6</b>	<b>238.7</b>	<b>232.6</b>	<b>256.8</b>	<b>259.9</b>	<b>255.8</b>
<b>Total (excluding LULUCF)</b>	<b>229.0</b>	<b>236.5</b>	<b>236.7</b>	<b>243.8</b>	<b>230.3</b>	<b>234.1</b>	<b>236.5</b>	<b>249.1</b>	<b>260.1</b>	<b>257.1</b>

Greenhouse Gas Emissions	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO <sub>2</sub> equivalent (kt)									
CO <sub>2</sub> emissions incl. net CO <sub>2</sub> from LULUCF	241.3	215.6	221.8	235.2	237.4	237.1	244.1	223.0	243.9	226.7
CO <sub>2</sub> emissions excl. net CO <sub>2</sub> from LULUCF	216.9	214.7	220.0	229.3	229.4	229.0	231.1	200.8	219.5	205.4
CH <sub>4</sub> emissions incl. CH <sub>4</sub> from LULUCF	16.7	17.6	17.7	17.9	18.0	18.4	19.2	19.4	19.6	19.4
CH <sub>4</sub> emissions excl. CH <sub>4</sub> from LULUCF	16.7	17.6	17.7	17.9	18.0	18.4	19.2	19.4	19.6	19.4
N <sub>2</sub> O emissions incl. N <sub>2</sub> O from LULUCF	10.2	10.3	10.4	10.4	10.1	10.3	10.5	10.6	10.7	10.6
N <sub>2</sub> O emissions excl. N <sub>2</sub> O from LULUCF	9.9	9.9	10.1	10.1	9.8	9.9	10.1	10.2	10.3	10.2
HFCs	4.1	4.9	5.5	6.2	7.1	7.4	7.8	8.5	9.1	9.1
PFCs	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
SF <sub>6</sub>	0.1	0.2	0.2	0.2	0.3	0.3	0.1	0.1	0.3	0.1
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (including LULUCF)</b>	<b>272.5</b>	<b>248.5</b>	<b>255.7</b>	<b>270.1</b>	<b>272.9</b>	<b>273.5</b>	<b>281.7</b>	<b>261.7</b>	<b>283.8</b>	<b>266.1</b>
<b>Total (excluding LULUCF)</b>	<b>247.7</b>	<b>247.3</b>	<b>253.6</b>	<b>263.8</b>	<b>264.5</b>	<b>265.0</b>	<b>268.3</b>	<b>239.0</b>	<b>259.0</b>	<b>244.4</b>

Greenhouse Gas Emissions	2010	2011	2012	2013	2014	2015	2016	2017	1990-2017
	CO <sub>2</sub> equivalent (kt)								%
CO <sub>2</sub> emissions incl. net CO <sub>2</sub> from LULUCF	210.6	200.4	209.2	208.7	177.2	169.6	157.7	165.3	-19.6%
CO <sub>2</sub> emissions excl. net CO <sub>2</sub> from LULUCF	190.8	176.8	185.3	192.5	161.1	158.9	148.9	155.1	-22.0%
CH <sub>4</sub> emissions incl. CH <sub>4</sub> from LULUCF	18.8	19.1	19.5	18.7	18.7	18.4	18.4	18.0	-5.8%
CH <sub>4</sub> emissions excl. CH <sub>4</sub> from LULUCF	18.8	19.1	19.5	18.7	18.7	18.4	18.4	18.0	-5.8%
N <sub>2</sub> O emissions incl. N <sub>2</sub> O from LULUCF	10.4	10.8	10.7	10.4	10.3	10.3	10.2	10.1	-9.6%
N <sub>2</sub> O emissions excl. N <sub>2</sub> O from LULUCF	10.0	10.4	10.3	10.0	9.9	9.9	9.8	9.7	-10.8%
HFCs	9.7	10.0	10.4	10.6	10.7	10.4	10.6	10.7	see caption
PFCs	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	---
SF <sub>6</sub>	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	---
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	---
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	---
<b>Total (including LULUCF)</b>	<b>249.7</b>	<b>240.4</b>	<b>249.9</b>	<b>248.7</b>	<b>217.0</b>	<b>208.9</b>	<b>196.9</b>	<b>204.2</b>	<b>-13.5%</b>
<b>Total (excluding LULUCF)</b>	<b>229.5</b>	<b>216.4</b>	<b>225.6</b>	<b>232.1</b>	<b>200.5</b>	<b>197.8</b>	<b>187.7</b>	<b>193.6</b>	<b>-15.4%</b>

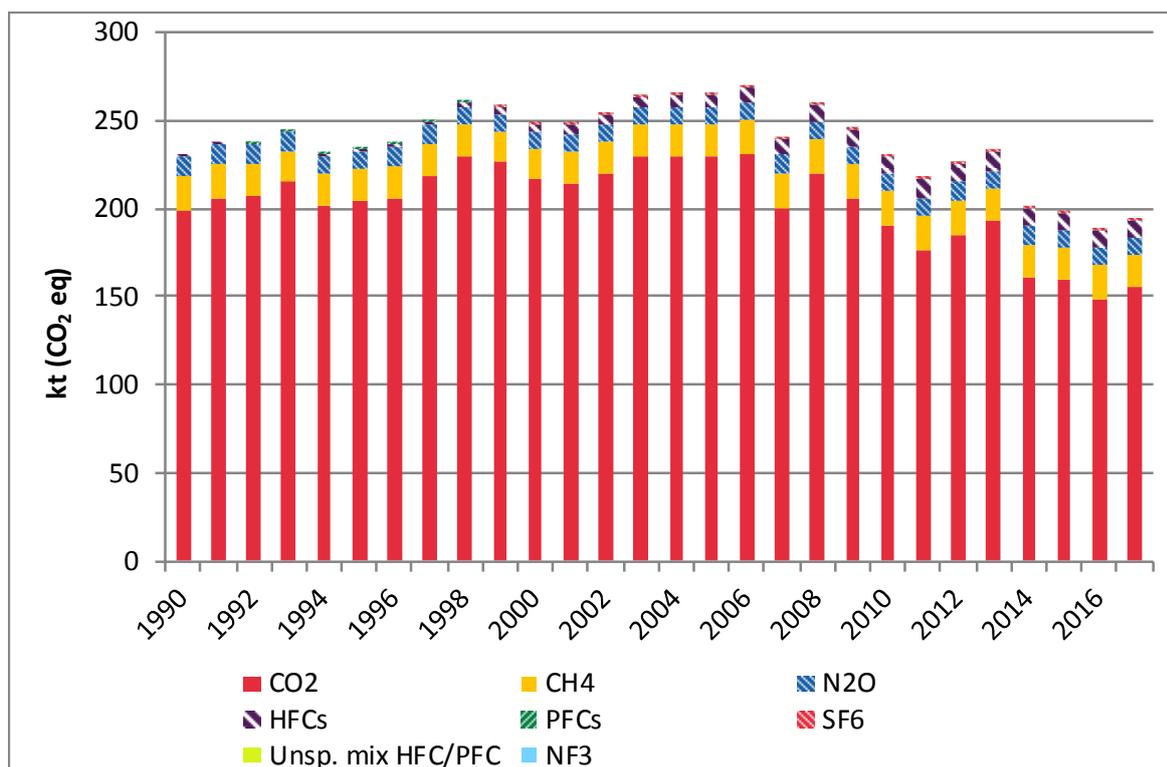


Figure 2-3 Trend of Liechtenstein's greenhouse gas emissions by gases. CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O correspond to the respective total emissions excluding LULUCF. Note that NF<sub>3</sub> emissions are not occurring (NO).

As shown in Table 2-2 and Figure 2-3, total emissions excluding and including LULUCF emissions are clearly below base year emissions. No trend can be identified in the period 1990-2006, however, from 2006 onwards, a decreasing trend starts to develop. The emission maximum occurred in 2006. Emission trends for the individual gases can be described as follows:

- Total emissions (in CO<sub>2</sub>eq) excluding LULUCF sources or sinks decreased by 15.4% from 1990 to 2017.
- Total emissions (in CO<sub>2</sub>eq) including LULUCF show a decrease of 13.5% in 2017 compared to 1990 levels.
- Accounting for 80.1% of the total emissions in 2017, CO<sub>2</sub> is the most dominant greenhouse gas emitted in Liechtenstein. CH<sub>4</sub> emissions represent 9.3% and N<sub>2</sub>O emissions 5.0% of the total emissions.
- CO<sub>2</sub> emissions (excluding net CO<sub>2</sub> from LULUCF) have declined by 22.0% between 1990 and 2017. In comparison to the previous reporting year 2016, CO<sub>2</sub> emissions (excluding net CO<sub>2</sub> from LULUCF) increased by 4.2% in 2017. The latest development is mainly due to the increase in the CO<sub>2</sub> levy by January 1, 2016, which caused an increase in sales of gas oil in 2015 and a reduced apparent consumption in 2016 and subsequently again an increase in consumption in 2017. In general, the most important drivers of net CO<sub>2</sub> emissions are fuel prices and winter temperatures (heating degree days), influencing the source categories contributing to a large share of CO<sub>2</sub> emissions under 1A Fuel combustion (1A2 Manufacturing industries and construction, 1A3 Transport and 1A4 Other sectors).
- CH<sub>4</sub> emissions (excluding CH<sub>4</sub> from LULUCF) have decreased by 5.8% since 1990. Compared to 2016, CH<sub>4</sub> emissions (excluding LULUCF) show a decrease by 2.3% in 2017. A

major reason for this development is the number of livestock (in particular cattle), which strongly influence CH<sub>4</sub> emissions from enteric fermentation and which have been reduced between 1990-2000 and have increased again since (however, still being below the 1990 level). The share of CH<sub>4</sub> increased from 8.3% in 1990 to 9.3% in 2017.

- N<sub>2</sub>O emissions (excluding N<sub>2</sub>O from LULUCF) have declined by 10.8% in 2017 compared to 1990. Compared to 2016, N<sub>2</sub>O emissions (without LULUCF) in 2017 slightly decreased by 0.4%. The main source of N<sub>2</sub>O emissions is agriculture (manure management and agricultural soils). The share of N<sub>2</sub>O slightly increased from 4.8% (1990) to 5.0% (2017).
- HFC emissions increased due to their role as substitutes for CFCs. SF<sub>6</sub> emissions originate from electrical transformation stations and play a minor role for the total of the synthetic gases (F-gases). PFC emissions are occurring since 1997 and are increasing on a low level. The share of the sum of all F-gases (within total emissions excl. LULUCF) increased from 0.00005% (1990) to 5.6% (2017).

### 2.2.3 Emission trends by sector

Table 2-3 shows emission trends for all major source and sink categories. As the largest share of emissions originated from sector 1 Energy, the table shows the contributions of the source categories attributed to it in more detail (1A1-1A5, 1B).

A graphical representation of the data is given in Figure 2-4.

Table 2-3 Summary of Liechtenstein's GHG emissions by source and sink categories in CO<sub>2</sub> equivalent (kt). The last column shows the percent change in emissions in 2017 compared to the base year 1990.

Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO <sub>2</sub> equivalent (kt)									
<b>1 Energy</b>	<b>201.1</b>	<b>208.6</b>	<b>209.4</b>	<b>217.6</b>	<b>203.6</b>	<b>206.8</b>	<b>208.6</b>	<b>221.2</b>	<b>232.1</b>	<b>229.4</b>
1A1 Energy industries	0.2	0.9	1.9	2.0	1.8	2.1	2.6	2.5	2.9	2.9
1A2 Manufacturing industries & constr.	36.3	36.0	36.4	37.6	35.7	35.7	35.8	37.6	40.4	39.9
1A3 Transport	76.6	90.0	89.3	87.2	79.8	81.8	83.1	86.7	86.3	90.5
1A4 Other sectors	87.6	81.4	81.4	90.3	85.8	86.6	86.5	93.6	101.7	95.4
1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B Fugitive emissions from fuels	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8
<b>2 IPPU</b>	<b>0.7</b>	<b>0.6</b>	<b>0.7</b>	<b>0.8</b>	<b>1.1</b>	<b>1.9</b>	<b>2.2</b>	<b>2.6</b>	<b>3.2</b>	<b>3.8</b>
<b>3 Agriculture</b>	<b>25.5</b>	<b>25.5</b>	<b>24.8</b>	<b>23.8</b>	<b>23.9</b>	<b>23.7</b>	<b>23.9</b>	<b>23.5</b>	<b>23.0</b>	<b>22.1</b>
<b>5 Waste</b>	<b>1.8</b>	<b>1.7</b>	<b>1.7</b>	<b>1.7</b>	<b>1.8</b>	<b>1.7</b>	<b>1.8</b>	<b>1.7</b>	<b>1.7</b>	<b>1.8</b>
<b>Total (excluding LULUCF)</b>	<b>229.0</b>	<b>236.5</b>	<b>236.7</b>	<b>243.8</b>	<b>230.3</b>	<b>234.1</b>	<b>236.5</b>	<b>249.1</b>	<b>260.1</b>	<b>257.1</b>
<b>4 LULUCF</b>	<b>7.0</b>	<b>-9.1</b>	<b>2.0</b>	<b>-1.3</b>	<b>18.3</b>	<b>4.6</b>	<b>-3.9</b>	<b>7.8</b>	<b>-0.1</b>	<b>-1.3</b>
<b>Total (including LULUCF)</b>	<b>235.9</b>	<b>227.4</b>	<b>238.7</b>	<b>242.5</b>	<b>248.6</b>	<b>238.7</b>	<b>232.6</b>	<b>256.8</b>	<b>259.9</b>	<b>255.8</b>

Source and Sink Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO <sub>2</sub> equivalent (kt)									
<b>1 Energy</b>	<b>219.8</b>	<b>217.5</b>	<b>222.7</b>	<b>232.0</b>	<b>231.8</b>	<b>231.5</b>	<b>233.6</b>	<b>203.2</b>	<b>222.1</b>	<b>207.9</b>
1A1 Energy industries	2.8	2.9	2.5	2.8	3.0	3.1	2.9	2.6	2.9	3.0
1A2 Manufacturing industries & constr.	36.5	36.4	37.9	41.2	39.9	39.2	40.6	33.9	36.4	27.6
1A3 Transport	91.3	87.8	83.8	83.5	82.2	81.8	79.2	83.3	87.7	81.8
1A4 Other sectors	88.4	89.4	97.6	103.5	105.8	106.3	109.9	82.3	93.9	94.5
1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B Fugitive emissions from fuels	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.1
<b>2 IPPU</b>	<b>4.6</b>	<b>5.5</b>	<b>6.1</b>	<b>6.9</b>	<b>7.8</b>	<b>8.1</b>	<b>8.4</b>	<b>9.1</b>	<b>9.9</b>	<b>9.7</b>
<b>3 Agriculture</b>	<b>21.5</b>	<b>22.5</b>	<b>22.9</b>	<b>23.0</b>	<b>23.0</b>	<b>23.6</b>	<b>24.6</b>	<b>24.9</b>	<b>25.1</b>	<b>25.0</b>
<b>5 Waste</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.7</b>
<b>Total (excluding LULUCF)</b>	<b>247.7</b>	<b>247.3</b>	<b>253.6</b>	<b>263.8</b>	<b>264.5</b>	<b>265.0</b>	<b>268.3</b>	<b>239.0</b>	<b>259.0</b>	<b>244.4</b>
<b>4 LULUCF</b>	<b>24.8</b>	<b>1.3</b>	<b>2.2</b>	<b>6.3</b>	<b>8.5</b>	<b>8.5</b>	<b>13.4</b>	<b>22.7</b>	<b>24.8</b>	<b>21.7</b>
<b>Total (including LULUCF)</b>	<b>272.5</b>	<b>248.5</b>	<b>255.7</b>	<b>270.1</b>	<b>272.9</b>	<b>273.5</b>	<b>281.7</b>	<b>261.7</b>	<b>283.8</b>	<b>266.1</b>

Source and Sink Categories	2010	2011	2012	2013	2014	2015	2016	2017	1990-2017
	CO <sub>2</sub> equivalent (kt)								%
<b>1 Energy</b>	<b>193.3</b>	<b>179.2</b>	<b>187.8</b>	<b>195.0</b>	<b>163.4</b>	<b>161.2</b>	<b>151.2</b>	<b>157.5</b>	<b>-21.7%</b>
1A1 Energy industries	3.3	3.1	2.8	3.0	2.5	2.0	2.2	2.1	1109.4%
1A2 Manufacturing industries & constr.	26.1	23.6	25.7	26.4	27.1	27.4	25.7	27.4	-24.5%
1A3 Transport	77.6	76.8	79.8	79.5	73.8	61.1	59.7	60.3	-21.3%
1A4 Other sectors	85.2	74.7	78.3	84.9	58.9	69.5	62.5	66.4	-24.1%
1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	-
1B Fugitive emissions from fuels	1.1	1.1	1.1	1.2	1.1	1.1	1.2	1.2	223.6%
<b>2 IPPU</b>	<b>10.2</b>	<b>10.4</b>	<b>10.8</b>	<b>11.2</b>	<b>11.2</b>	<b>10.9</b>	<b>10.9</b>	<b>11.1</b>	<b>1598.6%</b>
<b>3 Agriculture</b>	<b>24.2</b>	<b>24.9</b>	<b>25.1</b>	<b>24.0</b>	<b>24.4</b>	<b>24.1</b>	<b>24.1</b>	<b>23.5</b>	<b>-8.0%</b>
<b>5 Waste</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.6</b>	<b>1.6</b>	<b>1.5</b>	<b>1.6</b>	<b>-10.7%</b>
<b>Total (excluding LULUCF)</b>	<b>229.5</b>	<b>216.4</b>	<b>225.6</b>	<b>232.1</b>	<b>200.5</b>	<b>197.8</b>	<b>187.7</b>	<b>193.6</b>	<b>-15.4%</b>
<b>4 LULUCF</b>	<b>20.3</b>	<b>24.0</b>	<b>24.3</b>	<b>16.6</b>	<b>16.5</b>	<b>11.1</b>	<b>9.2</b>	<b>10.5</b>	<b>51.7%</b>
<b>Total (including LULUCF)</b>	<b>249.7</b>	<b>240.4</b>	<b>249.9</b>	<b>248.7</b>	<b>217.0</b>	<b>208.9</b>	<b>196.9</b>	<b>204.2</b>	<b>-13.5%</b>

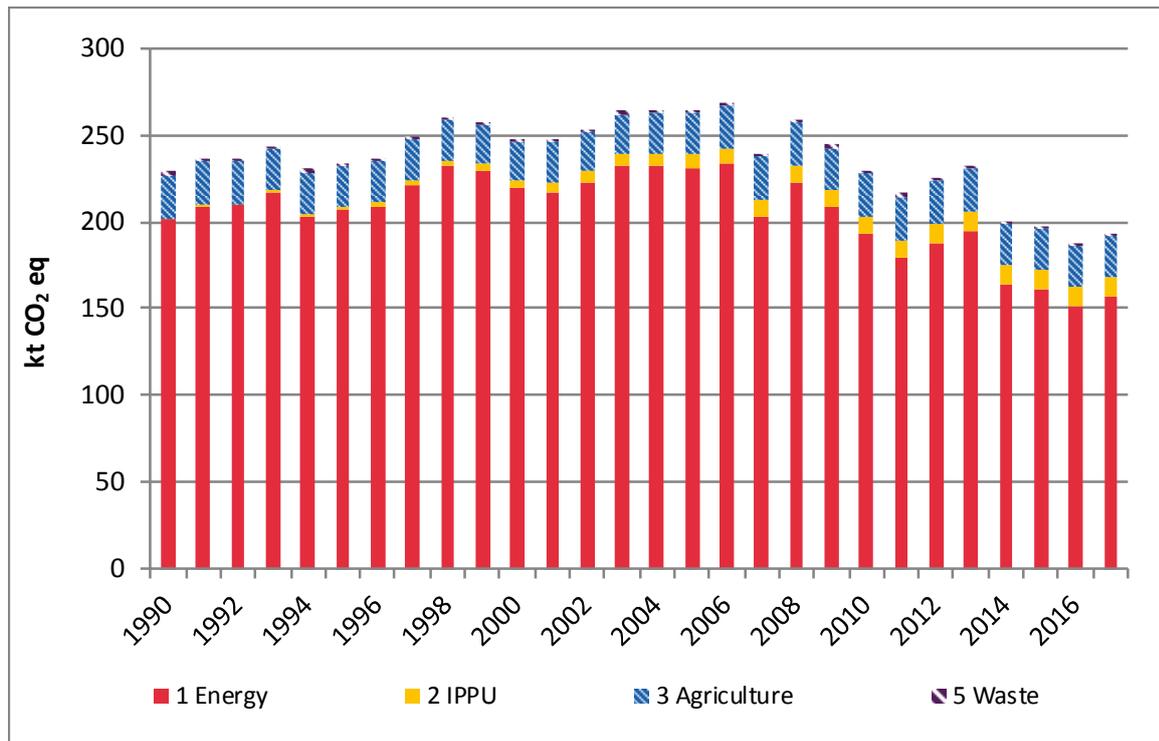


Figure 2-4 Trend of Liechtenstein's greenhouse gas emissions by main source categories in CO<sub>2</sub> equivalent (kt) (excl. net CO<sub>2</sub> from LULUCF).

The following emission trends are characteristic within the sectors:

**Sector 1 Energy:** In 2017, 81.3% of Liechtenstein's GHG emissions (excluding LULUCF) originate from sector 1 Energy, which is 1.1 percentage points more than in 2016. The share of sector 1 Energy in the total emissions declined by 6.5 percentage points since 1990. Also, the total emissions of the sector 1 Energy clearly decreased in comparison to 1990 levels (21.7%). The source categories within sector 1 Energy show the following trends between 1990 and 2017:

- **1A1 Energy industries:** Since 1990, Liechtenstein's gas-grid has been extended and natural gas has replaced gas oil as the main heating fuel in buildings. Total emissions have increased by about a factor of 12 since 1990.
- **1A2 Manufacturing industries and construction:** Total emissions from this source category have declined by 24.5% since 1990. Gaseous fuels are the more important energy carrier in Liechtenstein. In 2017, emissions from gaseous fuels increased by 2.6% compared to 1990 and by 6.8% compared to 2016. Liquid fuel emissions decreased by 44.1% compared to 1990.
- **1A3 Transport:** In previous years, fuel consumption in road transportation was mostly in line with a general development of road-vehicle kilometres of all vehicle categories. Total emissions have started decreasing since 2012. However, emissions of 1A3 slightly increased in 2017 (1.1%) compared to the previous year. The overall trend shows a decrease of 21.3% between 1990 and 2017. This reduction is mainly provoked by a shift in the fuel prices, which have decreased in Austria and increased in Liechtenstein between 2013 and 2016 (SFOE 2017c).

- **1A4 Other sectors:** GHG emissions in source category 1A4 have increased by 6.3% compared to the previous reporting year 2016. An important driver of emissions from category 1A4 are heating degree days, which generally correlate well with the use of heating fuels. Various emission reduction measures in Liechtenstein are influencing the fuel consumption. For instance, the increase in the CO<sub>2</sub> levy in 2016, which caused an increase in sales of gas oil in 2015 and a reduced apparent consumption in 2016 and subsequently again an increase in 2017. A similar increase of the CO<sub>2</sub> levy took place in 2010. Another example is the installation of a district heating pipeline, which is one factor leading to the stronger declining trend of the CO<sub>2</sub> emissions in comparison to the trend in heating degree days. The observed difference in the trends of CO<sub>2</sub> emissions and heating degree days is an indication of a decoupling between heating activities and CO<sub>2</sub> emissions.

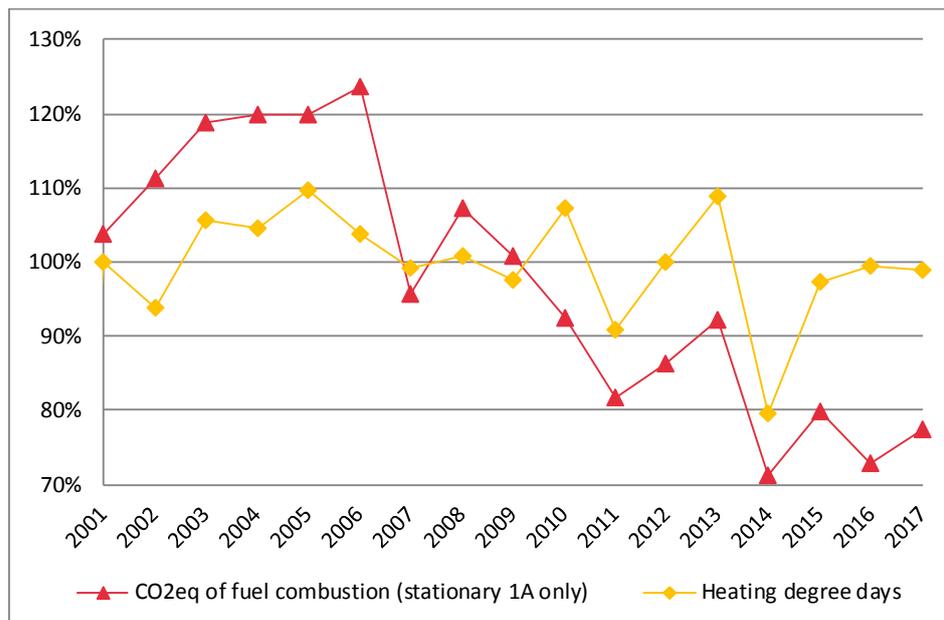


Figure 2-5 Relative trend for CO<sub>2</sub> emissions from 1A Fuel Combustion compared with the number of heating degree days. The drop of emissions in 2007 is driven by high oil and gas prices.

- **1A5 Other (mobile):** Liechtenstein does not have any emissions under source category 1A5 because Liechtenstein has no army.
- **1B Fugitive emissions from fuels:** In parallel with the installation and subsequent extension of Liechtenstein's gas supply network since 1990, fugitive emissions have strongly increased over the period 1990-2017 (223.6%).

**Sector 2 Industrial processes and product use:** Due to the lack of heavy industry within the borders of Liechtenstein, there are only small sources of F-gases and emissions are on a low level. Still, the use of F-gases has increased throughout the period 1990-2017, which leads to enormous rising emissions in sector 2 by almost a factor of 17. The most important source category is 2F Product uses as substitutes for ozone-depleting substances (ODS) due to the replacement of CFCs with HFCs.

**Sector 3 Agriculture:** In 2017, emissions are below the 1990 level by 8.0%. The main parameter influencing CH<sub>4</sub> and N<sub>2</sub>O emissions from agriculture are animal numbers (in particular cattle and swine). Since the numbers of these animals declined since 1990, emissions have also been reduced.

**Sector 4 LULUCF:** Figure 2-6 shows CO<sub>2</sub> emissions or removals by sources and sinks from LULUCF categories in Liechtenstein. The dominant categories when looking at the changes in CO<sub>2</sub> emissions are gain and loss of living biomass in forests. There is a considerable annual variation of loss of living biomass in forests dependent on the wood harvesting rate and storm events. The reasons for the relatively high net CO<sub>2</sub> emissions in 1990 and 2000 are the European storms Vivian (February 1990) and Lothar (December 1999), respectively, which caused great damages in the forest stands and markedly increased harvesting. In January 1994, the Rhine valley and especially Liechtenstein was hit by a strong foehn storm with large wind throws (see <http://www.sturmarchiv.ch>).

In a medium-term perspective, harvesting rates in Liechtenstein's forests appeared to expand between 2001 and 2008 mainly due to increased use of energy wood. Harvesting rates started to decline after 2012 due to the international and domestic economic framework conditions.

The total net emissions increased by 51.7% between 1990 and 2017.

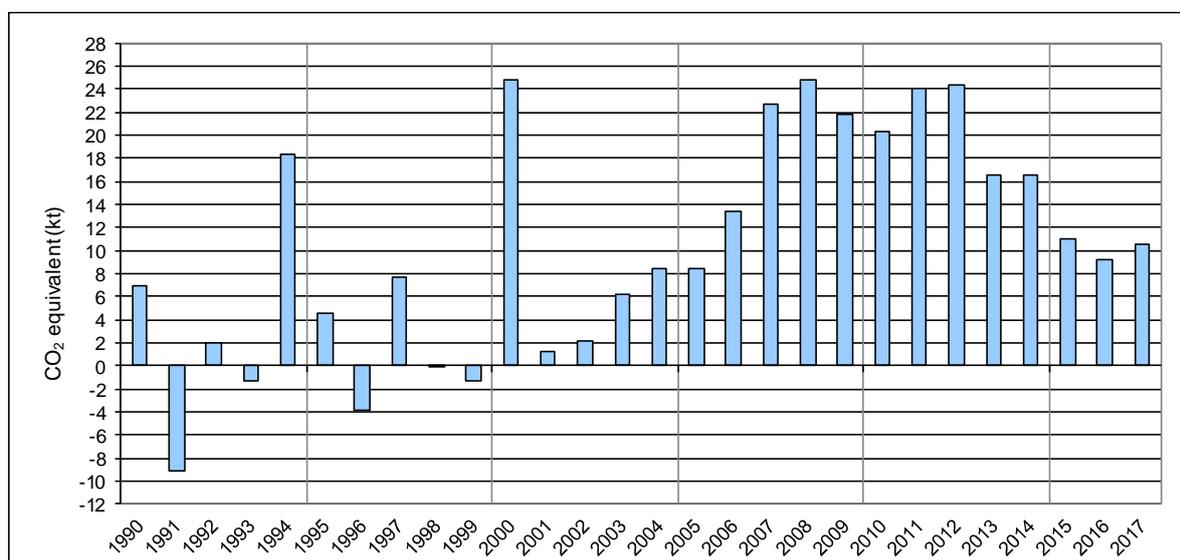


Figure 2-6 Net CO<sub>2</sub> emissions of source category 4 LULUCF in kt CO<sub>2</sub> equivalent.

**Sector 5 Waste:** In Liechtenstein, only few emissions occur from the sector Waste, since all municipal solid waste is exported to a Swiss incineration plant. The waste sector shows a decrease between 1990 and 2017 (10.7%). The development of the greenhouse gas emissions is dominated by two source categories: 5A Solid waste disposal as well as 5D Wastewater treatment and discharge. In source category 5A Solid waste disposal, a steady decrease of greenhouse gas emissions can be observed due to stopped landfilling in 1974. In source category 5D Wastewater treatment and discharge, sewage gas has only been used as fuel for boilers or co-generation up to 2014. Since then, all sewage gas is up-graded and supplied to the gas grid, which results in lower greenhouse gas emissions in this source category.

### 2.2.4 Emission trends for precursor greenhouse gases and SO<sub>2</sub>

Liechtenstein is member to the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) and submits data on air pollutants including indirect GHG. For the precursor substances NO<sub>x</sub>, CO and NMVOC as well as for the gas SO<sub>2</sub>, data from the current state of knowledge in air pollution reporting is shown in Table 2-4 (Acontec 2019). The system

boundaries for the road transportation sector categories are not the same as under the UNFCCC reporting since Liechtenstein uses, the territorial approach under the CLRTAP and the sales principle for the UNFCCC reporting, which restricts the comparability of the two data sets. In particular, there would be inconsistencies within activity data and accordingly within implied emission factors of the results of the two approaches. Therefore, the data is not reported in CRF table 6.

Table 2-4: Development of NO<sub>x</sub>, CO, NMVOC and SO<sub>x</sub> emissions (in t).

Precursor gases and SO <sub>2</sub>	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	tonnes									
NO <sub>x</sub>	593	594	597	587	570	558	555	557	563	552
CO	1'395	1'234	1'136	1'024	961	862	793	750	709	669
NMVOC	1'243	1'107	1'041	887	834	690	649	615	580	558
SO <sub>x</sub>	129	101	92	83	85	72	68	80	68	49

Precursor gases and SO <sub>2</sub>	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	tonnes									
NO <sub>x</sub>	535	517	511	517	497	493	480	450	435	415
CO	697	589	559	571	551	544	531	558	531	551
NMVOC	472	447	414	386	349	342	335	326	323	321
SO <sub>x</sub>	42	45	48	44	38	41	38	23	28	27

Precursor gases and SO <sub>2</sub>	2010	2011	2012	2013	2014	2015	2016	2017	1990-2017
	tonnes								%
NO <sub>x</sub>	391	386	390	387	367	357	337	330	-44%
CO	544	548	539	488	506	524	499	491	-65%
NMVOC	316	311	308	300	295	288	284	275	-78%
SO <sub>x</sub>	23	20	20	20	15	16	13	13	-90%

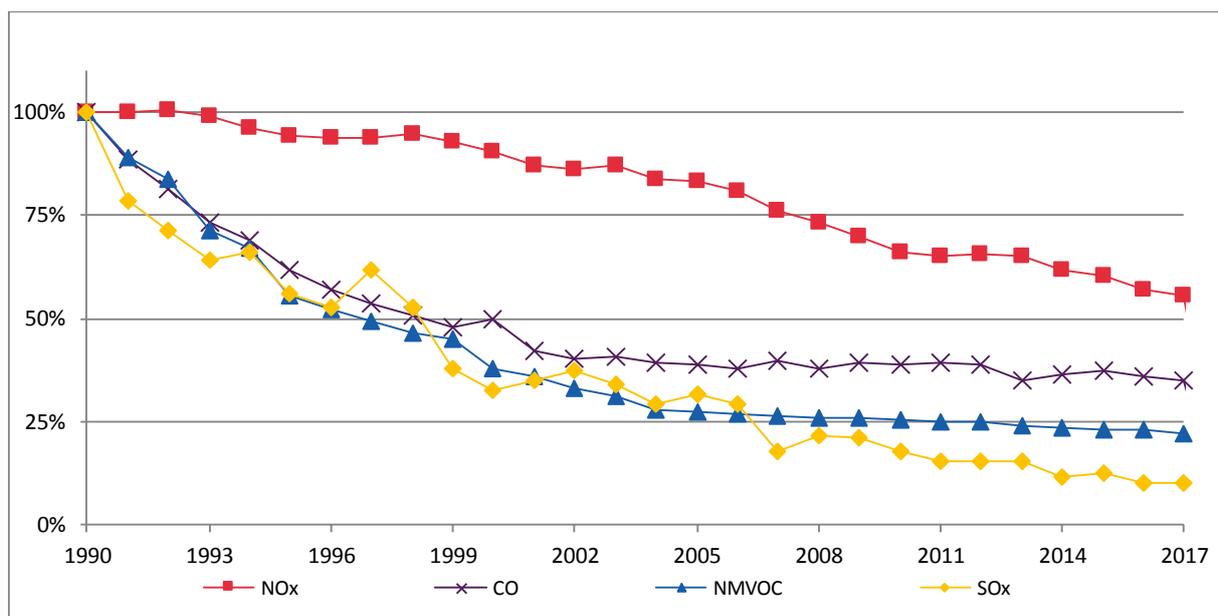


Figure 2-7 Trend of NO<sub>x</sub>, CO, NMVOC and SO<sub>x</sub> emissions.

The complete CLRTAP Inventory data may be found on the internet (see OE 2019):  
[https://www.ceip.at/ms/ceip\\_home1/ceip\\_home/status\\_reporting/2019\\_submissions/](https://www.ceip.at/ms/ceip_home1/ceip_home/status_reporting/2019_submissions/)

### 2.2.5 Emission trends in KP-LULUCF inventory

Table 2-5 and Figure 2-8 illustrate the total net emissions occurring from activities under KP-LULUCF. Deforestation and forest management until 2014 are emission sources, while afforestation as well as forest management activities after 2014 are sinks. The development of emissions from forest management is mainly driven by the harvesting rate. Reforestation does not occur in Liechtenstein.

Table 2-5: Development of net CO<sub>2</sub> equivalent emissions of afforestation, deforestation and forest management in Liechtenstein.

KP-LULUCF	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	CO <sub>2</sub> equivalent (kt)									
Afforestation	-0.26	-0.26	-0.27	-0.28	-0.29	-0.29	-0.30	-0.31	-0.32	-0.32
Deforestation	3.98	4.06	4.16	4.26	4.36	4.47	4.57	4.68	4.76	4.60
Forest Mangement	13.72	10.51	8.91	12.82	13.11	5.22	5.13	-0.46	-2.36	-0.65



Figure 2-8 Trend of emissions of afforestation, deforestation and forest management in Liechtenstein.

### 3. Quantified Economy-wide Emission Reduction Target (QEWER)

#### Liechtenstein's quantified economy-wide emission reduction target

Liechtenstein quantified economy-wide emission reduction target is -20% of its 1990 total GHG emissions by 2020. Optionally, to increase its ambitions to -30%, if other developed countries commit themselves to comparable emissions reduction efforts and if economically more advanced developing countries take appropriate mitigation actions. Liechtenstein submitted in April 2014 its national information relating the ambition of its commitment under the 2<sup>nd</sup> commitment period of the Kyoto Protocol in accordance with Decision FCCC/KP/CMP/2012/L.9. The submission follows the content of paragraph 9 of that decision.

With respect to a possible increase of Liechtenstein's commitment under the second period of the Kyoto Protocol the Government has carefully examined the option and decided not to increase its ambition over the communicated commitment of -20% compared to 1990. The Government is of the view that the current commitment already states a very ambitious goal – which will require a considerable effort to be achieved by domestic measures only.

At the current stage an increase of ambition would correspond automatically with a respective increase of acquisition of emission reductions abroad. Such situation would indirectly contradict Liechtenstein's legal framework that requires the Government to primarily focus on domestic greenhouse gas reductions.

In April 2015 the Liechtenstein Government submitted its Intended Nationally Determined Contribution (INDC) to the Secretariat of the UNFCCC. The INDC includes a quantified economy-wide emission reduction target for 2030. The assumptions underlying Liechtenstein's INDC are based on the possibility to achieve emission reductions abroad which may be accounted towards Liechtenstein's reduction target in 2030. However, primary focus will be on domestic emission reductions. Liechtenstein aims at a reduction of greenhouse gases by 40 % compared to 1990 by 2030. The reduction target will be subject to the approval of the Liechtenstein Parliament.

Table 2(a)

LIE\_BR4\_v0.2

#### Description of quantified economy-wide emission reduction target: base year<sup>a</sup>

Party	Liechtenstein	
Base year /base period	1990	
Emission reduction target	% of base year/base period	% of 1990 <sup>b</sup>
	20.00	
Period for reaching target	BY-2020	

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> Optional.

Table 2(b)

LIE\_BR4\_v0.2

**Description of quantified economy-wide emission reduction target: gases and sectors covered<sup>a</sup>**

<i>Gases covered</i>		<i>Base year for each gas (year):</i>
CO <sub>2</sub>		1990
CH <sub>4</sub>		1990
N <sub>2</sub> O		1990
HFCs		1990
PFCs		1990
SF <sub>6</sub>		1990
NF <sub>3</sub>		
Other Gases (specify)		
Sectors covered <sup>b</sup>	Energy	Yes
	Transport <sup>f</sup>	Yes
	Industrial processes <sup>g</sup>	Yes
	Agriculture	Yes
	LULUCF	Yes
	Waste	Yes
	Other Sectors (specify)	

*Abbreviations* : LULUCF = land use, land-use change and forestry.

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> More than one selection will be allowed. If Parties use sectors other than those indicated above, the explanation of how these sectors relate to the sectors defined by the IPCC should be provided.

<sup>f</sup> Transport is reported as a subsector of the energy sector.

<sup>g</sup> Industrial processes refer to the industrial processes and solvent and other product use sectors.

Table 2(c)

LIE\_BR4\_v0.2

**Description of quantified economy-wide emission reduction target: global warming potential values (GWP)<sup>a</sup>**

<i>Gases</i>	<i>GWP values<sup>b</sup></i>
CO <sub>2</sub>	4th AR
CH <sub>4</sub>	4th AR
N <sub>2</sub> O	4th AR
HFCs	4th AR
PFCs	4th AR
SF <sub>6</sub>	4th AR
NF <sub>3</sub>	
Other Gases (specify)	

*Abbreviations* : GWP = global warming potential

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> Please specify the reference for the GWP: Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) or the Fourth Assessment Report of the IPCC.

Table 2(d)

LIE\_BR4\_v0.2

**Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector<sup>a</sup>**

Role of LULUCF	LULUCF in base year level and target	Included
	Contribution of LULUCF is calculated using	Land-based approach

*Abbreviation:* LULUCF = land use, land-use change and forestry.

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

### Use of international market-based mechanisms

Liechtenstein will continue the use of carbon credits generated from the flexible mechanisms of the Kyoto Protocol and from new market-based mechanisms under the Convention in order to ensure the achievement of the abovementioned reduction target. Current projections, as contained in Liechtenstein's 7<sup>th</sup> National Communication (Chapter 5.3), forecast a total demand of around 26'787 t CO<sub>2</sub> eq to be reduced abroad. This number is based actual emissions until 2017 and estimates for 2018-2020.

However, in order to calculate the exact amount of carbon credits until 2020 the Government will have to conclude further estimations and projections, based on the effective implementation of policy measures which have been proposed in the Government's Energy Strategy 2020.

Liechtenstein has not yet calculated the exact amount of required carbon credits from abroad (2013). During COP 18 in 2012 in Doha, Qatar Liechtenstein declared not to acquire AAUs for compliance purposes under the second commitment period of the Kyoto Protocol (FCCC/KP/CMP/2012/L.9). Liechtenstein use a limited amount of its own AAUs to be carried over in the second commitment period.

With regard to Liechtenstein's emission reduction target in 2030 Liechtenstein may take advantage of the possibility to achieve emission reductions abroad which may be accounted towards Liechtenstein's reduction target in 2030. To this respect it is envisaged to make use of the respective mechanisms described in Art. 6 of the Paris Agreement.

Liechtenstein requests to carry-over from the first commitment period of the Kyoto protocol 42'984 AAUs to the second commitment period. A first estimation of the target gap for the second commitment period was conducted in 2015 for two assumptions. One assumption was for constant emissions based on the 2012 emissions and the other assumption was considering the projections based on the NC6 WM scenario (refer to Table 3-1). Liechtenstein will still put every effort in reaching its goal with domestic measures. Both assumptions should show the minimum and maximum of the target gap using market-based mechanisms. The minimum amount for CP2 would be 123'614 t CO<sub>2</sub>eq and a maximum of 227'384 t CO<sub>2</sub>eq. Liechtenstein has submitted its' initial report; the assigned amount is 1'556'044 t CO<sub>2</sub>. The amount in CTF Table 2(e)I is an estimation and reflects the mean value of both assumptions.

Table 3-1 Estimation of target gap using market- based mechanisms

	constant emissions	Emissions WEM
<b>total emissions (2013-2020)</b>	<b>1'803'200</b>	<b>1'559'619</b>
Kyoto 2 target	1'532'832	1'532'832
total target gap	270'368	26'787
Carry-over from CP1	42'984	42'984
<b>target gap including carry-over</b>	<b>227'384</b>	<b>-16'197</b>

Table 2(e)I

LIE\_BR4\_v0.2

**Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention<sup>a</sup>**

<i>Market-based mechanisms under the Convention</i>	<i>Possible scale of contributions (estimated kt CO<sub>2</sub> eq)</i>
CERs	201.25
ERUs	0.00
AAUs <sup>i</sup>	0.00
Carry-over units <sup>j</sup>	42.98
Other mechanism units under the Convention (specify) <sup>d</sup>	

*Abbreviations* : AAU = assigned amount unit, CER = certified emission reduction, ERU = emission reduction unit.

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>d</sup> As indicated in paragraph 5(e) of the guidelines contained in annex I of decision 2/CP.17 .

<sup>i</sup> AAUs issued to or purchased by a Party.

<sup>j</sup> Units carried over from the first to the second commitment periods of the Kyoto Protocol, as described in decision 13/CMP.1 and consistent with decision 1/CMP.8.

Table 2(e)II

LIE\_BR4\_v0.2

**Description of quantified economy-wide emission reduction target: other market-based mechanisms<sup>a</sup>**

<i>Other market-based mechanisms (Specify)</i>	<i>Possible scale of contributions (estimated kt CO<sub>2</sub> eq)</i>

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

Table 2(f)

LIE\_BR4\_v0.2

**Description of quantified economy-wide emission reduction target: any other information<sup>a,b</sup>**

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<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> This information could include information on the domestic legal status of the target or the total assigned amount of emission units for the period for reaching a target. Some of this information is presented in the narrative part of the biennial report.

## 4. Progress in achievement of QEWER target

### Mitigation actions and their effects in Liechtenstein

Liechtenstein endeavours to enshrine the principle of sustainability in its policies. This includes provident use of resources and maintenance of a high quality of life.

In 2010, Liechtenstein therefore introduced an indicator-based system for an annual assessment of the country's path towards a sustainable development. To this respect the Government has chosen to link the indicator-based assessment to the sustainability definition of the Brundtland Commission. According to that definition sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The system is comparable to the indicator-based assessment of the Swiss Federal Office of Statistics and the European system of Eurostat.

The assessment in Liechtenstein until today shows a mixed picture concerning sustainability. In the areas of international cooperation as well as education and culture the trends are going towards sustainability. The areas of employment, energy and climate as well as natural resources show a positive trend towards sustainability. The areas of living conditions, health and economy show no clear trend and the development must be assessed as neutral. In the areas of social cohesion and mobility, however, the developments are not going towards sustainability. The increasing motorisation rate and the decrease of the environmentally friendly passenger mobility lead to an unsustainable development in the area of mobility.

The assessment of the country's sustainable development also serves as an incentive for the development of respective policies and measures, especially in areas where an unsustainable development can be observed. To the extent possible, Liechtenstein also tries to contribute to the solution of global environmental problems. Climate protection enjoys a high political priority in this regard, constituting a primary field of action in Liechtenstein's environmental policy. Climate mitigation and adaptation action was included in the Government program for the upcoming four years.

Liechtenstein has integrated its climate policy very strongly into the individual sectorial policies. The focus is on energy policy, environmental policy, transport policy, agricultural and forestry policy. All of these areas encompass measures that contribute to the reduction of greenhouse gases. In order to ensure a coordinated implementation of climate policies within the various areas the Government passed a Climate Protection Strategy in 2007. The Strategy requires an interdisciplinary coordination in the fields of environment, energy, building, transportation, agriculture and forestry with respect to the development of climate policy measures. The strategy was revised in the year 2015. Liechtenstein's Ministry of Environment and the Office of Environment are the coordinating authorities with respect to the execution of the Climate Protection Strategy.

Because of the small size of the country, cross-border cooperation plays an important role. Especially important is the relationship with Switzerland and the cooperation among the countries in the Lake Constance area. Thanks to the Customs Treaty, cross-border measures and bilateral execution are simplified in many areas, because various Swiss enactments are directly applicable in Liechtenstein pursuant to the Treaty. In these cases, Liechtenstein executes the provisions similarly to a Swiss canton (e.g. mineral oil tax). Accordingly, most policy areas are very closely linked with Swiss policy, in terms of both content and execution.

Pursuant to the cross-border cooperation with Switzerland, Liechtenstein and Switzerland concluded "The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein" (2009). The agreement enables Liechtenstein to implement several environmental levies of Switzerland into national law while using the existing infrastructure of the Swiss authorities for the execution of the respective national laws. The Ministry of Environment and the Office of Environment and the Office for Foreign Affairs are the competent authorities with respect to the execution of the bilateral agreement.

One of the core elements of Liechtenstein's Policies and Measures is the linkage to energy conservation throughout the various sectors. The envisaged reduction of fossil fuel use aims to that respect at a modification of longer-term trends in anthropogenic GHG emissions and thereby also serves the objective of the Climate Convention. As Liechtenstein is a small country every national PaM also reflects a regional PaM due to many linkages to EU or Swiss legislation.

According to the revised Climate Strategy of 2015 the Government aims at a continuation of the path that was taken with the Energy Strategy 2020 until 2030 and beyond.

As there are **NO** other changes in PaMs nor changes in domestic institutional arrangements, including institutional, legal, administrative and procedural arrangements used for domestic compliance, monitoring, reporting, archiving of information and evaluation of progress towards the economy-wide reduction target compared to those reported in the previous NC7/BR3, only a summary of the already existing mitigation actions are provided in Table 4-1.

Table 4-1 Information on reported policies and measures with mitigation co-benefits (for quantified mitigation actions, see CTF Table3 below)

<b>Sectors affected</b>	<b>List of key policies and measures with mitigation co-benefits (not quantifiable)</b>
<b>Policy framework and cross-sectoral measures</b>	Planned National Climate Strategy (2015) Environmental Protection Act that provides the legal basis for emission limits for commercial and household and waste diversion measures, and establishes the Action Plan for Air Environmental policy that includes environmental levies Emissions regulations with regard to emission limits Emissions Trading Act that governs involvement of two industrial facilities in the European Union Emissions Trading System
<b>Energy</b>	
Renewable energy	CO <sub>2</sub> Act that introduces levies to drive efficiencies in the consumption of energy Ordinance on the Liberalization of the Electricity Market including green electricity, hydropower and geothermal measures
Energy efficiency	Energy Ordinance (2008)
Residential and commercial sectors	Building design and standards for public buildings  Promotion of photovoltaic systems through feed-in tariff system
<b>Transport</b>	National Transport Policy that includes measures to manage emissions from vehicles including an environment (fuel) levy on heavy-duty vehicles, adoption of European exhaust emission standards to limit CO <sub>2</sub> emissions from passenger vehicles and promotion of green transportation  Integrated transport planning exploring increased usage of public transport and bicycles
<b>Agriculture</b>	Agriculture Law and related measures to promote sustainable agriculture practices
<b>Forestry</b>	Forestry Act and related measures to promote sustainable forest management
<b>Waste management</b>	Environmental Protection Act Technical Ordinance on Waste Registration, evaluation, authorization and restriction of chemicals

Table 3 from the CTF table contains the mitigation actions in Liechtenstein which can be quantified. Note that the excel sheets of the CTF tables are password protected, so the layout of the table could not be optimized (font size, column width, lines).

Table 3  
Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action <sup>a</sup>	Sector(s) affected <sup>b</sup>	GHG(s) affected	Objective and/or activity affected	Type of instrument <sup>c</sup>	Status of implementation <sup>d</sup>	Brief description <sup>e</sup>	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO <sub>2</sub> eq)
									2020
Energy Efficiency Act	Energy	CO <sub>2</sub>	Aims for the reduction of energy, the intelligent and economic use of energy as well as the promotion of renewable energies. Promotion of heat insulation (renovation of old buildings), residential technical installations (room heating and nonpotable water), solar energy (thermal solar collectors and photovoltaics) and demonstration facilities.		Implemented		2008	Office of Economic Affairs	2.89
Steam pipeline	Energy	CO <sub>2</sub>	Acquisition of steam from waste incineration plant in neighbouring city of Buchs (Switzerland) in order to replace fossil fuels for manufacturing industry.		Implemented		2009	Private	2.20
Liechtenstein Energy Strategy 2020*	Energy	CO <sub>2</sub>	Governmental Strategy that ensures a sustainable energy supply.		Implemented		2012	Government of Liechtenstein / Office of Economic Affairs	6.89

Note: The two final columns specify the year identified by the Party for estimating impacts (based on the status of the measure and whether an ex post or ex ante estimation is available).

Abbreviations: GHG = greenhouse gas; LULUCF = land use, land-use change and forestry.

<sup>a</sup> Parties should use an asterisk (\*) to indicate that a mitigation action is included in the 'with measures' projection.

<sup>b</sup> To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors, cross-cutting, as appropriate.

<sup>c</sup> To the extent possible, the following types of instrument should be used: economic, fiscal, voluntary agreement, regulatory, information, education, research, other.

<sup>d</sup> To the extent possible, the following descriptive terms should be used to report on the status of implementation: implemented, adopted, planned.

<sup>e</sup> Additional information may be provided on the cost of the mitigation actions and the relevant timescale.

<sup>f</sup> Optional year or years deemed relevant by the Party.

Information on the effective quantity of units from market-based mechanisms under the Convention is provided in CTF Table 4. Recommendations from the TRR (FCCC/TRR.3/LIE) have been incorporated as feasible in Liechtenstein's BR4. Information about earlier reviews is provided in the earlier BRs.

Table 4  
Reporting on progress<sup>a, b</sup>

LIE\_BR4\_v0.2

Year <sup>c</sup>	Total emissions excluding LULUCF	Contribution from LULUCF <sup>d</sup>	Quantity of units from market based mechanisms under the Convention		Quantity of units from other market based mechanisms	
	(kt CO <sub>2</sub> eq)	(kt CO <sub>2</sub> eq)	(number of units)	(kt CO <sub>2</sub> eq)	(number of units)	(kt CO <sub>2</sub> eq)
Base year/period (1990)			NA <sup>e</sup>			
2010						
2011						
2012						
2013						
2014				0.00 <sup>e</sup>		
2015				0.00 <sup>e</sup>		
2016				150.32 <sup>e</sup>		
2017				50.93 <sup>e</sup>		

Abbreviation: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> For the base year, information reported on the emission reduction target shall include the following: (a) total GHG emissions, excluding emissions and removals from the LULUCF sector; (b) emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the Conference of the Parties and the activities and/or land that will be accounted for; (c) total GHG emissions, including emissions and removals from the LULUCF sector. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraphs 9(a-c) of the UNFCCC biennial reporting guidelines for developed country Parties, information on the use of units from market-based mechanisms.

<sup>c</sup> Parties may add additional rows for years other than those specified below.

<sup>d</sup> Information in this column should be consistent with the information reported in table 4(a)I or 4(a)II, as appropriate. The Parties for which all relevant information on the LULUCF contribution is reported in table 1 of this common tabular format can refer to table 1.

Table 4(a)I

LIE\_BR4\_v0.2

**Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2017** <sup>a,b</sup>

	<i>Net GHG emissions/removals from LULUCF categories</i> <sup>c</sup>	<i>Base year/period or reference level value</i> <sup>d</sup>	<i>Contribution from LULUCF for reported year</i>	<i>Cumulative contribution from LULUCF</i> <sup>e</sup>	<i>Accounting approach</i> <sup>f</sup>
	<i>(kt CO<sub>2</sub> eq)</i>				
Total LULUCF					Land-based approach
A. Forest land					Land-based approach
1. Forest land remaining forest land					Land-based approach
2. Land converted to forest land					Land-based approach
3. Other <sup>g</sup>					Land-based approach
B. Cropland					Land-based approach
1. Cropland remaining cropland					Land-based approach
2. Land converted to cropland					Land-based approach
3. Other <sup>g</sup>					Land-based approach
C. Grassland					Land-based approach
1. Grassland remaining grassland					Land-based approach
2. Land converted to grassland					Land-based approach
3. Other <sup>g</sup>					Land-based approach
D. Wetlands					Land-based approach
1. Wetland remaining wetland					Land-based approach
2. Land converted to wetland					Land-based approach
3. Other <sup>g</sup>					Land-based approach
E. Settlements					Land-based approach
1. Settlements remaining settlements					Land-based approach
2. Land converted to settlements					Land-based approach
3. Other <sup>g</sup>					Land-based approach
F. Other land					Land-based approach
1. Other land remaining other land					Land-based approach
2. Land converted to other land					Land-based approach
3. Other <sup>g</sup>					Land-based approach
G. Other					Land-based approach
Harvested wood products					Land-based approach

*Abbreviations:* GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

<sup>c</sup> For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for the reporting under the Convention or its Kyoto Protocol, explain in the biennial report how the value was derived.

<sup>d</sup> Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

<sup>e</sup> If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

<sup>f</sup> Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant accounting parameters (i.e. natural disturbances, caps).

<sup>g</sup> Specify what was used for the category "other". Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or its Kyoto Protocol.

Table 4(a)I

LIE\_BR4\_v0.2

**Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2018<sup>a, b</sup>**

	Net GHG emissions/removals from LULUCF categories <sup>c</sup>	Base year/period or reference level value <sup>d</sup>	Contribution from LULUCF for reported year	Cumulative contribution from LULUCF <sup>e</sup>	Accounting approach <sup>f</sup>
	(kt CO <sub>2</sub> eq)				
Total LULUCF					Land-based approach
A. Forest land					Land-based approach
1. Forest land remaining forest land					Land-based approach
2. Land converted to forest land					Land-based approach
3. Other <sup>g</sup>					Land-based approach
B. Cropland					Land-based approach
1. Cropland remaining cropland					Land-based approach
2. Land converted to cropland					Land-based approach
3. Other <sup>g</sup>					Land-based approach
C. Grassland					Land-based approach
1. Grassland remaining grassland					Land-based approach
2. Land converted to grassland					Land-based approach
3. Other <sup>g</sup>					Land-based approach
D. Wetlands					Land-based approach
1. Wetland remaining wetland					Land-based approach
2. Land converted to wetland					Land-based approach
3. Other <sup>g</sup>					Land-based approach
E. Settlements					Land-based approach
1. Settlements remaining settlements					Land-based approach
2. Land converted to settlements					Land-based approach
3. Other <sup>g</sup>					Land-based approach
F. Other land					Land-based approach
1. Other land remaining other land					Land-based approach
2. Land converted to other land					Land-based approach
3. Other <sup>g</sup>					Land-based approach
G. Other					Land-based approach
Harvested wood products					Land-based approach

Abbreviations : GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

<sup>c</sup> For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for the reporting under the Convention or its Kyoto Protocol, explain in the biennial report how the value was derived.

<sup>d</sup> Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

<sup>e</sup> If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

<sup>f</sup> Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant accounting parameters (i.e. natural disturbances, caps).

<sup>g</sup> Specify what was used for the category "other". Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or its Kyoto Protocol.

Table 4(a)II

LIE\_BR4\_v0.2

Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol<sup>a,b,c</sup>

Source: Submission 2020 v1, LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	Base year <sup>d</sup>	Net emissions/removals <sup>e</sup>									Accounting parameters <sup>f</sup>	Accounting quantity <sup>g</sup>	
		2013	2014	2015	2016	2017	2018	2019	2020	Total <sup>h</sup>			
(kt CO <sub>2</sub> eq)													
A. Article 3.3 activities													
A.1. Afforestation/reforestation		-0.29	-0.30	-0.31	-0.32	-0.32						-1.55	-1.55
Excluded emissions from natural disturbances(5)		NO	NO	NO	NO	NO						NO	NO
Excluded subsequent removals from land subject to natural disturbances(6)		NO	NO	NO	NO	NO						NO	NO
A.2. Deforestation		4.47	4.57	4.68	4.76	4.60						23.09	23.09
B. Article 3.4 activities													
B.1. Forest management												7.86	6.06
Net emissions/removals		5.43	5.33	-0.26	-2.17	-0.46						7.86	
Excluded emissions from natural disturbances(5)		NO	NO	NO	NO	NO						NO	NO
Excluded subsequent removals from land subject to natural disturbances(6)		NO	NO	NO	NO	NO						NO	NO
Any debits from newly established forest (CEF-ne)(7,j)(8)													
Forest management reference level (FMRL)(9)												0.10	
Technical corrections to FMRL(10)												0.26	
Forest management cap <sup>k</sup>												64.17	6.06
B.2. Cropland management (if elected)		NO	NO	NO	NO	NO						NO	NO
B.3. Grazing land management (if elected)		NO	NO	NO	NO	NO						NO	NO
B.4. Revegetation (if elected)		NO	NO	NO	NO	NO						NO	NO
B.5. Wetland drainage and rewetting (if elected)		NO	NO	NO	NO	NO						NO	NO

Note: 1 kt CO<sub>2</sub> eq equals 1 Gg CO<sub>2</sub> eq.

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> Developed country Parties with a quantified economy-wide emission reduction target as communicated to the secretariat and contained in document FCCC/SB/2011/INF.1/Rev.1 or any update to that document, that are Parties to the Kyoto Protocol, may use table 4(a)II for reporting of accounting quantities if LULUCF is contributing to the attainment of that target.

<sup>c</sup> Parties can include references to the relevant parts of the national inventory report, where accounting methodologies regarding LULUCF are further described in the documentation box or in the biennial report.

<sup>d</sup> Net emissions and removals in the Party's base year, as established by decision 9/CP.2.

<sup>e</sup> All values are reported in the information table on accounting for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, of the CRF for the relevant inventory year as reported in the current submission and are automatically entered in this table.

<sup>f</sup> Additional columns for relevant years should be added, if applicable.

<sup>g</sup> Cumulative net emissions and removals for all years of the commitment period reported in the current submission.

<sup>h</sup> The values in the cells "3.3 offset" and "Forest management cap" are absolute values.

<sup>i</sup> The accounting quantity is the total quantity of units to be added to or subtracted from a Party's assigned amount for a particular activity in accordance with the provisions of Article 7, paragraph 4, of the Kyoto Protocol.

<sup>j</sup> In accordance with paragraph 4 of the annex to decision 16/CMP.1, debits resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than the credits accounted for on that unit of land.

<sup>k</sup> In accordance with paragraph 10 of the annex to decision 16/CMP.1, for the first commitment period a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3 paragraph 3, may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

<sup>l</sup> In accordance with paragraph 11 of the annex to decision 16/CMP.1, for the first commitment period of the Kyoto Protocol only, additions to and subtractions from the assigned amount of a Party resulting from Forest management under Article 3, paragraph 4, after the application of paragraph 10 of the annex to decision 16/CMP.1 and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

Table 4(b)  
Reporting on progress<sup>a, b, c</sup>

LIE\_BR4\_v0.2

Units of market based mechanisms			Year	
			2017	2018
Kyoto Protocol units <sup>d</sup>	Kyoto Protocol units	(number of units)	150323	50938
		(kt CO <sub>2</sub> eq)		
	AAUs	(number of units)		
		(kt CO <sub>2</sub> eq)		
	ERUs	(number of units)		
		(kt CO <sub>2</sub> eq)		
	CERs	(number of units)	150323	50938
		(kt CO <sub>2</sub> eq)		
tCERs	(number of units)			
	(kt CO <sub>2</sub> eq)			
ICERs	(number of units)			
	(kt CO <sub>2</sub> eq)			
Other units <sup>d, e</sup>	Units from market-based mechanisms under the Convention	(number of units)		
		(kt CO <sub>2</sub> eq)		
	Units from other market-based mechanisms	(number of units)		
		(kt CO <sub>2</sub> eq)		
Total	(number of units)	150323	50938	
	(kt CO <sub>2</sub> eq)			

*Abbreviations*: AAUs = assigned amount units, CERs = certified emission reductions, ERUs = emission reduction units, ICERs = long-term certified emission reductions, tCERs = temporary certified emission reductions.

Note: 2011 is the latest reporting year.

<sup>a</sup> Reporting by a developed country Party on the information specified in the common tabular format does not prejudice the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

<sup>b</sup> For each reported year, information reported on progress made towards the emission reduction target shall include, in addition to the information noted in paragraphs 9(a-c) of the reporting guidelines, on the use of units from market-based mechanisms.

<sup>c</sup> Parties may include this information, as appropriate and if relevant to their target.

<sup>d</sup> Units surrendered by that Party for that year that have not been previously surrendered by that or any other Party.

<sup>e</sup> Additional rows for each market-based mechanism should be added, if applicable.

## 5. Projections and the total effect of policies and measures

This chapter covers Liechtenstein's greenhouse gas emissions under the three scenarios 'without measures' (WOM), 'with existing measures' (WEM) and 'with additional measures' (WAM) according to the guidelines for the preparation of national communications (UNFCCC 2017):

- The 'without measures' (WOM) scenario projection excludes all policies and measures implemented, adopted or planned after the year chosen as the starting point for that projection. Similar to past projections (e.g. BR2 or NC6), this starting point is the year 2008.
- The 'with existing measures' (WEM) scenario projection encompasses currently implemented and adopted policies and measures. In Liechtenstein, projections based on specific measures are only available for the sector Energy (1A Fuel combustion). For the waste sector, a projection exists in Liechtenstein's Waste Plan (Liechtensteiner Abfallplanung 2012-2070, Government 2011). Further projections for the sectors Energy (1B Fugitive emissions from fuels) as well as for IPPU (2) and Agriculture (3) were adopted from Switzerland's WEM projection in its latest national communication (FOEN 2018). The projections for LULUCF were assumed to be constant (mean of the latest five inventory years) and the projection of international bunkers is based on a linear extrapolation of the reported inventory data.
- The 'with additional measures' (WAM) scenario projection also encompasses planned policies and measures. In Liechtenstein, additional measures only exist in the energy sector. Where necessary, the WAM scenario from Switzerland's latest national communication was adopted (FOEN 2018).

The sector Energy is dominating Liechtenstein's greenhouse gas emissions. In the year 2017, emissions from this sector amounted 81.3% of Liechtenstein's total emissions (see section 2.2.3). Therefore, the focus for the elaboration of Liechtenstein's projections in its BR4 lies on the Energy sector and thereby on the Energy Strategy 2020.

### 5.1 Projections

#### 5.1.1 Legal basis

The following acts directly impact (total) greenhouse gas emissions in Liechtenstein:

- Environment: Environmental Protection Act
- Climate: Emissions Trading Act and CO<sub>2</sub> Act
- Energy: Energy Efficiency Act
- Transport: HVF, promotion of public transport and green vehicles/fuels
- Agriculture / Forestry: Forestry Act
- Waste: Environmental Protection Act, Technical ordinance on waste

Based on these acts, a number of policies and measures have already been implemented, are currently being implemented or are planned.

### 5.1.2 Policies and measures considered

This chapter gives an overview over estimated mitigation impacts of its reported policies and measures.

#### Sector 1 Energy

The greenhouse gas reduction measures described in this section are taken from the Energy Efficiency Act (EEG 2008) and from Liechtenstein's Energy Strategy (Government 2012b).

Under the **Energy Efficiency Act** (EEG 2008), Liechtenstein introduced various measures to counter rising energy consumption. The most relevant measures in place are subsidies for the refurbishment of old buildings, solar collector systems and substitution of conventional heating to heat pumps and wood firing. In addition, municipalities in Liechtenstein individually complement these national measures. Further activities such as private energy savings initiatives (e.g. new heating) are not related to the EEG but also relevant for emission reductions.

**Liechtenstein's Energy Strategy 2020** consists of a package of energy related measures. The target of the strategy is to reduce greenhouse gas emissions by 20% in 2020 compared to 2008. It distinguishes three scenarios:

- Scenario 1: Business as usual. Measures and instruments that are already in place are continued, but no further measures are planned. According to Scenario 1, energy use would increase by 12% (2008-2020) and the share of renewable would rise to 12.5% (compared to 8.2% in 2008).
- Scenario 2: Stabilizing energy use by energy efficiency and increasing the share of renewable energy. According to Scenario 2, energy use would stay constant between 2008 and 2020 and the share of renewable energy should rise to 20% (compared to 8.2% in 2008).
- Scenario 3: Forcing energy efficiency and renewable energies. According to Scenario 3, energy use would be reduced by 20% between 2008 and 2020 and the share of renewable energy should rise to 40% (compared to 8.2% in 2008).

For Liechtenstein's BR4, Scenario 2 from the Energy Strategy 2020 is chosen as basis for the WEM and WAM scenarios in the energy sector. This scenario is also specifically focused on in the "Action Plan Energy" that is presented in the Energy Strategy. The WEM scenario covers measures that are already implemented and that are planned to continue after 2020. The WAM scenario covers more pronounced or additional measures (mainly to be implemented and have an impact between 2020 and 2030).

In 2017, the Government published a half-time report (Government 2017) and updated the expected emission reductions of several measures. Liechtenstein's Energy Strategy 2020 will be updated to a longer time range in the coming years.

Table 5-1 shows the aggregated effect of those measures in the energy sub-sectors. Table 5-2 shows the measures considered in the energy sector for each scenario WOM, WEM and WAM (considering the updated reduction expectations from the half-time report of the Energy Strategy 2020).

No projections for sector 1B Fugitive emissions from fuel use are available for Liechtenstein. Therefore, the Swiss projections were adopted. Due to the bilateral agreement on environmental levies between Switzerland and Liechtenstein, the Swiss projections can be adopted due to similar circumstances in Liechtenstein.

Table 5-1 Aggregated effect of considered measures in the energy sector (emissions, cumulated over five years period)

Sector	Measure	Scenario	Expected emission reductions [t CO <sub>2</sub> eq]			
			2018-2020	2021-2025	2026-2030	Total
1A1	Energy industries (total)	WOM	-	-	-	-
		WEM	-59	-	-	-59
		WAM	-59	-	-	-59
1A2	Manufacturing industries and construction (total)	WOM	-	-	-	-
		WEM	5'862	66	66	5'994
		WAM	5'862	66	66	5'994
1A3	Transport (total)	WOM	-	-	-	-
		WEM	562	1'404	4'289	6'255
		WAM	562	2'554	7'739	10'855
1A4	Other sectors (total)	WOM	-	-	-	-
		WEM	11'590	5'376	5'376	22'343
		WAM	11'590	8'561	8'561	28'713
1A5	Other (total)	WOM	<i>NO</i>	<i>NO</i>	<i>NO</i>	<i>NO</i>
		WEM	<i>NO</i>	<i>NO</i>	<i>NO</i>	<i>NO</i>
		WAM	<i>NO</i>	<i>NO</i>	<i>NO</i>	<i>NO</i>
1A	Fuel combustion (total)	WOM	-	-	-	-
		WEM	17'955	6'846	9'731	<b>34'532</b>
		WAM	17'955	11'181	16'366	<b>45'502</b>

Table 5-2 Measures considered for projections of emissions, cumulated over five years period, from the energy sector (negative sign refers to an increase instead of a reduction).

Sector	Measure	Scenario	Expected emission reductions [t CO <sub>2</sub> eq]			
			2018-2020	2021-2025	2026-2030	Total
1A1	Electricity generation with combined heat and power	WOM	-	-	-	-
		WEM	-59	-	-	-59
		WAM	-59	-	-	-59
1A2	Efficiency measures in industry and commerce	WOM	-	-	-	-
		WEM	39	66	66	171
		WAM	39	66	66	171
1A2	Use of heat recovery in industry and development of heat distribution	WOM	-	-	-	-
		WEM	4'292	-	-	4'292
		WAM	4'292	-	-	4'292
1A2 1A4	(Energetic) renovation of buildings	WOM	-	-	-	-
		WEM	1'971	1'095	1'095	4'161
		WAM	1'971	1'095	1'095	4'161
1A2 1A4	Incentive system "Minergie" standard (buildings)	WOM	-	-	-	-
		WEM	53	88	88	228
		WAM	53	88	88	228
1A2 1A4	Solar collectors and heat pump boilers	WOM	-	-	-	-
		WEM	488	690	690	1'868
		WAM	488	690	690	1'868
1A2 1A4	Wood heatings	WOM	-	-	-	-
		WEM	329	-	-	329
		WAM	329	-	-	329
1A2 1A4	Standards for electrical equipment and illumination	WOM	-	-	-	-
		WEM	5'376	-	-	5'376
		WAM	5'376	-	-	5'376
1A2 1A4	Incentive systems for energy suppliers	WOM	-	-	-	-
		WEM	1'072	-	-	1'072
		WAM	1'072	-	-	1'072
1A2 1A4	Use of biogas	WOM	-	-	-	-
		WEM	1'205	-	-	1'205
		WAM	1'205	-	-	1'205
1A2 1A4	Heating pumps (increased replacement of oil and gas heating)	WOM	-	-	-	-
		WEM	2'628	2'190	2'190	7'008
		WAM	2'628	5'375	5'375	13'378
1A3	Electric vehicles	WOM	-	-	-	-
		WEM	562	1'404	1'989	3'955
		WAM	562	1'404	1'989	3'955
1A3	Efficiency standards for road vehicles	WOM	-	-	-	-
		WEM	-	-	2'300	2'300
		WAM	-	1'150	5'750	6'900
1A4	New standards for new buildings	WOM	-	-	-	-
		WEM	-	1'314	1'314	2'628
		WAM	-	1'314	1'314	2'628

### 5.1.3 Without Measures (WOM) scenario

The WOM scenario for Liechtenstein's BR4 is generally based on the WOM scenario from Liechtenstein's Sixth National Communication (NC6, OE 2014). The starting year for the WOM is 2008. This was also the starting year for the WOM scenario in Liechtenstein's NC6. 2008 was the year when the Energy Efficiency Act was adopted in Liechtenstein, and no oth-

er (quantifiable) measures were implemented earlier than 2008 in Liechtenstein. The WOM scenario assumes that no measures were or will be implemented in the years 2008-2030.

The projection of the WOM scenario is shown in chapter 5.2.1.

#### 5.1.4 With Existing Measures (WEM) scenario

The most relevant reduction potentials in the WEM scenario are in the Energy sector. The potentials are defined through the Energy Efficiency Act and the Energy Strategy 2020.

The projections under the WEM scenario for the greenhouse gases CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and F-Gases are shown below. Note that no projections are available for precursor gases and SO<sub>2</sub>. NF<sub>3</sub> is not occurring (NO) in Liechtenstein.

#### Projection of CO<sub>2</sub> emissions in the WEM scenario

Table 5-3 and Figure 5-1 show the development of CO<sub>2</sub> emissions between 1990 and 2030.

From 1990 to 2017 (reported values), CO<sub>2</sub> emissions (excl. LULUCF) decreased by 22.0%. CO<sub>2</sub> emissions are dominated from the sector Energy. The fluctuations in the development of the emissions are mainly due to different weather conditions (warm and cold winters) and therefore fluctuating heating degree days influencing category 1A4 Other sectors.

From 2017 to 2030, a further reduction of CO<sub>2</sub> emissions (excl. LULUCF) by 22.1% is predicted. A major share of these projected reductions is attributed to sector 1A4 Other sectors and 1A2 Manufacturing industries and construction, and in particular to the measures from the Energy Strategy 2020: (energetic) renovation of buildings and heating pumps. Less pronounced reductions are also predicted for sectors 1A3 Transport and 1A1 Energy industries.

In total, the reduction of CO<sub>2</sub> emissions (excl. LULUCF) under the WEM scenario in the period 1990-2030 is assumed to amount 39.2%.

Table 5-3 CO<sub>2</sub> emissions by sector for the WEM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

CO <sub>2</sub> in kt CO <sub>2</sub> eq		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WEM)</b>	<b>198.97</b>	<b>204.20</b>	<b>216.85</b>	<b>228.97</b>	<b>190.81</b>	<b>158.93</b>	<b>155.14</b>	<b>137.34</b>	<b>130.55</b>	<b>120.90</b>
<b>1</b>	<b>Energy</b>	<b>198.70</b>	<b>203.98</b>	<b>216.63</b>	<b>228.71</b>	<b>190.60</b>	<b>158.74</b>	<b>154.95</b>	<b>137.16</b>	<b>130.38</b>	<b>120.74</b>
<b>1A</b>	Fuel combustion	198.70	203.98	216.63	228.71	190.60	158.74	154.95	137.16	130.38	120.74
	1A1 Energy industries	0.12	2.00	2.67	3.03	3.15	2.02	2.09	2.15	2.15	2.15
	1A2 Manufacturing industries & constr.	36.19	35.60	36.31	39.03	25.98	27.25	27.31	21.47	21.41	21.34
	1A3 Transport	75.36	80.30	89.84	81.07	77.06	60.71	59.88	59.33	57.93	53.67
	1A4 Other sectors	87.02	86.09	87.81	105.58	84.41	68.75	65.67	54.21	48.90	43.58
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>2</b>	<b>Industrial processes and product use</b>	<b>0.20</b>	<b>0.16</b>	<b>0.17</b>	<b>0.20</b>	<b>0.15</b>	<b>0.14</b>	<b>0.14</b>	<b>0.13</b>	<b>0.12</b>	<b>0.10</b>
<b>3</b>	<b>Agriculture</b>	<b>0.06</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.04</b>	<b>0.05</b>	<b>0.04</b>	<b>0.04</b>	<b>0.04</b>	<b>0.04</b>
<b>4</b>	<b>LULUCF</b>	<b>6.64</b>	<b>4.31</b>	<b>24.47</b>	<b>8.09</b>	<b>19.84</b>	<b>10.64</b>	<b>10.13</b>	<b>12.28</b>	<b>12.28</b>	<b>12.28</b>
<b>5</b>	<b>Waste</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.43</b>	<b>0.43</b>	<b>0.49</b>	<b>0.48</b>	<b>0.84</b>	<b>1.19</b>	<b>0.86</b>	<b>0.93</b>	<b>1.05</b>	<b>1.17</b>

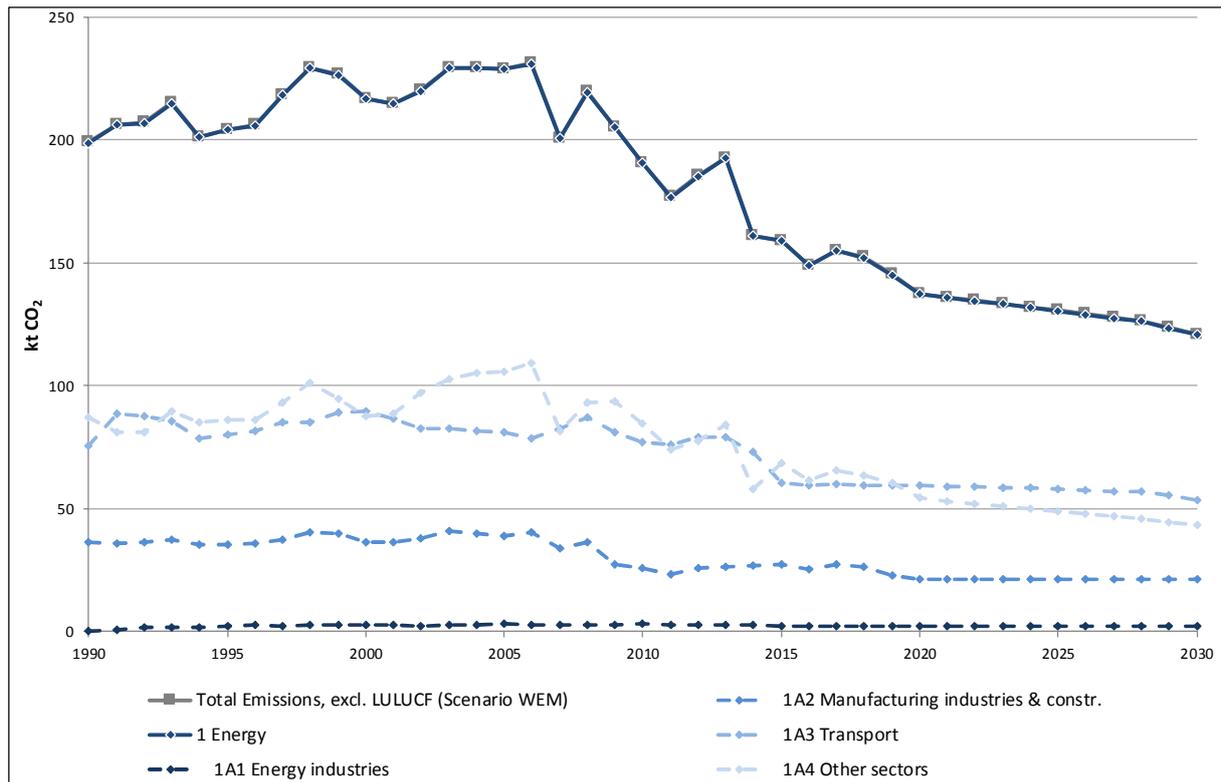


Figure 5-1 CO<sub>2</sub> emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WEM

**Projection of CH<sub>4</sub> emissions in the WEM scenario**

Table 5-4 and Figure 5-2 show the development of CH<sub>4</sub> emissions between 1990 and 2030.

From 1990 to 2017 (reported values), CH<sub>4</sub> emissions (excl. LULUCF) decreased by 5.8%. The main contributor to CH<sub>4</sub> emissions is the sector Agriculture, where animal numbers have a high influence on emissions (especially category 3A Enteric fermentation).

From 2017 to 2030, a further reduction of CH<sub>4</sub> emissions (excl. LULUCF) by 2.4% is predicted due to slight reductions in sectors Energy and Agriculture.

In total, the reduction of CH<sub>4</sub> emissions (excl. LULUCF) under the WEM scenario in the period 1990-2030 is assumed to amount 8.1%.

Table 5-4 CH<sub>4</sub> emissions by sector for the WEM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

CH <sub>4</sub> in kt CO <sub>2</sub> eq											
IPCC	Source/Sink Categories	1990	1995	2000	2005	Reported data (GHG inventories)			Projections		
						2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WEM)</b>	<b>19.12</b>	<b>17.91</b>	<b>16.74</b>	<b>18.42</b>	<b>18.85</b>	<b>18.41</b>	<b>18.00</b>	<b>17.78</b>	<b>17.59</b>	<b>17.57</b>
<b>1</b>	<b>Energy</b>	<b>1.22</b>	<b>1.32</b>	<b>1.55</b>	<b>1.72</b>	<b>1.70</b>	<b>1.64</b>	<b>1.65</b>	<b>1.58</b>	<b>1.55</b>	<b>1.53</b>
<b>1A</b>	Fuel combustion	0.85	0.72	0.72	0.64	0.57	0.49	0.47	0.40	0.37	0.34
	1A1 Energy industries	0.00	0.02	0.03	0.04	0.04	0.02	0.02	0.02	0.02	0.02
	1A2 Manufacturing industries & constr.	0.05	0.06	0.06	0.06	0.04	0.04	0.05	0.04	0.04	0.04
	1A3 Transport	0.53	0.39	0.33	0.19	0.12	0.06	0.05	0.05	0.05	0.04
	1A4 Other sectors	0.27	0.26	0.30	0.34	0.38	0.36	0.35	0.29	0.26	0.23
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	Fugitive emissions from fuels	0.36	0.60	0.83	1.09	1.13	1.15	1.18	1.18	1.18	1.19
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	0.36	0.60	0.83	1.09	1.13	1.15	1.18	1.18	1.18	1.19
<b>2</b>	<b>Industrial processes and product use</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>
<b>3</b>	<b>Agriculture</b>	<b>16.72</b>	<b>15.46</b>	<b>14.04</b>	<b>15.53</b>	<b>16.10</b>	<b>15.92</b>	<b>15.51</b>	<b>15.30</b>	<b>15.14</b>	<b>15.14</b>
<b>4</b>	<b>LULUCF</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>
<b>5</b>	<b>Waste</b>	<b>1.18</b>	<b>1.12</b>	<b>1.15</b>	<b>1.17</b>	<b>1.05</b>	<b>0.85</b>	<b>0.85</b>	<b>0.90</b>	<b>0.90</b>	<b>0.90</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

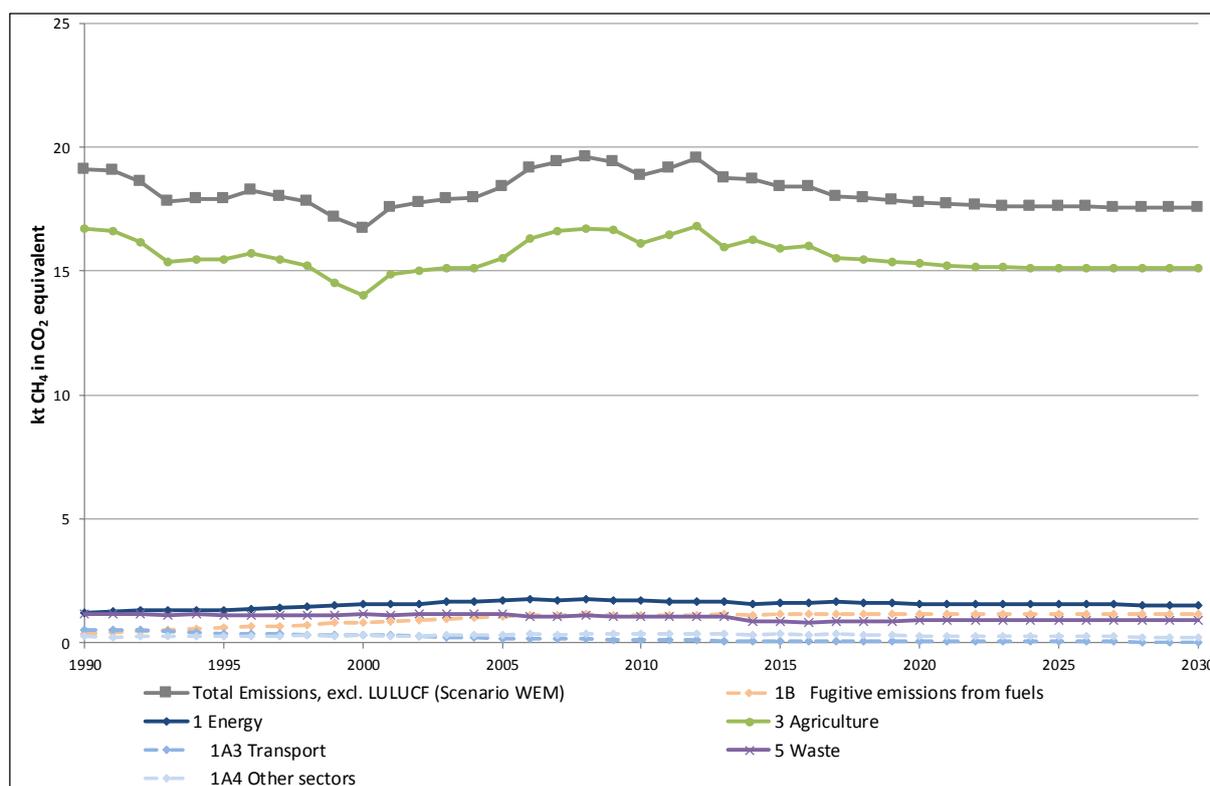


Figure 5-2 CH<sub>4</sub> emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WEM

**Projection of N<sub>2</sub>O emissions in the WEM scenario**

Table 5-5 and Figure 5-3 show the development of N<sub>2</sub>O emissions between 1990 and 2030.

From 1990 to 2017 (reported values), N<sub>2</sub>O emissions (excl. LULUCF) decreased by 10.8%. Similar to CH<sub>4</sub>, the main contributor to N<sub>2</sub>O emissions is the sector Agriculture, where animal numbers have a high influence on emissions (especially category 3A Enteric fermentation).

From 2017 to 2030, a further reduction of N<sub>2</sub>O emissions (excl. LULUCF) by 4.1% is predicted due to slight reductions in sectors Energy and Agriculture.

In total, the reduction of N<sub>2</sub>O emissions (excl. LULUCF) under the WEM scenario in the period 1990-2030 is assumed to amount 14.4%.

Table 5-5 N<sub>2</sub>O emissions by sector for the WEM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

N <sub>2</sub> O in kt CO <sub>2</sub> eq		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WEM)</b>	<b>10.91</b>	<b>10.63</b>	<b>9.88</b>	<b>9.89</b>	<b>10.00</b>	<b>9.92</b>	<b>9.73</b>	<b>9.56</b>	<b>9.42</b>	<b>9.33</b>
<b>1</b>	<b>Energy</b>	<b>1.15</b>	<b>1.48</b>	<b>1.59</b>	<b>1.02</b>	<b>1.04</b>	<b>0.87</b>	<b>0.87</b>	<b>0.78</b>	<b>0.73</b>	<b>0.67</b>
<b>1A</b>	<b>Fuel combustion</b>	<b>1.15</b>	<b>1.48</b>	<b>1.59</b>	<b>1.02</b>	<b>1.04</b>	<b>0.87</b>	<b>0.87</b>	<b>0.78</b>	<b>0.73</b>	<b>0.67</b>
	1A1 Energy industries	0.05	0.06	0.07	0.07	0.07	0.00	0.01	0.01	0.01	0.01
	1A2 Manufacturing industries & constr.	0.09	0.08	0.08	0.09	0.08	0.09	0.09	0.07	0.07	0.07
	1A3 Transport	0.75	1.10	1.12	0.50	0.46	0.35	0.36	0.35	0.35	0.32
	1A4 Other sectors	0.26	0.25	0.31	0.35	0.43	0.43	0.42	0.34	0.31	0.28
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	<b>Fugitive emissions from fuels</b>	<b>NO,NA</b>	<b>NO,NA</b>	<b>NO,NA</b>	<b>NO,NA</b>	<b>NO,NA</b>	<b>NO,NA</b>	<b>NO,NA</b>	<b>NO,NA</b>	<b>NO,NA</b>	<b>NO,NA</b>
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
<b>2</b>	<b>Industrial processes and product use</b>	<b>0.45</b>	<b>0.36</b>	<b>0.26</b>	<b>0.23</b>	<b>0.20</b>	<b>0.20</b>	<b>0.21</b>	<b>0.19</b>	<b>0.17</b>	<b>0.15</b>
<b>3</b>	<b>Agriculture</b>	<b>8.73</b>	<b>8.17</b>	<b>7.40</b>	<b>7.99</b>	<b>8.05</b>	<b>8.12</b>	<b>7.93</b>	<b>7.83</b>	<b>7.74</b>	<b>7.74</b>
<b>4</b>	<b>LULUCF</b>	<b>0.31</b>	<b>0.30</b>	<b>0.35</b>	<b>0.39</b>	<b>0.41</b>	<b>0.42</b>	<b>0.42</b>	<b>0.50</b>	<b>0.50</b>	<b>0.50</b>
<b>5</b>	<b>Waste</b>	<b>0.58</b>	<b>0.61</b>	<b>0.63</b>	<b>0.65</b>	<b>0.72</b>	<b>0.74</b>	<b>0.72</b>	<b>0.76</b>	<b>0.76</b>	<b>0.76</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>

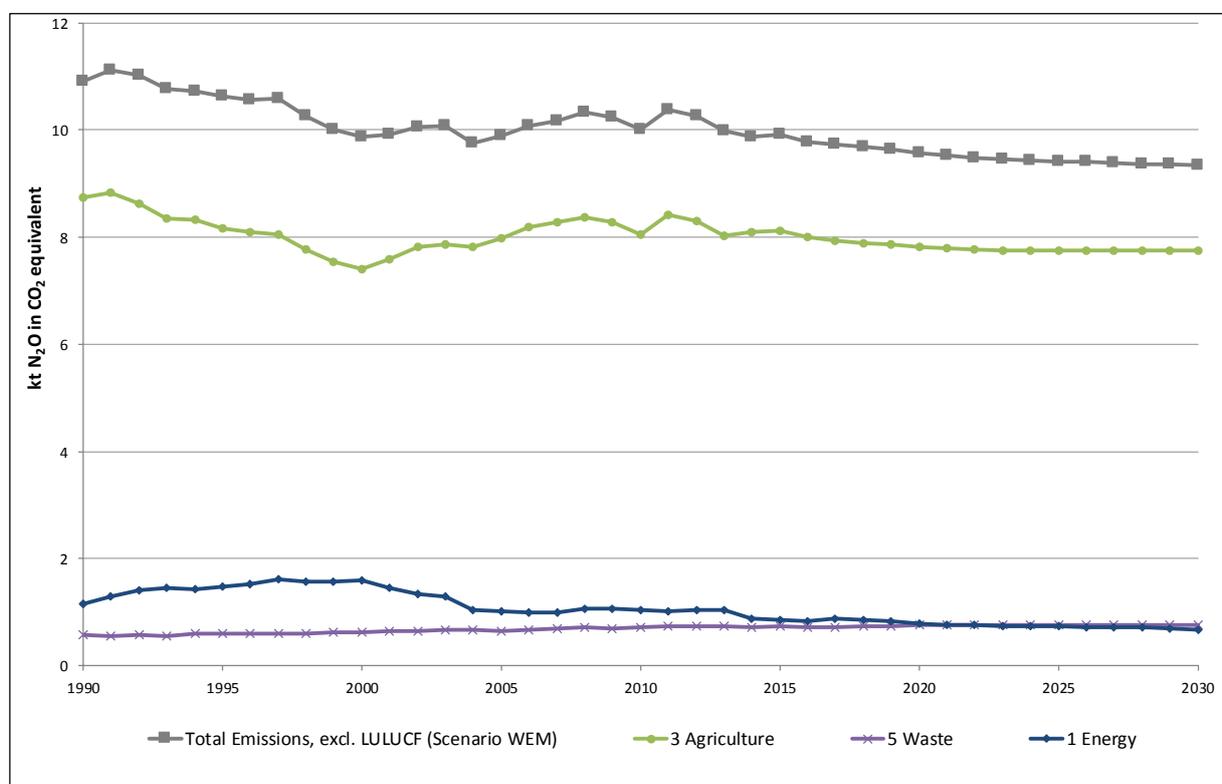


Figure 5-3 N<sub>2</sub>O emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WEM

### Projection of F-Gas emissions in the WEM scenario

Table 5-6 and Figure 5-4 show the development of F-Gas emissions (HFC, PFC and SF<sub>6</sub>) between 1990 and 2030.

From 1990 to 2017 (reported values), F-Gas emissions increased by a factor of 10<sup>5</sup>, having reached a peak in 2013. Since then, emissions have fluctuated. F-Gas emissions are vastly dominated by HFC.

From 2017 to 2030, F-Gas emissions are expected to decrease by 27.0% due to growing restrictions on the use of HFC.

In total, F-Gas emissions in the period 1990-2030 under the WEM scenario are assumed to increase by a factor of 75'000. However, the increasing trend is expected to have stopped in 2013.

Table 5-6 F-Gas emissions (HFC, PFC, SF<sub>6</sub>) by sector for the WEM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

HFC, PFC and SF <sub>6</sub> in kt CO <sub>2</sub> eq		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WEM)</b>	<b>0.00</b>	<b>1.37</b>	<b>4.21</b>	<b>7.70</b>	<b>9.80</b>	<b>10.52</b>	<b>10.75</b>	<b>10.09</b>	<b>9.15</b>	<b>7.85</b>
<b>2F</b>	Product uses as ODS substitutes	0.00	1.37	4.21	7.70	9.80	10.52	10.75	10.09	9.15	7.85
	HFC	0.00	1.37	4.11	7.38	9.71	10.45	10.69	10.03	9.10	7.80
	PFC	NO	0.00	0.01	0.07	0.07	0.04	0.02	0.02	0.01	0.01
	SF <sub>6</sub>	NO	NO	0.09	0.26	0.02	0.04	0.05	0.04	0.04	0.03



Figure 5-4 F-Gas emissions (HFC, PFC, SF<sub>6</sub>) by sector from 1990 to 2030 for the scenario WEM

### 5.1.5 With Additional Measures (WAM) scenario

The WAM scenario includes further or more ambitious measures from the Energy Efficiency Act and from the Energy Strategy 2020, in particular concerning efficiency standards for road vehicles and increased replacement of oil and gas heating with heating pumps.

**The projections under the WAM scenario for the greenhouse gases CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and F-Gases are shown below.** Note that no projections are available for precursor gases and SO<sub>2</sub>. NF<sub>3</sub> is not occurring (NO) in Liechtenstein.

#### Projection of CO<sub>2</sub> emissions in the WAM scenario

Table 5-7 and Figure 5-5 show the development of CO<sub>2</sub> emissions between 1990 and 2030. Emissions between 1990 and 2017 are the same as in the WEM scenario, see section 5.1.4.

From 2017 to 2030, a further reduction of CO<sub>2</sub> emissions (excl. LULUCF) by 29.1% is predicted. The main reasons for this reduction are the additional measures in the Energy sector under the WAM scenario: efficiency standards for road vehicles and increased replacement of oil and gas heating with heating pumps.

In total, the reduction of CO<sub>2</sub> emissions (excl. LULUCF) under the WAM scenario in the period 1990-2030 is assumed to amount 44.7%.

Table 5-7 CO<sub>2</sub> emissions by sector for the WAM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

CO <sub>2</sub> in kt CO <sub>2</sub> eq		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WAM)</b>	<b>198.97</b>	<b>204.20</b>	<b>216.85</b>	<b>228.97</b>	<b>190.81</b>	<b>158.93</b>	<b>155.14</b>	<b>137.34</b>	<b>126.26</b>	<b>110.02</b>
<b>1</b>	<b>Energy</b>	<b>198.70</b>	<b>203.98</b>	<b>216.63</b>	<b>228.71</b>	<b>190.60</b>	<b>158.74</b>	<b>154.95</b>	<b>137.16</b>	<b>126.09</b>	<b>109.88</b>
<b>1A</b>	Fuel combustion	198.70	203.98	216.63	228.71	190.60	158.74	154.95	137.16	126.09	109.88
	1A1 Energy industries	0.12	2.00	2.67	3.03	3.15	2.02	2.09	2.15	2.15	2.15
	1A2 Manufacturing industries & constr.	36.19	35.60	36.31	39.03	25.98	27.25	27.31	21.47	21.41	21.34
	1A3 Transport	75.36	80.30	89.84	81.07	77.06	60.71	59.88	59.33	56.79	49.10
	1A4 Other sectors	87.02	86.09	87.81	105.58	84.41	68.75	65.67	54.21	45.75	37.28
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>2</b>	<b>Industrial processes and product use</b>	<b>0.20</b>	<b>0.16</b>	<b>0.17</b>	<b>0.20</b>	<b>0.15</b>	<b>0.14</b>	<b>0.14</b>	<b>0.12</b>	<b>0.11</b>	<b>0.09</b>
<b>3</b>	<b>Agriculture</b>	<b>0.06</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.04</b>	<b>0.05</b>	<b>0.04</b>	<b>0.04</b>	<b>0.04</b>	<b>0.04</b>
<b>4</b>	<b>LULUCF</b>	<b>6.64</b>	<b>4.31</b>	<b>24.47</b>	<b>8.09</b>	<b>19.84</b>	<b>10.64</b>	<b>10.13</b>	<b>12.28</b>	<b>12.28</b>	<b>12.28</b>
<b>5</b>	<b>Waste</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.43</b>	<b>0.43</b>	<b>0.49</b>	<b>0.48</b>	<b>0.84</b>	<b>1.19</b>	<b>0.86</b>	<b>0.93</b>	<b>1.05</b>	<b>1.17</b>

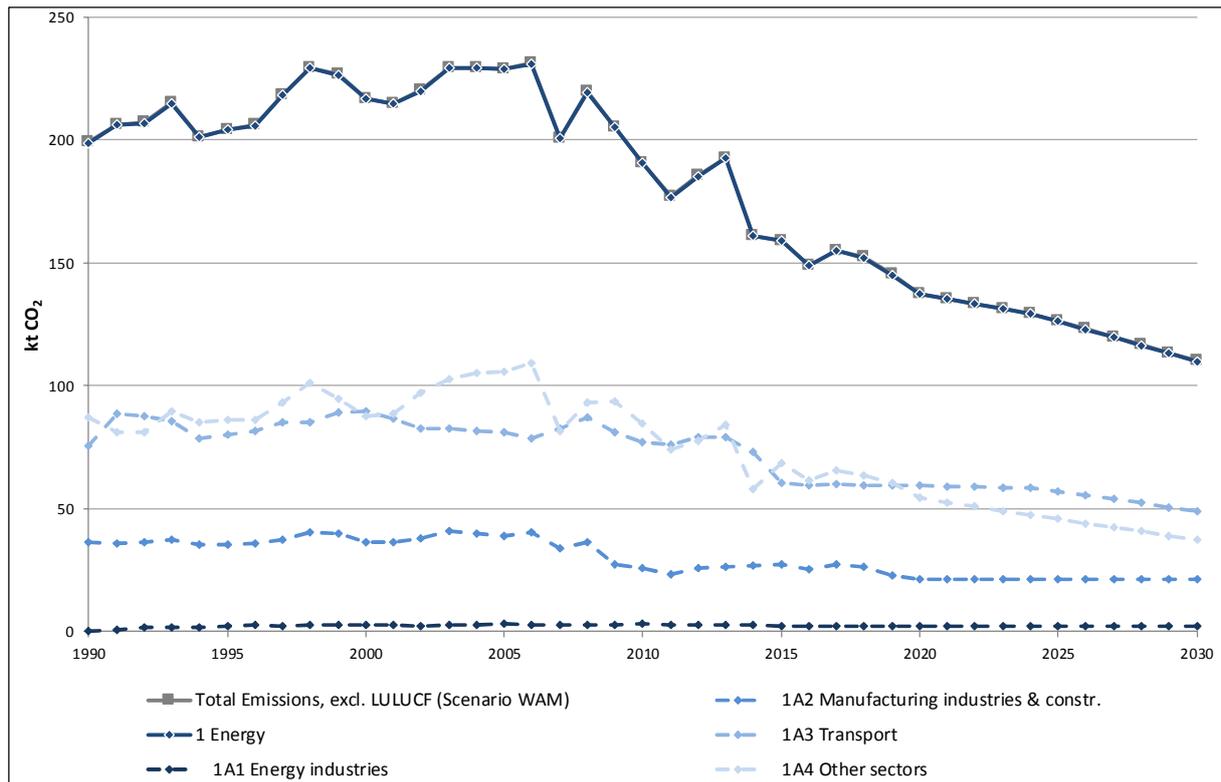


Figure 5-5 CO<sub>2</sub> emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WAM

### Projection of CH<sub>4</sub> emissions in the WAM scenario

Table 5-8 and Figure 5-6 show the development of CH<sub>4</sub> emissions between 1990 and 2030. Emissions between 1990 and 2017 are the same as in the WEM scenario, see section 5.1.4.

From 2017 to 2030, a further reduction of CH<sub>4</sub> emissions (excl. LULUCF) by 8.1% is predicted. The main reasons for this reduction are the more pronounced reductions anticipated in Switzerland's WAM scenario for the Agriculture sector.

In total, the reduction of CH<sub>4</sub> emissions (excl. LULUCF) under the WAM scenario in the period 1990-2030 is assumed to amount 13.5%.

Table 5-8 CH<sub>4</sub> emissions by sector for the WAM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

CH <sub>4</sub> in kt CO <sub>2</sub> eq		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WAM)</b>	<b>19.12</b>	<b>17.91</b>	<b>16.74</b>	<b>18.42</b>	<b>18.85</b>	<b>18.41</b>	<b>18.00</b>	<b>17.78</b>	<b>17.22</b>	<b>16.54</b>
<b>1</b>	<b>Energy</b>	<b>1.22</b>	<b>1.32</b>	<b>1.55</b>	<b>1.72</b>	<b>1.70</b>	<b>1.64</b>	<b>1.65</b>	<b>1.58</b>	<b>1.54</b>	<b>1.49</b>
<b>1A</b>	Fuel combustion	0.85	0.72	0.72	0.64	0.57	0.49	0.47	0.40	0.35	0.30
	1A1 Energy industries	0.00	0.02	0.03	0.04	0.04	0.02	0.02	0.02	0.02	0.02
	1A2 Manufacturing industries & constr.	0.05	0.06	0.06	0.06	0.04	0.04	0.05	0.04	0.04	0.04
	1A3 Transport	0.53	0.39	0.33	0.19	0.12	0.06	0.05	0.05	0.05	0.04
	1A4 Other sectors	0.27	0.26	0.30	0.34	0.38	0.36	0.35	0.29	0.24	0.20
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	Fugitive emissions from fuels	0.36	0.60	0.83	1.09	1.13	1.15	1.18	1.18	1.18	1.19
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	0.36	0.60	0.83	1.09	1.13	1.15	1.18	1.18	1.18	1.19
<b>2</b>	<b>Industrial processes and product use</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>
<b>3</b>	<b>Agriculture</b>	<b>16.72</b>	<b>15.46</b>	<b>14.04</b>	<b>15.53</b>	<b>16.10</b>	<b>15.92</b>	<b>15.51</b>	<b>15.30</b>	<b>14.79</b>	<b>14.15</b>
<b>4</b>	<b>LULUCF</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>
<b>5</b>	<b>Waste</b>	<b>1.18</b>	<b>1.12</b>	<b>1.15</b>	<b>1.17</b>	<b>1.05</b>	<b>0.85</b>	<b>0.85</b>	<b>0.90</b>	<b>0.90</b>	<b>0.90</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

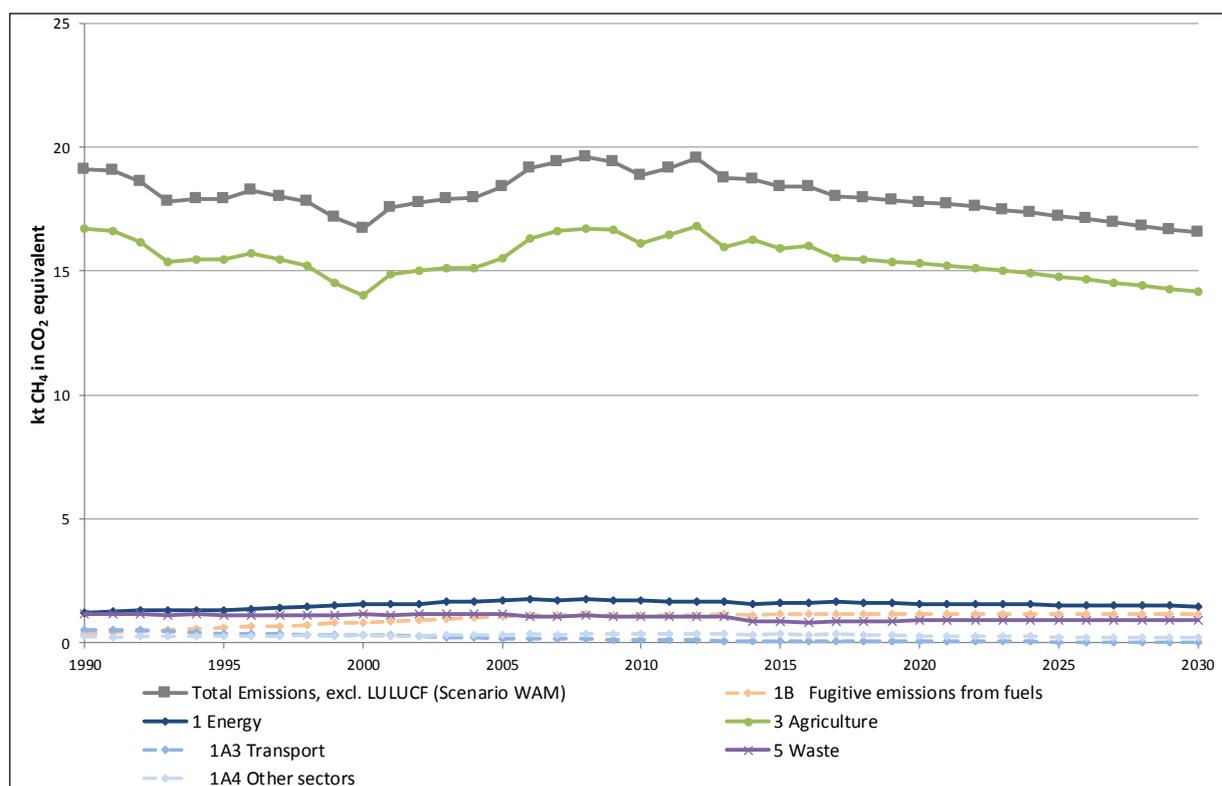


Figure 5-6 CH<sub>4</sub> emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WAM

### Projection of N<sub>2</sub>O emissions in the WAM scenario

Table 5-9 and Figure 5-7 show the development of N<sub>2</sub>O emissions between 1990 and 2030. Emissions between 1990 and 2017 are the same as in the WEM scenario, see section 5.1.4.

From 2017 to 2030, a further reduction of N<sub>2</sub>O emissions (excl. LULUCF) by 10.0% is predicted. The main reasons for this reduction are the more pronounced reductions anticipated in Switzerland's WAM scenario for the Agriculture sector.

In total, the reduction of N<sub>2</sub>O emissions (excl. LULUCF) under the WAM scenario in the period 1990-2030 is assumed to amount 19.7%.

Table 5-9 N<sub>2</sub>O emissions by sector for the WAM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

N <sub>2</sub> O in kt CO <sub>2</sub> eq		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WAM)</b>	<b>10.91</b>	<b>10.63</b>	<b>9.88</b>	<b>9.89</b>	<b>10.00</b>	<b>9.92</b>	<b>9.73</b>	<b>9.56</b>	<b>9.20</b>	<b>8.76</b>
<b>1</b>	<b>Energy</b>	<b>1.15</b>	<b>1.48</b>	<b>1.59</b>	<b>1.02</b>	<b>1.04</b>	<b>0.87</b>	<b>0.87</b>	<b>0.78</b>	<b>0.71</b>	<b>0.61</b>
<b>1A</b>	Fuel combustion	1.15	1.48	1.59	1.02	1.04	0.87	0.87	0.78	0.71	0.61
	1A1 Energy industries	0.05	0.06	0.07	0.07	0.07	0.00	0.01	0.01	0.01	0.01
	1A2 Manufacturing industries & constr.	0.09	0.08	0.08	0.09	0.08	0.09	0.09	0.07	0.07	0.07
	1A3 Transport	0.75	1.10	1.12	0.50	0.46	0.35	0.36	0.35	0.34	0.29
	1A4 Other sectors	0.26	0.25	0.31	0.35	0.43	0.43	0.42	0.34	0.29	0.24
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	Fugitive emissions from fuels	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
<b>2</b>	<b>Industrial processes and product use</b>	<b>0.45</b>	<b>0.36</b>	<b>0.26</b>	<b>0.23</b>	<b>0.20</b>	<b>0.20</b>	<b>0.21</b>	<b>0.19</b>	<b>0.17</b>	<b>0.14</b>
<b>3</b>	<b>Agriculture</b>	<b>8.73</b>	<b>8.17</b>	<b>7.40</b>	<b>7.99</b>	<b>8.05</b>	<b>8.12</b>	<b>7.93</b>	<b>7.83</b>	<b>7.56</b>	<b>7.24</b>
<b>4</b>	<b>LULUCF</b>	<b>0.31</b>	<b>0.30</b>	<b>0.35</b>	<b>0.39</b>	<b>0.41</b>	<b>0.42</b>	<b>0.42</b>	<b>0.50</b>	<b>0.50</b>	<b>0.50</b>
<b>5</b>	<b>Waste</b>	<b>0.58</b>	<b>0.61</b>	<b>0.63</b>	<b>0.65</b>	<b>0.72</b>	<b>0.74</b>	<b>0.72</b>	<b>0.77</b>	<b>0.77</b>	<b>0.77</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>

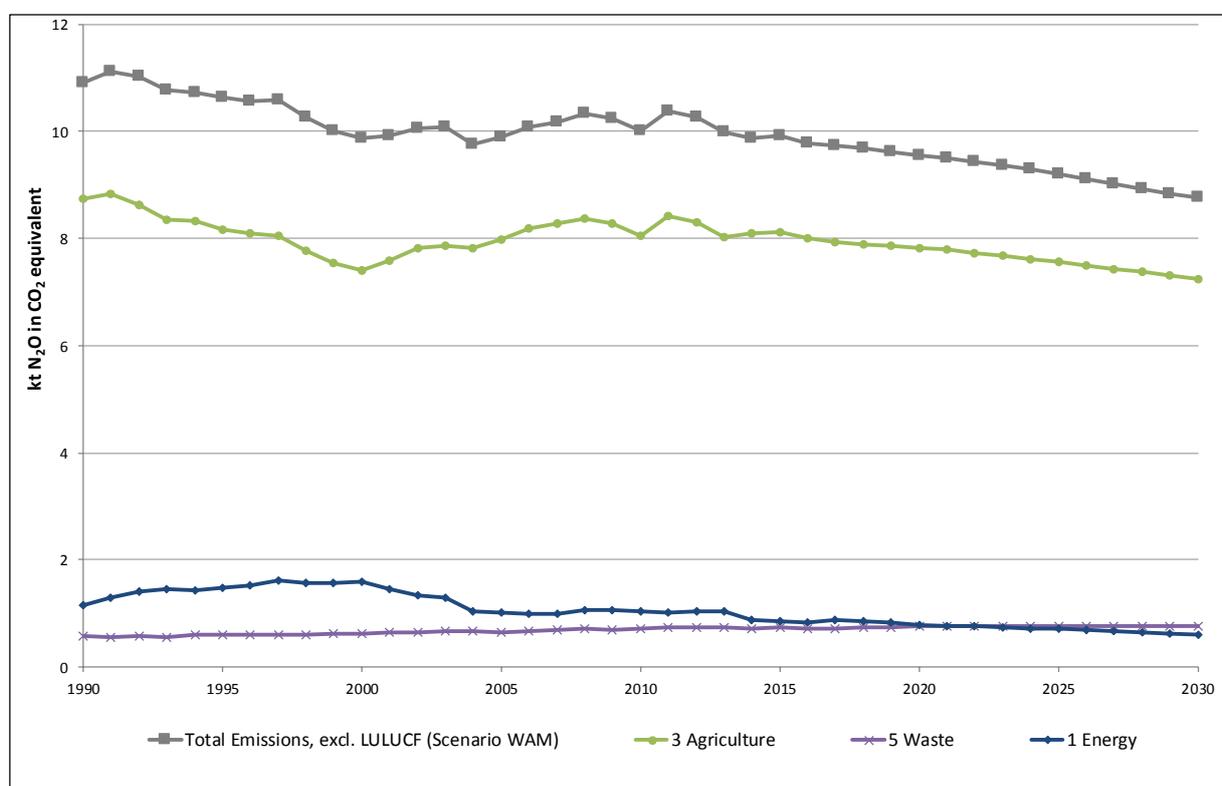


Figure 5-7 N<sub>2</sub>O emissions by sector (excl. LULUCF) from 1990 to 2030 for the scenario WAM

### Projection of F-Gas emissions in the WAM scenario

Table 5-10 and Figure 5-8 show the development of F-Gas emissions (HFC, PFC and SF<sub>6</sub>) between 1990 and 2030. Emissions between 1990 and 2017 are the same as in the WEM scenario, see section 5.1.4.

From 2017 to 2030, F-Gas emissions are expected to decrease by 30.8%. The main reason for this reduction is the more pronounced reduction anticipated in Switzerland's WAM scenario for the IPPU sector due to stronger restrictions on HFCs and a stepwise prohibition of SF<sub>6</sub>.

In total, F-Gas emissions in the period 1990-2030 under the WAM scenario are assumed to increase by a factor of 71'000. However, the increasing trend is expected to have stopped in 2013.

Table 5-10 F-Gas emissions (HFC, PFC, SF<sub>6</sub>) by sector for the WAM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

HFC, PFC and SF <sub>6</sub> in kt CO <sub>2</sub> eq		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WAM)</b>	<b>0.00</b>	<b>1.37</b>	<b>4.21</b>	<b>7.70</b>	<b>9.80</b>	<b>10.52</b>	<b>10.75</b>	<b>9.79</b>	<b>8.76</b>	<b>7.44</b>
<b>2F</b>	Product uses as ODS substitutes	0.00	1.37	4.21	7.70	9.80	10.52	10.75	9.79	8.76	7.44
	HFC	0.00	1.37	4.11	7.38	9.71	10.45	10.69	9.74	8.71	7.40
	PFC	NO	0.00	0.01	0.07	0.07	0.04	0.02	0.02	0.01	0.01
	SF <sub>6</sub>	NO	NO	0.09	0.26	0.02	0.04	0.05	0.04	0.04	0.03

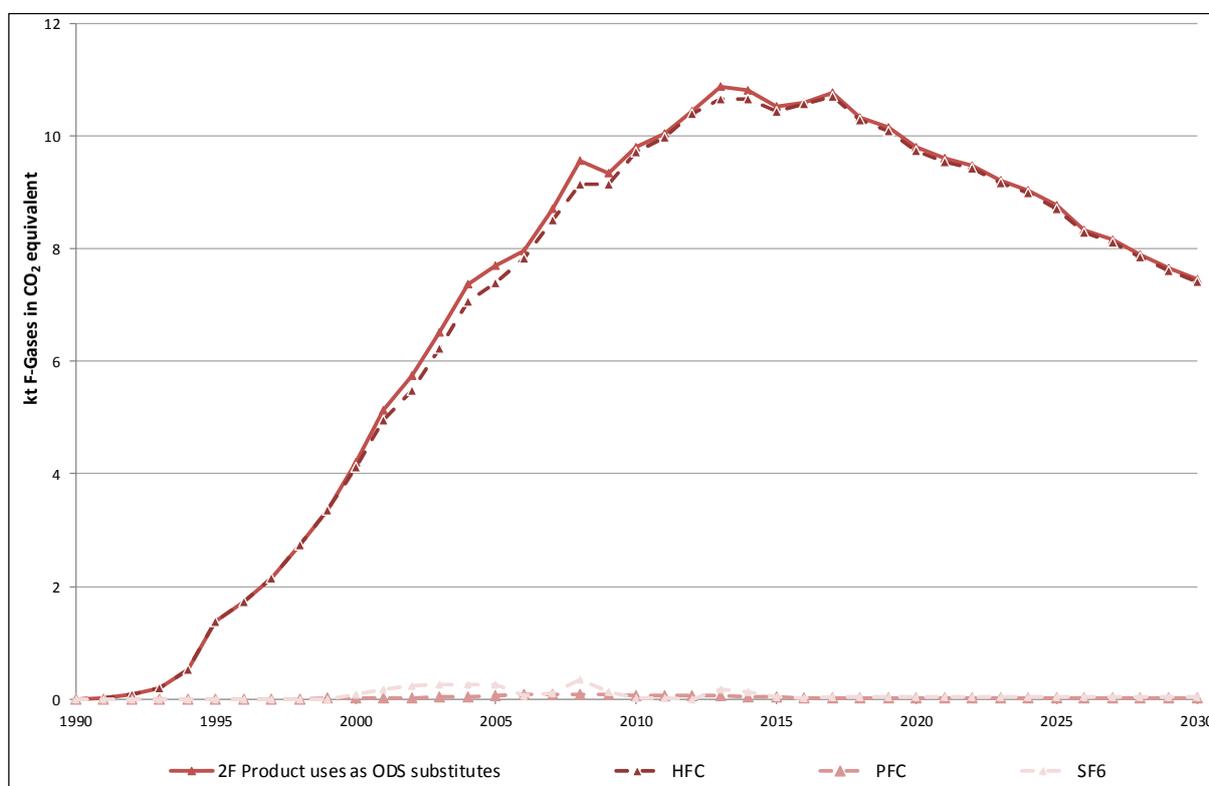


Figure 5-8 F-Gas emissions (HFC, PFC, SF<sub>6</sub>) by sector from 1990 to 2030 for the scenario WAM

## 5.2 Assessment of aggregate effect of policies and measures

### 5.2.1 Aggregate effect in the WOM scenario

Table 5-11 shows the development of total GHG emissions in CO<sub>2</sub> equivalent for the WOM scenario between 1990 and 2030. The WOM scenario is included in the figures for the WEM and WAM scenarios as a dotted line (in Table 5-11 and Figure 5-11, respectively).

Under the WOM scenario, an increase of emissions by 14.6% is assumed in the time period 1990-2030. The increase in the years 1990-2008 (starting year of the WOM projection) amounts 13.1%, from 2008-2030 the increase is estimated to be 1.4%.

Table 5-11 Total GHG emissions in CO<sub>2</sub>eq by sector for the WOM scenario (1990-2030)

CO <sub>2</sub> eq in kt CO <sub>2</sub> equivalent											
IPCC	Source/Sink Categories	1990	1995	2000	2005	Reported data (GHG inventories)			Projections		
						2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WOM)</b>	<b>228.99</b>	<b>234.10</b>	<b>247.68</b>	<b>264.98</b>	<b>254.33</b>	<b>256.46</b>	<b>258.27</b>	<b>261.22</b>	<b>261.53</b>	<b>262.53</b>
<b>1</b>	<b>Energy</b>	<b>201.06</b>	<b>206.79</b>	<b>219.77</b>	<b>231.46</b>	<b>217.36</b>	<b>218.77</b>	<b>220.33</b>	<b>223.41</b>	<b>223.43</b>	<b>224.43</b>
<b>1A</b>	<b>Fuel combustion</b>	<b>200.70</b>	<b>206.19</b>	<b>218.94</b>	<b>230.37</b>	<b>216.07</b>	<b>217.24</b>	<b>218.72</b>	<b>221.66</b>	<b>221.45</b>	<b>222.22</b>
	1A1 Energy industries	0.18	2.08	2.77	3.14	2.59	2.59	2.59	2.59	2.59	2.59
	1A2 Manufacturing industries & constr.	36.32	35.73	36.45	39.19	36.83	36.83	36.83	36.83	36.83	36.83
	1A3 Transport	76.64	81.79	91.29	81.77	84.01	80.52	80.66	80.94	80.73	81.50
	1A4 Other sectors	87.55	86.59	88.43	106.28	92.63	97.30	98.63	101.30	101.30	101.30
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	<b>Fugitive emissions from fuels</b>	<b>0.36</b>	<b>0.60</b>	<b>0.83</b>	<b>1.09</b>	<b>1.29</b>	<b>1.52</b>	<b>1.61</b>	<b>1.75</b>	<b>1.98</b>	<b>2.21</b>
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	0.36	0.60	0.83	1.09	1.29	1.52	1.61	1.75	1.98	2.21
<b>2</b>	<b>Industrial processes and product use</b>	<b>0.65</b>	<b>1.89</b>	<b>4.64</b>	<b>8.13</b>	<b>10.16</b>	<b>10.86</b>	<b>11.09</b>	<b>10.94</b>	<b>11.21</b>	<b>11.18</b>
<b>3</b>	<b>Agriculture</b>	<b>25.51</b>	<b>23.68</b>	<b>21.48</b>	<b>23.56</b>	<b>24.98</b>	<b>24.98</b>	<b>24.98</b>	<b>24.98</b>	<b>24.98</b>	<b>24.98</b>
<b>4</b>	<b>LULUCF</b>	<b>6.95</b>	<b>4.61</b>	<b>24.82</b>	<b>8.48</b>	<b>20.25</b>	<b>11.06</b>	<b>10.55</b>	<b>12.79</b>	<b>12.79</b>	<b>12.79</b>
<b>5</b>	<b>Waste</b>	<b>1.77</b>	<b>1.74</b>	<b>1.79</b>	<b>1.84</b>	<b>1.83</b>	<b>1.85</b>	<b>1.86</b>	<b>1.88</b>	<b>1.90</b>	<b>1.93</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.43</b>	<b>0.43</b>	<b>0.49</b>	<b>0.49</b>	<b>0.85</b>	<b>1.20</b>	<b>0.86</b>	<b>0.94</b>	<b>1.06</b>	<b>1.18</b>

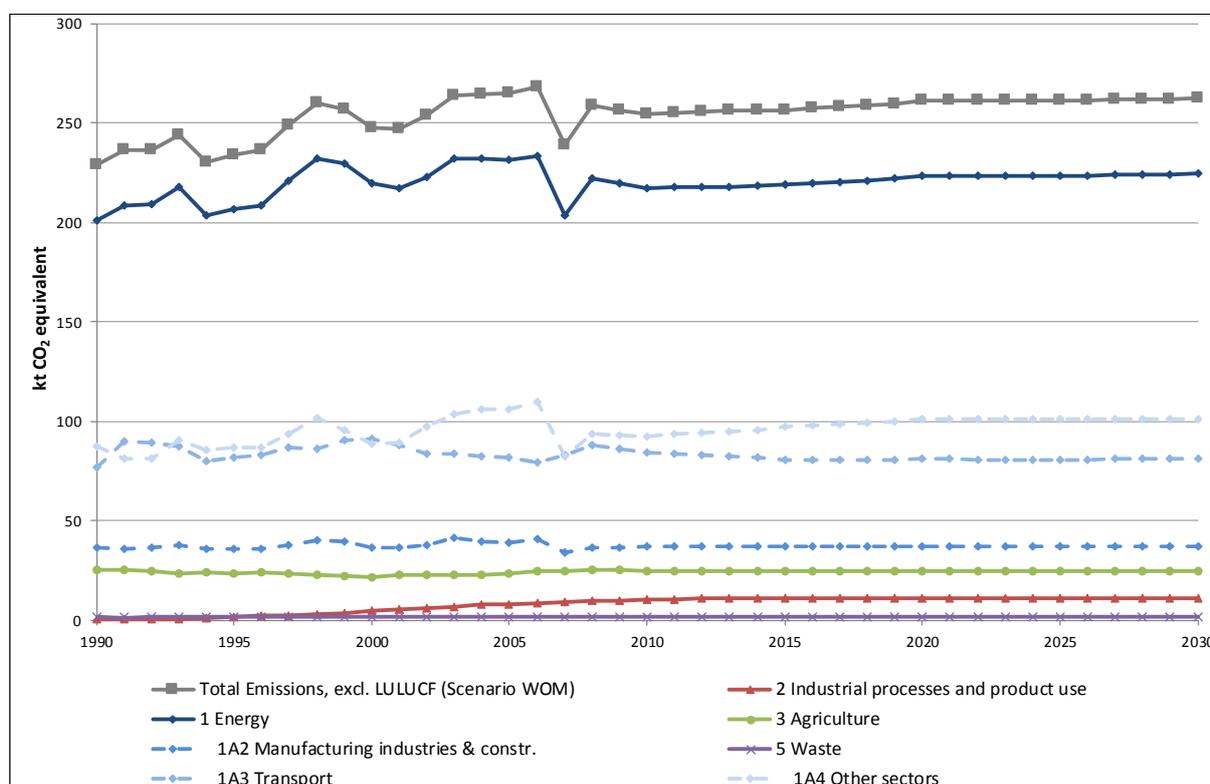


Figure 5-9 Total GHG emissions in CO<sub>2</sub>eq by sector (excl. LULUCF) from 1990 to 2030 for the scenario WOM

### 5.2.2 Aggregate effect in the WEM scenario

Table 5-12 and Figure 5-10 show the development of total GHG emissions in CO<sub>2</sub> equivalent between 1990 and 2030 for the WEM scenario. The total reduction from 1990-2030 under the WEM scenario is anticipated to be 32.0%.

Table 5-12 Total GHG emissions in CO<sub>2</sub>eq by sector for the WEM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

CO <sub>2</sub> eq in kt CO <sub>2</sub> equivalent		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WEM)</b>	<b>228.99</b>	<b>234.10</b>	<b>247.68</b>	<b>264.98</b>	<b>229.46</b>	<b>197.79</b>	<b>193.62</b>	<b>174.77</b>	<b>166.72</b>	<b>155.64</b>
<b>1</b>	<b>Energy</b>	<b>201.06</b>	<b>206.79</b>	<b>219.77</b>	<b>231.46</b>	<b>193.34</b>	<b>161.24</b>	<b>157.47</b>	<b>139.51</b>	<b>132.67</b>	<b>122.94</b>
<b>1A</b>	Fuel combustion	200.70	206.19	218.94	230.37	192.21	160.09	156.29	138.33	131.49	121.76
	1A1 Energy industries	0.18	2.08	2.77	3.14	3.26	2.05	2.12	2.18	2.18	2.18
	1A2 Manufacturing industries & constr.	36.32	35.73	36.45	39.19	26.10	27.38	27.44	21.58	21.51	21.45
	1A3 Transport	76.64	81.79	91.29	81.77	77.63	61.12	60.29	59.73	58.33	54.04
	1A4 Other sectors	87.55	86.59	88.43	106.28	85.21	69.55	66.43	54.84	49.46	44.09
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	Fugitive emissions from fuels	0.36	0.60	0.83	1.09	1.13	1.15	1.18	1.18	1.19	1.19
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	0.36	0.60	0.83	1.09	1.13	1.15	1.18	1.18	1.19	1.19
<b>2</b>	<b>Industrial processes and product use</b>	<b>0.65</b>	<b>1.89</b>	<b>4.64</b>	<b>8.13</b>	<b>10.16</b>	<b>10.86</b>	<b>11.09</b>	<b>10.41</b>	<b>9.44</b>	<b>8.09</b>
<b>3</b>	<b>Agriculture</b>	<b>25.51</b>	<b>23.68</b>	<b>21.48</b>	<b>23.56</b>	<b>24.19</b>	<b>24.09</b>	<b>23.48</b>	<b>23.17</b>	<b>22.93</b>	<b>22.93</b>
<b>4</b>	<b>LULUCF</b>	<b>6.95</b>	<b>4.61</b>	<b>24.82</b>	<b>8.48</b>	<b>20.25</b>	<b>11.06</b>	<b>10.55</b>	<b>12.79</b>	<b>12.79</b>	<b>12.79</b>
<b>5</b>	<b>Waste</b>	<b>1.77</b>	<b>1.74</b>	<b>1.79</b>	<b>1.84</b>	<b>1.78</b>	<b>1.60</b>	<b>1.58</b>	<b>1.67</b>	<b>1.67</b>	<b>1.67</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.43</b>	<b>0.43</b>	<b>0.49</b>	<b>0.49</b>	<b>0.85</b>	<b>1.20</b>	<b>0.86</b>	<b>0.94</b>	<b>1.06</b>	<b>1.18</b>

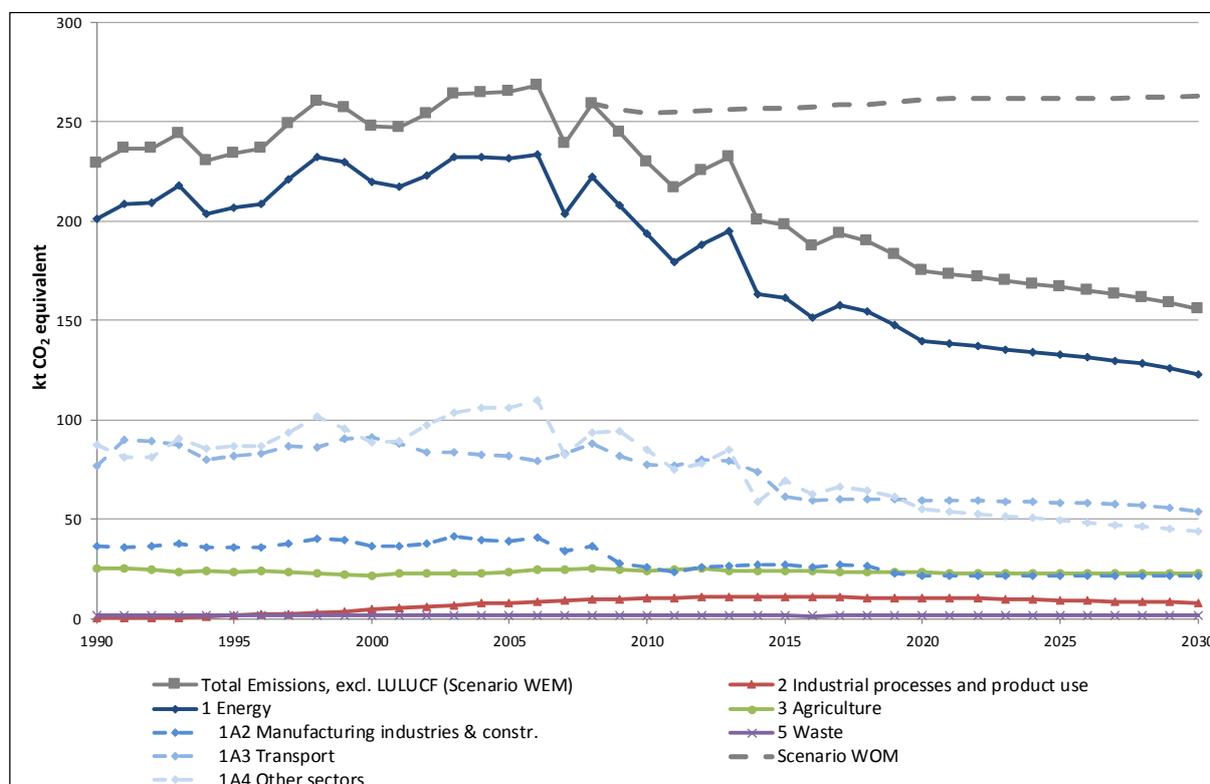


Figure 5-10 Total GHG emissions in CO<sub>2</sub>eq by sector (excl. LULUCF) from 1990 to 2030 for the scenario WEM (dashed, grey line 2008-2030: total emissions scenario of WOM scenario)

### 5.2.3 Aggregate effect in the WAM scenario

Table 5-13 and Figure 5-11 show the development of total GHG emissions in CO<sub>2</sub> equivalent between 1990 and 2030 for the WAM scenario. The total reduction from 1990-2030 under the WAM scenario is anticipated to be 37.7%.

Table 5-13 Total GHG emissions in CO<sub>2</sub>eq by sector for the WAM scenario (1990-2030; reported values for 1990-2017 from OE 2019; projected values for 2018-2030)

CO <sub>2</sub> eq in kt CO <sub>2</sub> equivalent		Reported data (GHG inventories)							Projections		
IPCC	Source/Sink Categories	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
<b>Total</b>	<b>Emissions, excl. LULUCF (Scenario WAM)</b>	<b>228.99</b>	<b>234.10</b>	<b>247.68</b>	<b>264.98</b>	<b>229.46</b>	<b>197.79</b>	<b>193.62</b>	<b>174.47</b>	<b>161.45</b>	<b>142.76</b>
<b>1</b>	<b>Energy</b>	<b>201.06</b>	<b>206.79</b>	<b>219.77</b>	<b>231.46</b>	<b>193.34</b>	<b>161.24</b>	<b>157.47</b>	<b>139.51</b>	<b>128.34</b>	<b>111.97</b>
<b>1A</b>	Fuel combustion	200.70	206.19	218.94	230.37	192.21	160.09	156.29	138.33	127.15	110.79
	1A1 Energy industries	0.18	2.08	2.77	3.14	3.26	2.05	2.12	2.18	2.18	2.18
	1A2 Manufacturing industries & constr.	36.32	35.73	36.45	39.19	26.10	27.38	27.44	21.58	21.51	21.45
	1A3 Transport	76.64	81.79	91.29	81.77	77.63	61.12	60.29	59.73	57.18	49.44
	1A4 Other sectors	87.55	86.59	88.43	106.28	85.21	69.55	66.43	54.84	46.28	37.72
	1A5 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>1B</b>	Fugitive emissions from fuels	0.36	0.60	0.83	1.09	1.13	1.15	1.18	1.18	1.19	1.19
	1B1 Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	0.36	0.60	0.83	1.09	1.13	1.15	1.18	1.18	1.19	1.19
<b>2</b>	<b>Industrial processes and product use</b>	<b>0.65</b>	<b>1.89</b>	<b>4.64</b>	<b>8.13</b>	<b>10.16</b>	<b>10.86</b>	<b>11.09</b>	<b>10.11</b>	<b>9.04</b>	<b>7.68</b>
<b>3</b>	<b>Agriculture</b>	<b>25.51</b>	<b>23.68</b>	<b>21.48</b>	<b>23.56</b>	<b>24.19</b>	<b>24.09</b>	<b>23.48</b>	<b>23.17</b>	<b>22.39</b>	<b>21.43</b>
<b>4</b>	<b>LULUCF</b>	<b>6.95</b>	<b>4.61</b>	<b>24.82</b>	<b>8.48</b>	<b>20.25</b>	<b>11.06</b>	<b>10.55</b>	<b>12.79</b>	<b>12.79</b>	<b>12.79</b>
<b>5</b>	<b>Waste</b>	<b>1.77</b>	<b>1.74</b>	<b>1.79</b>	<b>1.84</b>	<b>1.78</b>	<b>1.60</b>	<b>1.58</b>	<b>1.68</b>	<b>1.68</b>	<b>1.68</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.43</b>	<b>0.43</b>	<b>0.49</b>	<b>0.49</b>	<b>0.85</b>	<b>1.20</b>	<b>0.86</b>	<b>0.94</b>	<b>1.06</b>	<b>1.18</b>

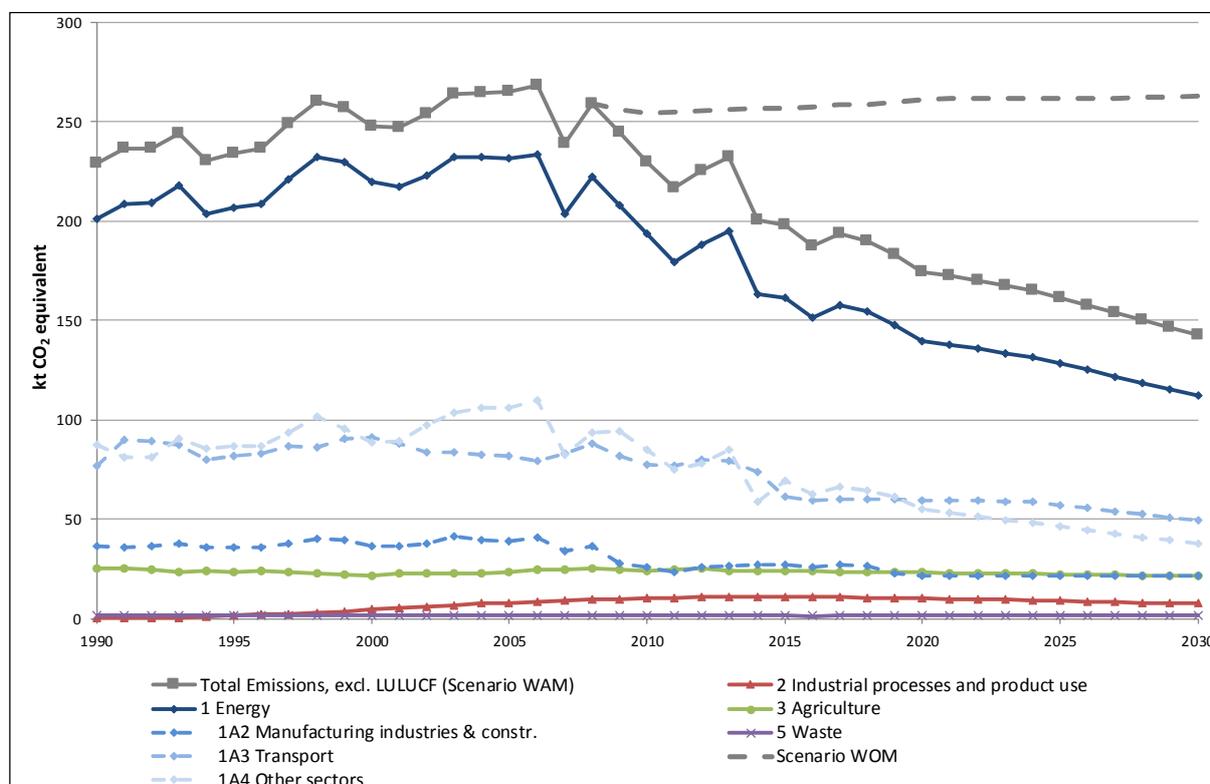


Figure 5-11 Total GHG emissions in CO<sub>2</sub>eq by sector (excl. LULUCF) from 1990 to 2030 for the scenario WAM (dashed, grey line 2008-2030: total emissions scenario of WOM scenario)

## 5.3 Methodology

### 5.3.1 Method for differentiating specific greenhouse gases

The initial calculation of the projections of Liechtenstein's greenhouse gas emissions are based on total emissions in CO<sub>2</sub> equivalent and not on specific gases. After this initial calculation, the differentiated projection for specific greenhouse gases (CH<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and F-Gases) was conducted based on factors derived from the latest NIR (OE 2019). These factors describe - for each source category - the share of a specific gas (e.g., CH<sub>4</sub>) compared to total CO<sub>2</sub> equivalent emissions in the year 2017. The projection of the total emissions in CO<sub>2</sub>eq can then be multiplied with these factors in order to calculate the gas-specific projection.

The factors for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O are depicted in Table 5-14, the ones for F-Gases (HFC, PFC and SF<sub>6</sub>) in Table 5-15.

Table 5-14 Factors describing the share of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions compared to the total CO<sub>2</sub>eq emissions, based on the newest reported values (year 2017) in Liechtenstein's national inventory (OE 2019)

IPCC	Source/Sink Categories	CO <sub>2</sub> factor (share of CO <sub>2</sub> compared to total CO <sub>2</sub> eq)	CH <sub>4</sub> factor (share of CH <sub>4</sub> compared to total CO <sub>2</sub> eq)	N <sub>2</sub> O factor (share of N <sub>2</sub> O compared to total CO <sub>2</sub> eq)	F-Gases factor (share of F-Gas compared to total CO <sub>2</sub> eq)	sum
<b>1</b>	<b>Energy</b>					
<b>1A</b>	<b>Fuel combustion</b>					
	1A1 Energy industries	0.984	0.011	0.004	NO	1.000
	1A2 Manufacturing industries & constr.	0.995	0.002	0.003	NO	1.000
	1A3 Transport	0.993	0.001	0.006	NO	1.000
	1A4 Other sectors	0.988	0.005	0.006	NO	1.000
	1A5 Other	NO	NO	NO	NO	NO
<b>1B</b>	<b>Fugitive emissions from fuels</b>					
	1B1 Solid fuels	NO	NO	NO	NO	NO
	1B2 Oil and natural gas	0.000	1.000	NO,NA	NO	1.000
<b>2</b>	<b>Industrial processes and product use</b>	<b>0.012</b>	<b>NO</b>	<b>0.019</b>	<b>0.969</b>	<b>1.000</b>
<b>3</b>	<b>Agriculture</b>	<b>0.002</b>	<b>0.660</b>	<b>0.338</b>	<b>NO</b>	<b>1.000</b>
<b>4</b>	<b>LULUCF</b>	<b>0.961</b>	<b>NO</b>	<b>0.039</b>	<b>NO</b>	<b>1.000</b>
<b>5</b>	<b>Waste</b>	<b>0.006</b>	<b>0.537</b>	<b>0.457</b>	<b>NO</b>	<b>1.000</b>
<b>Memo item</b>	<b>International bunkers (aviation)</b>	<b>0.992</b>	<b>0.000</b>	<b>0.008</b>	<b>NO</b>	<b>1.000</b>

Table 5-15 Factors describing the share of HFC, PFC and SF<sub>6</sub> emissions compared to the total CO<sub>2</sub>eq emissions, based on the newest reported values (year 2017) in Liechtenstein's national inventory (OE 2019)

IPCC	Source/Sink Categories	HFC factor (share of HFC compared to total CO <sub>2</sub> eq)	PFC factor (share of PFC compared to total CO <sub>2</sub> eq)	SF <sub>6</sub> factor (share of SF <sub>6</sub> compared to total CO <sub>2</sub> eq)	sum
2F	Product uses as ODS substitutes	0.994	0.002	0.004	1.000

This method for differentiating the GHG was used for the projection of all scenarios and, additionally, for estimating the WOM emissions for the years 2009-2017.

### 5.3.2 Methods for projecting the emissions from the Energy sector (1A Fuel combustion)

The projections of emissions from the Energy sector are based on Liechtenstein's Energy Strategy 2020 (Government 2012b) and on the half-time report concerning the Energy Strategy (Government 2017). The basis for the projections is the Scenario 2 of the Energy Strategy, which is characterized by a stabilization of energy consumption, an enhancement of renewable energy sources and a reduction of CO<sub>2</sub> emissions (see Table 5-16 for details). Scenario 2 defines a package of measures, implemented stepwise until 2020, in order to reach the greenhouse gas emission target.

Table 5-16 Objectives 2020 of Liechtenstein's Energy Strategy (Scenario 2, base year 2008)

	2008	Objectives 2020
Energy demand	1'390 GWh	1'390 GWh (±0%)
Share of renewable and domestic energy sources	8.2%	20%
Greenhouse gas emissions	263 kt CO <sub>2</sub> eq	184 kt CO <sub>2</sub> eq (-20%)

The specific measures implemented in the projection are described and explained in section 5.1.2.

#### Projections 2018-2020

The half-time report (Government 2017) of the Energy Strategy 2020 provides detailed yearly greenhouse gas reduction potentials (CO<sub>2</sub>eq) for each measure between the years 2008 and 2020. Two further steps had to be conducted to prepare the data for the projection of the years 2018-2020:

- The measures had to be assigned to the sub-categories of the Energy sector (i.e. 1A1, 1A2, 1A3, 1A4 and 1A5).
- Reduction potentials of some measures had to be divided between industry and households in order to match the NFR structure (in particular categories 1A2 and 1A4). Where possible, the shares were taken from Liechtenstein's NIR 2019 (OE 2019). Else, the shares were estimated by the expert of the energy department<sup>2</sup>.

The projection was undertaken on the basis of the reported emissions 2017 (from Liechtenstein's NIR 2019, OE 2019). The energy consumption is assumed to be constant (according to Scenario 2 of the Energy Strategy 2020). The yearly emission reduction potentials were (consecutively) subtracted from the emissions 2017 in order to estimate the projected emissions for the years 2018-2020.

<sup>2</sup> Expert judgement by J. Senn, Energy Department of Liechtenstein, see Senn (2017).

### **Projections 2021-2030**

For the projections 2021-2030, the yearly greenhouse gas reduction potentials (CO<sub>2</sub>eq) from the Energy Strategy 2020 were extrapolated. The extrapolations were estimated by expert judgements (see footnote 2):

- The measures electric vehicles and heat pump boilers and efficiency measures in industry and commerce were linearly extrapolated according to the yearly reduction potentials 2016-2020 (i.e. the last five years depicted in the half-time report of the Energy Strategy).
- The measures (energetic) renovation of buildings and heating pumps was continued on a lower level due to decreasing potential.
- The measures wood heating, solar collectors, standards for electrical equipment/illumination, use of heat recovery in industry/development of heat distribution, incentive systems and biogas use were not continued due to missing knowledge about potential reductions and high uncertainties.

### **5.3.3 Methods for projecting the emissions from further sectors**

#### **Sector 1B Fugitive emissions from fuels**

No projections for Liechtenstein are available for emissions from Fugitive emissions from fuels. Therefore, the Swiss projection of this sector was adopted for Liechtenstein. Due to the bilateral agreement on environmental levies between Liechtenstein and Switzerland, circumstances in Liechtenstein are comparable to the assumptions in the Swiss projections.

#### **Sector 2 Industrial processes and product use (IPPU)**

No projections for Liechtenstein are available for emissions from Industrial processes and product use. Therefore, the Swiss projection of this sector was adopted for Liechtenstein. Due to the similar population structure and level of motorization in Liechtenstein and Switzerland, which has a high influence on F-Gas emissions (refrigerators/cars), circumstances in Liechtenstein are comparable to the assumptions in the Swiss projections.

#### **Sector 3 Agriculture**

No projections for Liechtenstein are available for emissions from agriculture. Therefore, the Swiss projection of this sector was adopted for Liechtenstein. Due to the similar agricultural structure in Liechtenstein and Switzerland (e.g., direct payment systems), circumstances in Liechtenstein are comparable to the assumptions in the Swiss projections.

#### **Sector 4 Land use, land use change and forestry (LULUCF)**

No projections for Liechtenstein are available for emissions from LULUCF. Sources and sinks have shown high fluctuations in the past decades, in particular due to fluctuations of the amount of living biomass on forest land. Accordingly, the projection was simplified by keeping total LULUCF emissions on a constant level from 2018-2030, based on the average of the reported net emissions of the last five inventory years (2013-2017).

## Sector 5 Waste

The projection of emissions from the sector Waste was conducted according to Liechtenstein's Waste Plan (Liechtensteiner Abfallplanung 2012-2070, Government 2011). The study estimates activity data (AD; waste amount, in kg or in m<sup>3</sup>) for different waste categories in the years 2020, 2050 and 2070 (base year: 2009). The following parameters were used for the projection of the waste categories:

- Municipal solid waste: Development of population (trend scenario).
- Composting: Development of settlement and building zones (one important driver of compost amount in Liechtenstein are building activities on undeveloped land, which generate a lot of organic waste).
- Wastewater treatment: Development of hydraulic population equivalents, development of residual water content in sewage system.

For the years that are not explicitly covered in the Waste Plan study (i.e., relevant for Liechtenstein's BR4, the years 2018-2019 and 2021-2030), the waste amounts were linearly interpolated within the two periods 2009-2020 and 2020-2050.

For the projections in BR4, the waste categories were attributed to the four sub-categories of the Waste sector (5A Solid waste disposal, 5B Biological treatment of waste, 5C Incineration and open burning of waste and 5D Wastewater treatment and discharge). The relative year-to-year changes of the AD (waste amount) according to Liechtenstein's Waste Plan was then applied to the emissions of the Waste sector according to the NIR 2019 (OE 2019) in order to generate an emission projection.

Note that in Liechtenstein, the emissions from the waste sector are minor: municipal solid waste and compost are exported to municipal solid waste incineration and composting plants in Switzerland. As a result, wastewater treatment contributes most to emissions from the waste sector.

### 5.3.4 Methods for the WOM scenario

The WOM scenario in this BR4 is generally based on the WOM scenario from Liechtenstein's Sixth National Communication (NC6, OE 2014). The starting year for the WOM is 2008. This was also the starting year for the WOM scenario in Liechtenstein's NC6. 2008 was the year when the Energy Efficiency Act was adopted in Liechtenstein, and no other (quantifiable) measures were implemented earlier than 2008 in Liechtenstein.

#### Method for projecting the WOM emissions based on Liechtenstein's NC6:

This methodology has been applied for the sectors Energy (1A Fuel combustion) and Agriculture.

- Years 1990-2008: Reported data from Liechtenstein's NIR 2019 (OE 2019), since 2008 was the year the Energy Efficiency Act was adopted in this year and no (quantifiable) other measures were implemented earlier than 2008.
- Years 2009-2030: Year-to-year changes from the WOM scenario in Liechtenstein's NC6 (OE 2014) were used to project the development of emissions under the WOM scenario based on the year 2008.

**Further methods used for projecting the WOM scenario:**

Further methods had to be applied to sectors Energy (1B Fugitive emissions from fuels), IPPU, LULUCF, Waste and for the Memo item International bunkers (aviation). For these sectors, the assumptions made for the WOM in Liechtenstein's NC6 were not suitable anymore, leading to higher emissions in the WOM scenario than in the WEM or WAM scenario. Therefore, the projection for these sectors had to be made based on other assumptions.

## Sectors 1B Fugitive emissions from fuels and waste:

- Years 1990-2008: Reported data from Liechtenstein's NIR 2019 (OE 2019), since 2008 was the year the Energy Efficiency Act was adopted in this year and no (quantifiable) other measures were implemented earlier than 2008.
- Years 2009-2030: Extrapolated based on the reported emissions 1990-2008 based on the NIR 2019 (OE 2019).

## Sector 2 IPPU:

- Years 1990-2008: Reported data from Liechtenstein's NIR 2019 (OE 2019), since 2008 was the year the Energy Efficiency Act was adopted in this year and no (quantifiable) other measures were implemented earlier than 2008.
- Years 2009-2017: Reported values according to Liechtenstein's NIR 2019 (OE 2019), assuming that no (quantifiable) measures were implemented in the IPPU sector within these years.
- Years 2018-2030: Year-to-year changes from the WOM scenario in Switzerland's NC7 (FOEN 2018), assuming that due to the similar circumstances in Switzerland and Liechtenstein (e.g. bilateral agreement, partly identical policies and regulations) emissions in the IPPU sector will develop similarly if no measures are introduced.

## Sector 4 LULUCF and Memo item International bunkers (aviation):

- Years 1990-2008: Reported data from Liechtenstein's NIR 2019 (OE 2019), since 2008 was the year the Energy Efficiency Act was adopted in this year and no (quantifiable) other measures were implemented earlier than 2008.
- Years 2009-2017: Reported values according to Liechtenstein's NIR 2019 (OE 2019), assuming that no (quantifiable) measures were implemented in the IPPU sector within these years.
- Years 2018-2030: Similar emission projections as in the WEM scenario, since no (quantifiable) measures were included in Liechtenstein's WEM scenario for the BR4.

### 5.3.5 Changes of projections compared to BR3

In this section, the most relevant changes in the methodology for the projections compared to the latest Biennial Report (BR3) are described.

#### WEM

- 1A4: Compared to BR3, the reduction potential from the measure “Incentive system ‘Minergie’ standard (for buildings)” (see Table 5-2) was prolonged. It is assumed to also lead to emission reductions in the years 2020-2030 (according to the expert of the energy department).
- 1A4: Compared to the BR3, the reduction potential from the measure “New standards for new buildings” (see Table 5-2) was prolonged. It is assumed to also lead to emission reductions in the years 2024-2030 (according to the expert of the energy department).

#### WAM

- 1A4: Compared to BR3, the reduction potential from the measure “Incentive system ‘Minergie’ standard (for buildings)” (see Table 5-2) was prolonged. It is assumed to also lead to emission reductions in the years 2020-2030 (according to the expert of the energy department).
- 1A4: Compared to the BR3, the reduction potential from the measure “New standards for new buildings” (see Table 5-2) was prolonged. It is assumed to also lead to emission reductions in the years 2024-2030 (according to the expert of the energy department).

#### WOM

- The WOM scenario was newly elaborated, based on the WOM scenario from Liechtenstein's NC6 (see chapter 5.3.4 for details).

## **6. Provision of financial, technological and capacity-building support to developing country Parties**

According to the biennial reporting guidelines, the reporting obligations concerning financial, technological and capacity-building support to developing country parties only apply to Annex II Parties to the Convention (see FCCC/CP/2011/9/Add.1, Annex I, Chapter VI). Since Liechtenstein is not listed in Annex II of the Convention, the Government does not consider Liechtenstein to be bound by the respective provisions.

However, due to Liechtenstein's activities within the Fast Start Finance Period 2010 to 2012 as well as with regard to the Parliament's decision of 2012 to continue its engagement within the framework of international climate finance Liechtenstein has chosen to report these activities under paragraph 25, Chapter 7 "Other Reporting matters".

With respect to future submissions Liechtenstein aims at using that reporting format and opportunity to also address the request by Parties made in conjunction with the work program on long term finance at COP 19 in Warsaw.<sup>3</sup>

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<sup>3</sup> see paragraph 10 [http://unfccc.int/files/meetings/warsaw\\_nov\\_2013/decisions/application/pdf/cop19\\_ltf.pdf](http://unfccc.int/files/meetings/warsaw_nov_2013/decisions/application/pdf/cop19_ltf.pdf)

## 7. Other reporting elements

### **Liechtenstein's emissions measurements, reporting and verification and emission projections**

Liechtenstein accounts yearly for the national greenhouse gas inventory (NIR).

The annual publication of Liechtenstein's energy statistics, provided by the Office of Statistics, serves as a monitoring tool in order to evaluate the effect of the respective policies. Based on the Energy Strategy 2020 the Government has set up an administrative body that is responsible for the implementation and monitoring of measures set up by the Energy Strategy 2020.

### **Liechtenstein's activities within international climate finance**

Liechtenstein has repeatedly underscored its commitment to achieving the international Official Development Assistance (ODA) target of 0.7 %. Liechtenstein's most recent ODA percentage for the year 2016 is 0.42. As part of the global effort, Liechtenstein committed a respective climate finance contribution:

With calculations taking into account the national level of emissions, the financial capacity and the population size, the Liechtenstein Parliament decided in 2010 to introduce a new fast-start financing budget line of CHF 700.000 for the years 2011 and 2012. This budget was new and additional to the already existing IHCD budget. Liechtenstein's fast-start financing commitment was therefore not diverting from other important development priorities, but instead complemented and strengthened existing priorities. In 2012, the Parliament decided to extend its engagement in climate finance until 2015 with a total budget of CHF 600.000 on a voluntary basis. As a result, Liechtenstein has provided more than 2 Million USD of climate finance since 2011. In 2015, the Parliament decided to give permanence to the climate finance commitment and integrated climate finance into the regular budget of IHCD. As a result, the Government expects to support climate related projects with at least CHF 200'000 annually, starting from 2016.

Within its climate finance engagement Liechtenstein's primary concern is the delivery of effective results and benefits which address the sustainable development and climate change needs and priorities of developing countries. Moreover, Liechtenstein aims at providing support for planning and realising sustainable development by defining a responsible development framework, evaluating capacities, and making efficient and effective use of natural resources. To this end, Liechtenstein's climate finance not only aims to enhance good governance and capacity-building, but also to foster effects like improving living conditions and safeguarding subsistence, which is respecting dignity and creating additional sources of income and constant progress in the field of education and jobs.

Project actions and components covered by Liechtenstein's support under climate finance therefore need to:

- show a need driven approach, since they are developed by recipients and reflect their priorities;

- allow recipients to gain ownership of the processes and projects;
- activate the self-organisation of local populations;
- support socially, economically and environmentally friendly initiatives;
- contribute to promote gender equality, empowering women, raising awareness among young people and civil society and finally strengthening peace and security.

In general, support is given to developing country parties to support them in both adapting to and mitigating the effects of climate change. Support to developing country parties is provided through bilateral and multilateral channels.

With regards to the regional distribution of climate finance means, Liechtenstein's focus lies on the most vulnerable countries. 57 per cent of the means since 2011 were used for climate projects in Africa, 36 per cent for projects in Asia (mainly South Caucasus), and 7 per cent were used for projects in the Pacific region.

Liechtenstein's **adaptation** assistance focuses on improving resilience to extreme weather conditions and other hazards, by investing in infrastructure which can better withstand climate change impacts, and through other practical measures to support local communities in enhancing preparedness.

With regards to **mitigation** of climate change, Liechtenstein is putting emphasis on supporting energy efficiency programmes and promoting renewable energy systems in the Caucasus, Central Asia and African countries. Liechtenstein strives to achieve a balance between adaptation and mitigation projects. However, every project is based on the needs of the respective developing country party.

The Liechtenstein Government is of the view that the involvement of the private sector in climate finance flows is crucial. Therefore, the Government is currently planning to enhance the cooperation with the private sector with regards to climate finance. It is worth to mention that private, non-profit foundations provide more than 100 Million USD for charitable projects annually. The Government is of the view, that through an enhanced and closer cooperation between the public and private sector, the mobilisation of climate finance can be further improved.

## **7.1 Financial resources and transfer of technology**

The following chapter also serves to provide information as required by Art. 10 lit f) of the Kyoto Protocol.

### **7.1.1 Assistance to developing country Parties that are particularly vulnerable to climate change**

Solidarity with developing countries and with countries affected by disasters and armed conflicts is a traditional focus of Liechtenstein's foreign policy. The operational tasks of International Humanitarian Cooperation and Development (IHCD) are carried out by the Office for Foreign Affairs, the Immigration and Passport Office and the Liechtenstein Development Service (LED). The overall coordination of the IHCD activities lies with the Office for Foreign Affairs.

IHCD encompasses all forms of humanitarian assistance and development cooperation of the State of Liechtenstein. These activities are set out in the Law on International Humanitarian Cooperation and Development (IHCD Act) of 2007. Liechtenstein's engagement focuses on emergency and reconstruction assistance, international refugee and migration assistance as well as bilateral and multilateral development cooperation.

Liechtenstein works closely together with the affected population and local organizations, with aid and development organisations in Liechtenstein, Switzerland, Austria and Germany as well as with European and international organisations. Liechtenstein, through its IHCD, maintains working relationships with a large number of partners. The bulk of Liechtenstein's support is provided in the form of financial resources. Nevertheless, the LED maintains three coordination offices on the ground, namely in Moldova, Bolivia and Zimbabwe from where it can directly supervise its projects.

**Emergency and reconstruction assistance** offers short-term, urgent assistance measures in the event of natural disasters, political crises, and armed conflicts. The focus is primarily on preserving human life and protecting the affected population. Additionally, the medium-term development of social structures and infrastructure is supported in order to facilitate a quick return to normal life. 11 % of the IHCD resources are earmarked for this area. The urgency of the situation is the main criterion for Emergency and Reconstruction Assistance. There are accordingly no geographic priorities. However, special attention is paid to emergency situations that are largely ignored and underfunded by the international community.

**International Refugee and Migration Assistance** is based on a sustainable and comprehensive approach to dealing with global refugee and migration issues. This area takes up 12 % of the IHCD budget. Bilateral activities focus on the region of the Western Balkans. People in need of protection, including minorities, receive support for local integration and long-term improvement of their living conditions. As part of a holistic view of the migration issue, possibilities of circular migration, readmission agreements, and visa questions are also discussed. At the multilateral level, compliance with international legal, human rights, and humanitarian standards for refugees, internally displaced persons, returnees, stateless persons, and other persons in need of international protection is promoted.

The largest pillar of IHCD is **Bilateral Development Cooperation**, which is implemented by the Liechtenstein Development Service (LED). For this purpose, LED receives about 65 % of the overall resources each year, most of which is used for development projects with local partners (Southern partners) or partner organisations from Europe (Northern Partners). In Chişinău (Republic of Moldova), La Paz (Bolivia), and Harare (Zimbabwe), LED maintains its own local coordination offices. LED is currently engaged in ten priority countries. These are Moldova, Bolivia, Peru, Senegal, Mali, Burkina Faso, Niger, Mozambique, Zimbabwe, and Zambia. Thematically, LED focuses on the development of rural regions and education. Human rights, social justice, equal rights, climate and the protection of the environment and resources are important horizontal topics. Since the Food Security and Intercultural Bilingual Education concepts and the Microfinance directive were adopted, these areas have been given greater consideration. LED funds placements of persons from Liechtenstein to development projects managed by other organizations, and it arranges internships. Further fields of its work are public relations and awareness raising through publications, exhibitions and educational work in public schools. The cooperation between the Liechtenstein Government and LED, a foundation under private law, is governed by an owner's strategy, which is sup-

plemented and further specified each year by performance mandates. The LED foundation council decides on individual projects.

**Multilateral Development Cooperation** is used to fund projects of international organizations or internationally operating non-governmental organizations. This type of engagement is useful especially for problems of a global or cross-border nature where the international community jointly seeks solutions. In contrast to LED projects, which act mainly at the local level, this track can also be used to improve national and international framework conditions. Special attention is paid to fostering good governance. This includes advocacy for human rights, strengthening the rule of law and democracy, and combating international crime. Key priorities of Liechtenstein's foreign policy, especially in the area of human rights, are additionally promoted in this way as part of IHCD, which in turn underscores Liechtenstein's credibility. Of note in this regard is for instance Liechtenstein's advocacy of better inclusion of women in peace-building processes and the protection of children in armed conflict. Other priorities are health and the fight against HIV/AIDS. An intact environment and the sustainable development and use of natural resources are necessary preconditions for the social and economic development of a region. The shortage of certain natural resources, but also the lack of access to these resources constitutes a growing problem for many poor regions. IHCD seeks to protect the environment and natural resources as a basis of life also for coming generations. Of particular note from the perspective of environmental policy is Liechtenstein's engagement through financial and human resources, such as the provision of experts and the promotion of sustainable mountain region development in the Carpathians, the Caucasus, and Central Asia. 11 % of the IHCD budget is available for Multilateral Development Cooperation.

### **7.1.2 Provision of financial resources, including financial resources under Article 11 of the Kyoto Protocol**

In 2018, Liechtenstein's IHCD had a budget of about 22.6 million CHF, corresponding to about 600 CHF per capita. The total Official Development Assistance (ODA) amount was 25.8 million CHF. The most recent ODA-percentage for the year 2016 is 0.42.

An overview of Liechtenstein's financial contributions as part of its International Humanitarian Cooperation and Development in 2018 can be found in the 2018 Annual Report of the Government to Parliament (pp. 99-105)<sup>4</sup>. The following table provides an overview of contributions related to the environment in 2018.

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<sup>4</sup> See [https://www.llv.li/files/srk/rb18\\_ii-02-aeusseres-justiz-kultur.pdf](https://www.llv.li/files/srk/rb18_ii-02-aeusseres-justiz-kultur.pdf) (in German).

Table 7-1 Overview of the most important contributions as part of Liechtenstein's international engagement in environmental protection, 2018.

Type of contribution	Partner	Amount (CHF)
Adaptation to climate change through the protection of forests and reforestation in Zimbabwe	SAFIRE	83'448
Preservation of virgin forests in Adjara/Georgia	Community & Environment	11'067
Promotion of climate resilient and sustainable agriculture in Tajikistan	Caritas Switzerland	200'000
Climate Strategy project in Mali	HELVETAS	100'000
"Waterfootprint Liechtenstein": Drink tap water. Safe drinking water. Energy and emission reduction through refraining from using bottled water	Drink & Donate	55'000
Basel Convention: annual contribution	UNEP	413
Climate Convention: annual contribution	UNFCCC	1'882
Contribution to International Renewable Energy Agency	IRENA	1'570
Contribution to the EMEP Trust Fund	UNECE	817
Convention on Biological Diversity: annual contribution	UNEP	1'191
Convention on the Conservation of Migratory Species of Wild Animals (CMS): annual contribution	UNEP	441
Multilateral fund of the Montreal Protocol (Ozone Fund): annual contribution	UNEP	17'291
Permanent Secretariat of the Alpine Convention: annual contribution	Secretariat of the Alpine Convention	25'201
Ramsar Convention: annual contribution	IUCN	1'000
Rotterdam Convention: annual contribution	UNEP	308
Stockholm Convention: annual contribution	UNEP	1'232
UNCCD: annual contribution	UNCCD	602
UNEP: annual contribution / Environment Fund	UNEP	9'287
World Conservation Union (IUCN): annual contribution	IUCN	15'520
CITES: annual contribution	CITES	410
Minamata Convention on Mercury: annual contribution	UNEP	353
<b>TOTAL</b>		<b>527'033</b>

Table 7-2: Multilateral contributions

**Multilateral contributions**

	<b>Multilateral contributions (CHF) (SDC only)</b>			
	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Multilateral institutions:				
1. European Bank for Reconstruction and Development (EBRD)	0	0	0	0
2. United Nations Development Programme (UNDP)	125'000	175'000	125'000	25'000
3. UNEP	19'088	30'253	30'105	30'523
4. UNFCCC (Kyoto Adaptation Fund)	0	0	0	0
5. UNCCD	708	735	727	602
6. International Union for the Conservation of Nature (IUCN)	16'489	16'520	16'520	16'520
<b>Total</b>	<b>161'285</b>	<b>222'508</b>	<b>172'352</b>	<b>72'645</b>

**Summary of information on financial resources and technology transfer**

Official development assistance (ODA in 2018)	25'755'710 CHF
Climate-related aid in bilateral ODA	
Climate-related support programmes	
Contributions to GEF (USD million)	
Pledge for third GEF replenishment	
Activities implemented jointly	
JI and CDM under the Kyoto Protocol (2008 – 2012)	7'920'000 CHF
JI and CDM under the Kyoto Protocol (2013 – 2020)	tbd
Other (bilateral/multilateral)	

Abbreviations: CDM = clean development mechanism, GEF = Global Environment Facility, JI = joint implementation.

### 7.1.3 Activities related to transfer of technology

In connection with the protection and preservation of the environment, Liechtenstein as an Alpine country is particularly engaged on behalf of the development of mountain regions. Under the umbrella of the Alpine Convention, Alpine countries cultivate a partnership with mountain regions in the Balkans, the Carpathians, the Caucasus, and Central Asia.

Table 7-2: Activities related to transfer of technology

<b>Project / programme title:</b> Water and Energy Saving Project, Tanzania			
<b>Goal:</b> Improvement of food security through adapted water and energy saving irrigation technologies			
Recipient country	Sector	Total funding	Years in operation
Tanzania	Irrigation Technology	CHF 260'000	2
<b>Description:</b>			
<ul style="list-style-type: none"> <li>• Food security through small irrigation system (pedal pump)</li> <li>• Provide access to so called swiss-PEP irrigation technology for local peasants</li> </ul>			
<b>Expected added value of the programme:</b>			
<ul style="list-style-type: none"> <li>• Pedal pumps are produced locally</li> <li>• Operation of pedal pumps is largely CO<sub>2</sub> neutral</li> <li>• Improvement of food security and reduction of CO<sub>2</sub> emissions</li> </ul>			
<b>Technology transferred:</b>			
<ul style="list-style-type: none"> <li>• Transfer of swiss-PEP irrigation technology</li> </ul>			
<b>Impact on greenhouse gas emissions/sinks:</b> Reduction of 5'850 t of CO <sub>2</sub> per year			
Liechtenstein Development Service, LED (2014)			

Please note the currency exchange rate of Swiss Francs to US Dollar is almost 1:1 at the date of submission.

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## Annex 1: GHG inventory reporting tables (CRF)

The summary tables from Liechtenstein's GHG Inventory are depicted in this annex according to the common reporting format (CRF).

**SUMMARY 2 SUMMARY REPORT FOR CO<sub>2</sub> EQUIVALENT EMISSIONS**  
(Sheet 1 of 1)

Inventory 1990  
Submission 2019 v1  
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND	CO <sub>2</sub> <sup>(1)</sup>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	Unspecified mix of HFCs and PFCs	NF <sub>3</sub>	Total
SINK CATEGORIES									
CO <sub>2</sub> equivalent (kt)									
<b>Total (net emissions)<sup>(1)</sup></b>	205.61	19.12	11.22	0.00	NO	NO	NO	NO	235.94
<b>1. Energy</b>	198.70	1.22	1.15						201.06
A. Fuel combustion (sectoral approach)	198.70	0.85	1.15						200.70
1. Energy industries	0.12	0.00	0.05						0.18
2. Manufacturing industries and construction	36.19	0.05	0.09						36.32
3. Transport	75.36	0.53	0.75						76.64
4. Other sectors	87.02	0.27	0.26						87.55
5. Other	NO	NO	NO						NO
B. Fugitive emissions from fuels	0.00	0.36	NO,NA						0.36
1. Solid fuels	NO	NO	NO						NO
2. Oil and natural gas	0.00	0.36	NO,NA						0.36
C. CO <sub>2</sub> transport and storage	NO								NO
<b>2. Industrial processes and product use</b>	0.20	NO	0.45	0.00	NO	NO	NO	NO	0.65
A. Mineral industry	NO								NO
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	0.20	NO	NO						0.20
E. Electronic Industry				NO	NO	NO	NO	NO	NO
F. Product uses as ODS substitutes				0.00					0.00
G. Other product manufacture and use	NO	NO	0.45						0.45
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>3. Agriculture</b>	0.06	16.72	8.73						25.51
A. Enteric fermentation		13.66							13.66
B. Manure management		3.06	1.16						4.22
C. Rice cultivation		NO,NA							NO,NA
D. Agricultural soils		NA,NO	7.57						7.57
E. Prescribed burning of savannas		NO	NO						NO
F. Field burning of agricultural residues		NO,NA	NO,NA						NO,NA
G. Liming	NO								NO
H. Urea application	0.06								0.06
I. Other carbon-containing fertilizers	NO								NO
J. Other	NA	NA	NA						NA
<b>4. Land use, land-use change and forestry<sup>(1)</sup></b>	6.64	NO	0.31						6.95
A. Forest land	-0.82	NO	NO						-0.82
B. Cropland	4.54	NO	0.01						4.55
C. Grassland	1.83	NO	0.01						1.84
D. Wetlands	0.16	NO	0.00						0.16
E. Settlements	3.19	NO	0.20						3.38
F. Other land	0.44	NO	0.03						0.47
G. Harvested wood products	-2.69								-2.69
H. Other	NO	NO	NO						NO
<b>5. Waste</b>	0.01	1.18	0.58						1.77
A. Solid waste disposal	NO	0.48							0.48
B. Biological treatment of solid waste		0.10	0.06						0.16
C. Incineration and open burning of waste	0.01	0.01	0.00						0.02
D. Waste water treatment and discharge		0.59	0.52						1.10
E. Other	NO	NO	NO						NO
<b>6. Other (as specified in summary 1.A)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Memo items:<sup>(2)</sup></b>									
<b>International bunkers</b>	0.43	0.00	0.00						0.43
Aviation	0.43	0.00	0.00						0.43
Navigation	NO	NO	NO						NO
<b>Multilateral operations</b>	NO	NO	NO						NO
<b>CO<sub>2</sub> emissions from biomass</b>	6.37								6.37
<b>CO<sub>2</sub> captured</b>	90.51								90.51
<b>Long-term storage of C in waste disposal sites</b>	NA								NA
<b>Indirect N<sub>2</sub>O</b>			NO						NO
<b>Indirect CO<sub>2</sub><sup>(3)</sup></b>	NO								NO
<b>Total CO<sub>2</sub> equivalent emissions without land use, land-use change and forestry</b>									228.99
<b>Total CO<sub>2</sub> equivalent emissions with land use, land-use change and forestry</b>									235.94
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, without land use, land-use change and forestry</b>									NA
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, with land use, land-use change and forestry</b>									NA

<sup>(1)</sup> For carbon dioxide (CO<sub>2</sub>) from land use, land-use change and forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive

<sup>(2)</sup> See footnote 7 to table Summary 1.A.

<sup>(3)</sup> In accordance with the UNFCCC Annex I inventory reporting guidelines, for Parties that decide to report indirect CO<sub>2</sub> the national totals shall be provided with and without indirect CO<sub>2</sub>.

**SUMMARY 2 SUMMARY REPORT FOR CO<sub>2</sub> EQUIVALENT EMISSIONS**  
(Sheet 1 of 1)

Inventory 2017  
Submission 2019 v1  
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO <sub>2</sub> <sup>(1)</sup>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	Unspecified mix of HFCs and PFCs	NF <sub>3</sub>	Total	
	CO <sub>2</sub> equivalent (kt)									
<b>Total (net emissions)<sup>(1)</sup></b>	165.27	18.00	10.14	10.69	0.02	0.05	NO	NO	204.17	
<b>1. Energy</b>	154.95	1.65	0.87						157.47	
A. Fuel combustion (sectoral approach)	154.95	0.47	0.87						156.29	
1. Energy industries	2.09	0.02	0.01						2.12	
2. Manufacturing industries and construction	27.31	0.05	0.09						27.44	
3. Transport	59.88	0.05	0.36						60.29	
4. Other sectors	65.67	0.35	0.42						66.43	
5. Other	NO	NO	NO						NO	
B. Fugitive emissions from fuels	0.00	1.18	NO,NA						1.18	
1. Solid fuels	NO	NO	NO						NO	
2. Oil and natural gas	0.00	1.18	NO,NA						1.18	
C. CO <sub>2</sub> transport and storage	NO								NO	
<b>2. Industrial processes and product use</b>	0.14	NO	0.21	10.69	0.02	0.05	NO	NO	11.09	
A. Mineral industry	NO								NO	
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	
D. Non-energy products from fuels and solvent use	0.14	NO	NO						0.14	
E. Electronic industry				NO	NO	NO	NO	NO	NO	
F. Product uses as ODS substitutes				10.69	0.02				10.71	
G. Other product manufacture and use	NO	NO	0.21		NO	0.05			0.25	
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	
<b>3. Agriculture</b>	0.04	15.51	7.93						23.48	
A. Enteric fermentation		12.89							12.89	
B. Manure management		2.62	1.32						3.94	
C. Rice cultivation		NO,NA							NO,NA	
D. Agricultural soils		NA,NO	6.61						6.61	
E. Prescribed burning of savannas		NO	NO						NO	
F. Field burning of agricultural residues		NO,NA	NO,NA						NO,NA	
G. Liming	NO								NO	
H. Urea application	0.04								0.04	
I. Other carbon-containing fertilizers	NO								NO	
J. Other	NA	NA	NA						NA	
<b>4. Land use, land-use change and forestry<sup>(1)</sup></b>	10.13	NO	0.42						10.55	
A. Forest land	-2.76	NO	NO						-2.76	
B. Cropland	4.37	NO	0.02						4.39	
C. Grassland	3.40	NO	0.04						3.44	
D. Wetlands	0.43	NO	0.01						0.45	
E. Settlements	3.40	NO	0.20						3.60	
F. Other land	1.10	NO	0.07						1.17	
G. Harvested wood products	0.19								0.19	
H. Other	NO	NO	NO						NO	
<b>5. Waste</b>	0.01	0.85	0.72						1.58	
A. Solid waste disposal	NO	0.11							0.11	
B. Biological treatment of solid waste		0.15	0.09						0.24	
C. Incineration and open burning of waste	0.01	0.01	0.00						0.02	
D. Waste water treatment and discharge		0.58	0.63						1.21	
E. Other	NO	NO	NO						NO	
<b>6. Other (as specified in summary 1.A)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	
<b>Memo items:<sup>(2)</sup></b>										
<b>International bunkers</b>	0.86	0.00	0.01						0.86	
Aviation	0.86	0.00	0.01						0.86	
Navigation	NO	NO	NO						NO	
<b>Multilateral operations</b>	NO	NO	NO						NO	
<b>CO<sub>2</sub> emissions from biomass</b>	25.27								25.27	
<b>CO<sub>2</sub> captured</b>	87.94								87.94	
<b>Long-term storage of C in waste disposal sites</b>	NA								NA	
<b>Indirect N<sub>2</sub>O</b>			NO							
<b>Indirect CO<sub>2</sub><sup>(3)</sup></b>	NO									
	<b>Total CO<sub>2</sub> equivalent emissions without land use, land-use change and forestry</b>									193.62
	<b>Total CO<sub>2</sub> equivalent emissions with land use, land-use change and forestry</b>									204.17
	<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, without land use, land-use change and forestry</b>									NA
	<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, with land use, land-use change and forestry</b>									NA

<sup>(1)</sup> For carbon dioxide (CO<sub>2</sub>) from land use, land-use change and forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive

<sup>(2)</sup> See footnote 7 to table Summary 1.A.

<sup>(3)</sup> In accordance with the UNFCCC Annex I inventory reporting guidelines, for Parties that decide to report indirect CO<sub>2</sub> the national totals shall be provided with and without indirect CO<sub>2</sub>.

**SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES**  
**(Sheet 1 of 3)**

 Inventory 2017  
 Submission 2019 v1  
 LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO <sub>2</sub> emissions/removals	CH <sub>4</sub>	N <sub>2</sub> O	HFCs <sup>(1)</sup>	PFCs <sup>(1)</sup>	Unspecified mix of HFCs and PFCs <sup>(1)</sup>	SF <sub>6</sub>	NF <sub>3</sub>	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>
	(kt)			(kt CO <sub>2</sub> equivalent)			(kt)					
<b>Total national emissions and removals</b>	165.27	0.72	0.03	10.69	0.02	NO	0.00	NO	NO,NE,NA	NO,NE,NA	0.16	NO,NE,NA
<b>1. Energy</b>	154.95	0.07	0.00						NO,NE	NO,NE	NO,NE	NO,NE
A. Fuel combustion Reference approach(2)	156.36											
Sectoral approach(2)	154.95	0.02	0.00						NO,NE	NO,NE	NO,NE	NO,NE
1. Energy industries	2.09	0.00	0.00						NO,NE	NO,NE	NO,NE	NO,NE
2. Manufacturing industries and construction	27.31	0.00	0.00						NO,NE	NO,NE	NO,NE	NO,NE
3. Transport	59.88	0.00	0.00						NO,NE	NO,NE	NO,NE	NO,NE
4. Other sectors	65.67	0.01	0.00						NE	NE	NE	NE
5. Other	NO	NO	NO						NO	NO	NO	NO
B. Fugitive emissions from fuels	0.00	0.05	NO,NA						NO	NO	NO	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.00	0.05	NO,NA						NO	NO	NO	NO
C. CO <sub>2</sub> Transport and storage	NO											
<b>2. Industrial processes and product use</b>	0.14	NO	0.00	10.69	0.02	NO	0.00	NO	NO,NA	NO,NA	0.16	NO,NA
A. Mineral industry	NO								NO	NO	NO	NO
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO,NA	NO,NA	NO,NA	NO,NA
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	0.14	NO	NO						NO	NO	0.16	NO
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				10.69	0.02							
G. Other product manufacture and use	NO	NO	0.00		NO		0.00		NO	NO	NO	NO
H. Other <sup>(3)</sup>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Note: All footnotes for this table are given at the end of the table on sheet 3.

## SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES

(Sheet 2 of 3)

Inventory 2017  
Submission 2019 v1  
LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs <sup>(1)</sup>	PFCs <sup>(1)</sup>	Unspecified mix of HFCs	SF <sub>6</sub>	NF <sub>3</sub>	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>
	(kt)			(kt CO <sub>2</sub> equivalent)			(kt)					
<b>3. Agriculture</b>	0.04	0.62	0.03						NA,NE,NO	NA,NE,NO	NO,NE,NA	NO
A. Enteric fermentation		0.52										
B. Manure management		0.10	0.00								NO	
C. Rice cultivation		NO,NA									NO,NA	
D. Agricultural soils		NA,NO	0.02						NA,NE,NO	NA,NE,NO	NA,NE,NO	
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		NO,NA	NO,NA						NA,NO	NA,NO	NA,NO	
G. Liming	NO											
H. Urea application	0.04											
I. Other carbon-containing fertilizers	NO											
J. Other	NA	NA	NA						NA	NA	NA	NO
<b>4. Land use, land-use change and forestry<sup>(4)</sup></b>	10.13	NO	0.00						NO,NE	NO,NE	NO,NE	NO
A. Forest land <sup>(4)</sup>	-2.76	NO	NO						NO,NE	NO,NE	NE	
B. Cropland <sup>(4)</sup>	4.37	NO	0.00						NO	NO	NE	
C. Grassland <sup>(4)</sup>	3.40	NO	0.00						NO	NO	NE	
D. Wetlands <sup>(4)</sup>	0.43	NO	0.00						NO	NO	NE	
E. Settlements <sup>(4)</sup>	3.40	NO	0.00						NO	NO	NO,NE	
F. Other land <sup>(4)</sup>	1.10	NO	0.00						NO	NO	NE	
G. Harvested wood products	0.19											
H. Other <sup>(4)</sup>	NO	NO	NO						NO	NO	NO	NO
<b>5. Waste</b>	0.01	0.03	0.00						NO,NA	NO,NA	NO,NA	NO,NA
A. Solid waste disposal <sup>(5)</sup>	NO	0.00							NO	NO	NO	
B. Biological treatment of solid waste <sup>(5)</sup>		0.01	0.00						NO,NA	NO,NA	NO,NA	
C. Incineration and open burning of waste <sup>(5)</sup>	0.01	0.00	0.00						NO,NA	NO,NA	NO,NA	NO,NA
D. Wastewater treatment and discharge		0.02	0.00						NO,NA	NO,NA	NO,NA	
E. Other <sup>(5)</sup>	NO	NO	NO						NO	NO	NO	NO
<b>6. Other (please specify)<sup>(6)</sup></b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Note: All footnotes for this table are given at the end of the table on sheet 3.

**SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)**  
**(Sheet 3 of 3)**

Inventory 2017  
 Submission 2019 v1  
 LIECHTENSTEIN

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO <sub>2</sub> emissions/removals	CH <sub>4</sub>	N <sub>2</sub> O	HFCs <sup>(1)</sup>	PFCs <sup>(1)</sup>	Unspecified mix of HFCs and PFCs <sup>(1)</sup>	SF <sub>6</sub>	NF <sub>3</sub>	NO <sub>x</sub>	CO	NMVOC	SO <sub>2</sub>
	(kt)	(kt CO <sub>2</sub> equivalent)					(kt)					
<b>Memo items:<sup>(7)</sup></b>												
<b>International bunkers</b>	0.86	0.00	0.00						NO,NE	NO,NE	NO,NE	NO,NE
Aviation	0.86	0.00	0.00						NE	NE	NE	NE
Navigation	NO	NO	NO						NO	NO	NO	NO
<b>Multilateral operations</b>	NO	NO	NO						NO	NO	NO	NO
<b>CO<sub>2</sub> emissions from biomass</b>	25.27											
<b>CO<sub>2</sub> captured</b>	87.94											
<b>Long-term storage of C in waste disposal sites</b>	NA											
<b>Indirect N<sub>2</sub>O</b>			NO									
<b>Indirect CO<sub>2</sub></b>	NO											

<sup>(1)</sup> The emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), unspecified mix of HFCs and PFCs and other fluorinated gases are to be expressed as carbon dioxide (CO<sub>2</sub>) equivalent emissions. Data on disaggregated emissions of

<sup>(2)</sup> For verification purposes, Parties are requested to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach in the documentation box to table 1.A(c). For estimating national

<sup>(3)</sup> 2.H. Other includes pulp and paper and food and beverages industry.

<sup>(4)</sup> For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

<sup>(5)</sup> CO<sub>2</sub> from categories solid waste disposal on land and waste incineration should only be included if it stems from non-biogenic or inorganic waste streams. Only emissions from waste incineration without energy recovery are to be reported in the waste sector, whereas emissions from incineration with energy recovery are to be reported in the energy sector.

<sup>(6)</sup> If reporting any country-specific category under sector "6. Other", detailed explanations should be provided in Chapter 8: Other (CRF sector 6) of the national inventory report (NIR).

<sup>(7)</sup> Parties are asked to report emissions from international aviation and international navigation and multilateral operations, as well as CO<sub>2</sub> emissions from biomass and CO<sub>2</sub> captured, under Memo Items. These emissions should not be included in the national total emissions from the energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO<sub>2</sub> emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO<sub>2</sub> emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector.

## Annex 2: CTF Tables

Note that the excel sheets of the CTF tables are password protected, so the layout of the table could not be optimized (font size, column width, lines).

### CTF tables related to the GHG inventory

Table 1  
Emission trends: summary  
(Sheet 1 of 3)

LIE\_BR4\_v0.2

GREENHOUSE GAS EMISSIONS	Base year*	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt CO <sub>2</sub> eq									
CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	198.97	198.97	206.33	206.95	215.03	201.11	204.20	205.95	218.36	229.23
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	205.61	205.61	196.90	208.65	213.39	219.11	208.51	201.79	225.81	228.76
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	19.12	19.12	19.06	18.62	17.82	17.93	17.91	18.25	17.99	17.83
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	19.12	19.12	19.06	18.62	17.82	17.93	17.91	18.25	17.99	17.83
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	10.91	10.91	11.11	11.03	10.78	10.73	10.63	10.57	10.59	10.26
N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	11.22	11.22	11.41	11.33	11.08	11.03	10.93	10.87	10.90	10.59
HFCs	0.00	0.00	0.01	0.09	0.20	0.51	1.37	1.73	2.14	2.74
PFCs	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF <sub>6</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (without LULUCF)</b>	228.99	228.99	236.50	236.69	243.84	230.28	234.10	236.50	249.08	260.06
<b>Total (with LULUCF)</b>	235.94	235.94	227.38	238.69	242.50	248.58	238.72	232.64	256.84	259.92
<b>Total (without LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year*	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt CO <sub>2</sub> eq									
1. Energy	201.06	201.06	208.63	209.41	217.58	203.61	206.79	208.63	221.18	232.07
2. Industrial processes and product use	0.65	0.65	0.63	0.69	0.78	1.06	1.89	2.24	2.63	3.20
3. Agriculture	25.51	25.51	25.53	24.84	23.76	23.86	23.68	23.88	23.55	23.04
4. Land Use, Land-Use Change and Forestry <sup>b</sup>	6.95	6.95	-9.12	2.00	-1.34	18.30	4.61	-3.86	7.76	-0.15
5. Waste	1.77	1.77	1.71	1.74	1.72	1.76	1.74	1.74	1.73	1.75
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (including LULUCF)</b>	235.94	235.94	227.38	238.69	242.50	248.58	238.72	232.64	256.84	259.92

Notes:  
All footnotes for this table are given on sheet 3 of table 1.

Table 1  
Emission trends: summary  
(Sheet 2 of 3)

LIE\_BR4\_v0.2

GREENHOUSE GAS EMISSIONS	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	226.56	216.85	214.66	220.01	229.35	229.38	228.97	231.10	200.77	219.51
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	224.91	241.33	215.56	221.81	235.22	237.45	237.06	244.07	223.02	243.90	228.69
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	17.15	16.74	17.57	17.74	17.90	17.96	18.42	19.15	19.38	19.59	19.42
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	17.15	16.74	17.57	17.74	17.90	17.96	18.42	19.15	19.38	19.59	19.42
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	10.01	9.88	9.92	10.05	10.07	9.76	9.89	10.08	10.16	10.34	10.24
N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	10.35	10.23	10.28	10.42	10.45	10.14	10.28	10.48	10.56	10.75	10.65
HFCs	3.35	4.11	4.94	5.48	6.21	7.06	7.38	7.83	8.50	9.13	9.14
PFCs	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.08	0.08	0.08	0.07
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF <sub>6</sub>	0.00	0.09	0.17	0.24	0.25	0.26	0.26	0.06	0.11	0.35	0.14
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (without LULUCF)</b>	257.08	247.68	247.28	253.55	263.81	264.47	264.98	268.30	239.00	259.01	244.35
<b>Total (with LULUCF)</b>	255.77	272.50	248.53	255.72	270.06	272.93	273.46	281.67	261.65	283.80	266.10
<b>Total (without LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	1. Energy	229.42	219.77	217.46	222.74	232.04	231.85	231.46	233.61	203.22	222.10
2. Industrial processes and product use	3.81	4.64	5.52	6.13	6.93	7.81	8.13	8.37	9.10	9.95	9.68
3. Agriculture	22.10	21.48	22.53	22.87	23.01	22.99	23.56	24.57	24.91	25.12	25.00
4. Land Use, Land-Use Change and Forestry <sup>b</sup>	-1.31	24.82	1.25	2.17	6.25	8.45	8.48	13.37	22.65	24.80	21.75
5. Waste	1.76	1.79	1.77	1.81	1.83	1.83	1.84	1.76	1.77	1.84	1.75
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (including LULUCF)</b>	255.77	272.50	248.53	255.72	270.06	272.93	273.46	281.67	261.65	283.80	266.10

Notes:  
All footnotes for this table are given on sheet 3 of table 1.

Table 1  
Emission trends: summary  
(Sheet 3 of 3)

LIE\_BR4\_v0.2

GREENHOUSE GAS EMISSIONS	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kilotonnes of CO <sub>2</sub> equivalent								
CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	190.81	176.78	185.31	192.54	161.11	158.93	148.89	155.14	-22.03
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	210.65	200.41	209.20	208.73	177.19	169.57	157.67	165.27	-49.62
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	18.85	19.15	19.53	18.73	18.70	18.41	18.43	18.00	-5.83
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	18.85	19.15	19.53	18.73	18.70	18.41	18.43	18.00	-5.83
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	10.00	10.39	10.27	9.98	9.88	9.92	9.77	9.73	-10.80
N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	10.41	10.80	10.68	10.40	10.30	10.35	10.20	10.14	-9.56
HFCs	9.71	9.98	10.38	10.65	10.66	10.45	10.56	10.69	10,233,665.56
PFCs	0.07	0.06	0.06	0.06	0.04	0.04	0.03	0.02	100.00
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	0.00
SF <sub>6</sub>	0.02	0.01	0.00	0.17	0.12	0.04	0.01	0.05	100.00
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Total (without LULUCF)</b>	229.46	216.36	225.55	232.13	200.50	197.79	187.68	193.62	-15.45
<b>Total (with LULUCF)</b>	249.72	240.41	249.85	248.75	217.01	208.85	196.89	204.17	-13.47
<b>Total (without LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>Total (with LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	0.00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kilotonnes of CO <sub>2</sub> equivalent								
1. Energy	193.34	179.25	187.84	195.05	163.38	161.24	151.16	157.47	-21.68
2. Industrial processes and product use	10.16	10.39	10.77	11.22	11.16	10.86	10.93	11.09	1,598.59
3. Agriculture	24.19	24.91	25.13	24.02	24.38	24.09	24.06	23.48	-7.95
4. Land Use, Land-Use Change and Forestry <sup>b</sup>	20.25	24.05	24.30	16.62	16.51	11.06	9.21	10.55	51.71
5. Waste	1.78	1.82	1.81	1.84	1.58	1.60	1.54	1.58	-10.68
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Total (including LULUCF)</b>	249.72	240.41	249.85	248.75	217.01	208.85	196.89	204.17	-13.47

## Notes:

Further detailed information could be found in the common reporting format tables of the Party's greenhouse gas inventory, namely "Emission trends (CO<sub>2</sub>)", "Emission trends (CH<sub>4</sub>)", "Emission trends (N<sub>2</sub>O)" and "Emission trends (HFCs, PFCs and SF<sub>6</sub>)", which is included in an annex to this biennial report.

1 kt CO<sub>2</sub> eq equals 1 Gg CO<sub>2</sub> eq.

Abbreviation: LULUCF = land use, land-use change and forestry.

<sup>a</sup> The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

<sup>b</sup> Includes net CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from LULUCF.

Table 1(a)  
Emission trends (CO<sub>2</sub>)  
(Sheet 1 of 3)

LIE\_BR4\_v0.2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
<b>1. Energy</b>	198.70	198.70	206.07	206.70	214.79	200.89	203.98	205.74	218.14	229.02
A. Fuel combustion (sectoral approach)	198.70	198.70	206.07	206.70	214.79	200.89	203.98	205.74	218.14	229.02
1. Energy industries	0.12	0.12	0.79	1.82	1.88	1.76	2.00	2.50	2.44	2.83
2. Manufacturing industries and construction	36.19	36.19	35.83	36.21	37.47	35.52	35.60	35.66	37.50	40.24
3. Transport	75.36	75.36	88.52	87.75	85.64	78.36	80.30	81.87	85.14	84.88
4. Other sectors	87.02	87.02	80.93	80.92	89.80	85.25	86.09	86.00	93.05	101.08
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. CO <sub>2</sub> transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>2. Industrial processes</b>	0.20	0.20	0.19	0.18	0.17	0.16	0.16	0.16	0.17	0.16
A. Mineral industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	0.20	0.20	0.19	0.18	0.17	0.16	0.16	0.16	0.17	0.16
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>3. Agriculture</b>	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04
A. Enteric fermentation										
B. Manure management										
C. Rice cultivation										
D. Agricultural soils										
E. Prescribed burning of savannas										
F. Field burning of agricultural residues										
G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Urea application	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>4. Land Use, Land-Use Change and Forestry</b>	6.64	6.64	-9.42	1.70	-1.64	18.00	4.31	-4.16	7.44	-0.48
A. Forest land	-0.82	-0.82	-17.08	-6.15	-9.68	9.79	-4.08	-12.73	-1.66	-10.11
B. Cropland	4.54	4.54	4.53	4.52	4.51	4.50	4.49	4.48	4.48	4.49
C. Grassland	1.83	1.83	1.82	1.81	1.80	1.79	1.78	1.77	1.98	2.18
D. Wetlands	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.18	0.20
E. Settlements	3.19	3.19	3.19	3.19	3.19	3.19	3.19	3.19	3.23	3.26
F. Other land	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.53	0.61
G. Harvested wood products	-2.69	-2.69	-2.48	-2.27	-2.07	-1.87	-1.67	-1.48	-1.29	-1.11
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
A. Solid waste disposal	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Biological treatment of solid waste										
C. Incineration and open burning of waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
D. Waste water treatment and discharge										
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Memo items:</b>										
<b>International bunkers</b>	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.44	0.45	0.46
Aviation	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.44	0.45	0.46
Navigation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Multilateral operations</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>CO<sub>2</sub> emissions from biomass</b>	6.37	6.37	4.97	6.53	6.09	7.38	5.76	5.58	6.45	7.15
<b>CO<sub>2</sub> captured</b>	90.51	90.51	82.90	84.39	92.87	89.46	88.87	88.51	96.22	104.87
<b>Long-term storage of C in waste disposal sites</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Indirect N<sub>2</sub>O</b>										
<b>Indirect CO<sub>2</sub> (5)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total CO<sub>2</sub> equivalent emissions without land use, land-use change and forestry</b>	198.97	198.97	206.33	206.95	215.03	201.11	204.20	205.95	218.36	229.23
<b>Total CO<sub>2</sub> equivalent emissions with land use, land-use change and forestry</b>	205.61	205.61	196.90	208.65	213.39	219.11	208.51	201.79	225.81	228.76
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, without land use, land-use change and forestry</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, with land use, land-use change and forestry</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:  
All footnotes for this table are given on sheet 3 of table 1(a).

Table 1(a)  
Emission trends (CO<sub>2</sub>)  
(Sheet 2 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>1. Energy</b>	226.34	216.63	214.46	219.81	229.09	229.12	228.71	230.86	200.52	219.27	205.16
A. Fuel combustion (sectoral approach)	226.34	216.63	214.46	219.80	229.09	229.12	228.71	230.86	200.52	219.27	205.16
1. Energy industries	2.83	2.67	2.83	2.42	2.73	2.85	3.03	2.75	2.48	2.81	2.87
2. Manufacturing industries and construction	39.70	36.31	36.30	37.76	41.06	39.70	39.03	40.40	33.79	36.24	27.45
3. Transport	89.02	89.84	86.51	82.62	82.51	81.45	81.07	78.54	82.66	87.07	81.20
4. Other sectors	94.79	87.81	88.82	97.00	102.80	105.12	105.58	109.17	81.59	93.16	93.64
5. Other	NO										
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid fuels	NO										
2. Oil and natural gas and other emissions from energy production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. CO <sub>2</sub> transport and storage	NO										
<b>2. Industrial processes</b>	0.17	0.17	0.15	0.15	0.20	0.20	0.20	0.19	0.19	0.18	0.14
A. Mineral industry	NO										
B. Chemical industry	NO										
C. Metal industry	NO										
D. Non-energy products from fuels and solvent use	0.17	0.17	0.15	0.15	0.20	0.20	0.20	0.19	0.19	0.18	0.14
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	NO										
H. Other	NO										
<b>3. Agriculture</b>	0.04	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05
A. Enteric fermentation											
B. Manure management											
C. Rice cultivation											
D. Agricultural soils											
E. Prescribed burning of savannas											
F. Field burning of agricultural residues											
G. Liming	NO										
H. Urea application	0.04	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.04
I. Other carbon-containing fertilizers	NO										
J. Other	NO	NA									
<b>4. Land Use, Land-Use Change and Forestry</b>	-1.65	-2.47	0.89	1.80	5.87	8.07	8.09	12.97	22.25	24.39	21.24
A. Forest land	-11.81	-13.79	-10.25	-9.79	-5.95	-3.97	-4.17	0.50	9.55	11.48	8.31
B. Cropland	4.49	4.49	4.49	4.49	4.47	4.45	4.42	4.40	4.38	4.36	4.36
C. Grassland	2.38	2.58	2.79	2.99	3.09	3.18	3.27	3.36	3.46	3.55	3.56
D. Wetlands	0.22	0.24	0.27	0.29	0.29	0.30	0.30	0.31	0.31	0.32	0.33
E. Settlements	3.30	3.34	3.38	3.41	3.42	3.43	3.44	3.45	3.46	3.46	3.46
F. Other land	0.70	0.78	0.87	0.95	0.99	1.03	1.07	1.11	1.15	1.19	1.19
G. Harvested wood products	-0.93	-0.75	-0.65	-0.54	-0.44	-0.34	-0.25	-0.15	-0.06	0.04	0.13
H. Other	NO										
<b>5. Waste</b>	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
A. Solid waste disposal	NO										
B. Biological treatment of solid waste											
C. Incineration and open burning of waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
D. Waste water treatment and discharge											
E. Other	NO										
<b>6. Other (as specified in the summary table in CRF)</b>	NO										
<b>Memo items:</b>											
<b>International bunkers</b>	0.48	0.49	0.50	0.45	0.50	0.34	0.48	0.83	0.82	0.80	0.97
Aviation	0.48	0.49	0.50	0.45	0.50	0.34	0.48	0.83	0.82	0.80	0.97
Navigation	NO										
Multilateral operations	NO										
CO <sub>2</sub> emissions from biomass	7.80	12.05	8.15	8.33	10.45	11.33	12.27	13.91	18.02	18.22	21.54
CO <sub>2</sub> captured	98.98	96.32	93.45	101.90	109.63	112.68	119.24	119.24	95.43	107.20	111.22
Long-term storage of C in waste disposal sites	NA										
Indirect N <sub>2</sub> O											
Indirect CO <sub>2</sub> (3)	NO										
<b>Total CO<sub>2</sub> equivalent emissions without land use, land-use change and forestry</b>	226.56	216.85	214.66	220.01	229.35	229.38	228.97	231.10	200.77	219.51	205.35
<b>Total CO<sub>2</sub> equivalent emissions with land use, land-use change and forestry</b>	224.91	241.33	215.56	221.81	235.22	237.45	237.06	244.07	223.02	243.90	226.69
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, without land use, land-use change and forestry</b>	NA										
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, with land use, land-use change and forestry</b>	NA										

Notes:  
All footnotes for this table are given on sheet 3 of table 1(a).

Table 1(a)  
Emission trends (CO<sub>2</sub>)  
(Sheet 3 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	%								
<b>I. Energy</b>	190.60	176.57	185.12	192.34	160.91	158.74	148.70	154.95	-22.02
A. Fuel combustion (sectoral approach)	190.60	176.57	185.12	192.34	160.91	158.74	148.70	154.95	-22.02
1. Energy industries	3.15	2.95	2.71	2.92	2.48	2.02	2.14	2.09	1,624.89
2. Manufacturing industries and construction	25.98	23.47	25.61	26.29	26.99	27.25	25.56	27.31	-24.54
3. Transport	77.06	76.24	79.26	78.97	73.27	60.71	59.26	59.88	-20.54
4. Other sectors	84.41	73.91	77.54	84.15	58.17	68.75	61.74	65.67	-24.54
5. Other	NO	0.00							
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.65
1. Solid fuels	NO	0.00							
2. Oil and natural gas and other emissions from energy production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.65
C. CO <sub>2</sub> transport and storage	NO	0.00							
<b>2. Industrial processes</b>	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	-32.20
A. Mineral industry	NO	0.00							
B. Chemical industry	NO	0.00							
C. Metal industry	NO	0.00							
D. Non-energy products from fuels and solvent use	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	-32.20
E. Electronic industry									
F. Product uses as ODS substitutes									
G. Other product manufacture and use	NO	0.00							
H. Other	NO	0.00							
<b>3. Agriculture</b>	0.04	0.05	0.04	0.04	0.04	0.05	0.04	0.04	-24.02
A. Enteric fermentation									
B. Manure management									
C. Rice cultivation									
D. Agricultural soils									
E. Prescribed burning of savannas									
F. Field burning of agricultural residues									
G. Liming	NO	0.00							
H. Urea application	0.04	0.05	0.04	0.04	0.04	0.05	0.04	0.04	-24.02
I. Other carbon-containing fertilizers	NO	0.00							
J. Other	NA	0.00							
<b>4. Land Use, Land-Use Change and Forestry</b>	19.84	23.63	23.88	16.20	16.08	10.64	8.78	10.13	52.53
A. Forest land	6.71	10.48	10.71	3.00	2.87	-2.59	-4.45	-2.76	235.31
B. Cropland	4.37	4.38	4.38	4.39	4.40	4.39	4.38	4.37	-3.71
C. Grassland	3.56	3.57	3.57	3.58	3.58	3.59	3.59	3.40	86.21
D. Wetlands	0.35	0.36	0.38	0.39	0.41	0.42	0.44	0.43	173.11
E. Settlements	3.46	3.45	3.45	3.45	3.45	3.44	3.44	3.40	6.63
F. Other land	1.19	1.19	1.18	1.18	1.18	1.18	1.18	1.10	147.91
G. Harvested wood products	0.21	0.21	0.21	0.20	0.20	0.19	0.19	0.19	-106.92
H. Other	NO	0.00							
<b>5. Waste</b>	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-24.84
A. Solid waste disposal	NO	0.00							
B. Biological treatment of solid waste									
C. Incineration and open burning of waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-24.84
D. Waste water treatment and discharge									
E. Other	NO	0.00							
<b>6. Other (as specified in the summary table in CRF)</b>	NO	0.00							
<b>Memo items:</b>									
<b>International bunkers</b>	0.84	0.91	1.11	1.05	1.18	1.19	0.92	0.86	100.22
Aviation	0.84	0.91	1.11	1.05	1.18	1.19	0.92	0.86	100.22
Navigation	NO	0.00							
<b>Multilateral operations</b>	NO	0.00							
CO <sub>2</sub> emissions from biomass	22.85	24.70	25.21	22.02	22.39	25.39	24.93	25.27	296.67
CO <sub>2</sub> captured	103.48	95.13	99.14	102.03	78.41	91.82	83.99	87.94	-2.84
Long-term storage of C in waste disposal sites	NA	0.00							
<b>Indirect N<sub>2</sub>O</b>									
<b>Indirect CO<sub>2</sub> (3)</b>	NO	0.00							
<b>Total CO<sub>2</sub> equivalent emissions without land use, land-use change and forestry</b>	190.81	176.78	185.31	192.54	161.11	158.93	148.89	155.14	-22.03
<b>Total CO<sub>2</sub> equivalent emissions with land use, land-use change and forestry</b>	210.65	200.41	209.20	208.73	177.19	169.57	157.67	165.27	-19.62
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, without land use, land-use change and forestry</b>	NA	0.00							
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, with land use, land-use change and forestry</b>	NA	0.00							

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

<sup>7</sup> The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

<sup>8</sup> Fill in net emissions/removals as reported in CRF table Summary I.A of the latest reported inventory year. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

Table 1(b)  
Emission trends (CH<sub>4</sub>)  
(Sheet 1 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
<b>1. Energy</b>	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06
A. Fuel combustion (sectoral approach)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
1. Energy industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing industries and construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Transport	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
4. Other sectors	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive emissions from fuels	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.03
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
C. CO <sub>2</sub> transport and storage										
<b>2. Industrial processes</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Mineral industry										
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>3. Agriculture</b>	0.67	0.67	0.67	0.65	0.61	0.62	0.62	0.63	0.62	0.61
A. Enteric fermentation	0.55	0.55	0.54	0.53	0.50	0.51	0.51	0.52	0.51	0.50
B. Manure management	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11
C. Rice cultivation	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
D. Agricultural soils	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
G. Liming										
H. Urea application										
I. Other carbon-containing fertilizers										
J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>4. Land use, land-use change and forestry</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
A. Forest land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products										
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.04	0.05
A. Solid waste disposal	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
B. Biological treatment of solid waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste water treatment and discharge	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total CH<sub>4</sub> emissions without CH<sub>4</sub> from LULUCF</b>	0.76	0.76	0.76	0.74	0.71	0.72	0.72	0.73	0.72	0.71
<b>Total CH<sub>4</sub> emissions with CH<sub>4</sub> from LULUCF</b>	0.76	0.76	0.76	0.74	0.71	0.72	0.72	0.73	0.72	0.71
<b>Memo items:</b>										
<b>International bunkers</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Multilateral operations</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>CO<sub>2</sub> emissions from biomass</b>										
<b>CO<sub>2</sub> captured</b>										
<b>Long-term storage of C in waste disposal sites</b>										
<b>Indirect N<sub>2</sub>O</b>										
<b>Indirect CO<sub>2</sub> (S)</b>										

Notes:  
All footnotes for this table are given on sheet 3 of table 1(b).

Table 1(b)  
Emission trends (CH<sub>4</sub>)  
(Sheet 2 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>1. Energy</b>	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07
A. Fuel combustion (sectoral approach)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02
1. Energy industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing industries and construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Transport	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4. Other sectors	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
5. Other	NO										
B. Fugitive emissions from fuels	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04
1. Solid fuels	NO										
2. Oil and natural gas and other emissions from energy production	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04
C. CO <sub>2</sub> transport and storage											
<b>2. Industrial processes</b>	NO										
A. Mineral industry											
B. Chemical industry	NO										
C. Metal industry	NO										
D. Non-energy products from fuels and solvent use	NO										
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	NO										
H. Other	NO										
<b>3. Agriculture</b>	0.58	0.56	0.60	0.60	0.60	0.61	0.62	0.65	0.66	0.67	0.67
A. Enteric fermentation	0.48	0.46	0.49	0.50	0.50	0.51	0.52	0.54	0.55	0.56	0.55
B. Manure management	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11
C. Rice cultivation	NO, NA										
D. Agricultural soils	NA, NO										
E. Prescribed burning of savannas	NO										
F. Field burning of agricultural residues	NO, NA										
G. Liming											
H. Urea application											
I. Other carbon-containing fertilizers											
J. Other	NA										
<b>4. Land use, land-use change and forestry</b>	NO										
A. Forest land	NO										
B. Cropland	NO										
C. Grassland	NO										
D. Wetlands	NO										
E. Settlements	NO										
F. Other land	NO										
G. Harvested wood products											
H. Other	NO										
<b>5. Waste</b>	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04
A. Solid waste disposal	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
B. Biological treatment of solid waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste water treatment and discharge	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
E. Other	NO										
<b>6. Other (as specified in the summary table in CRF)</b>	NO										
<b>Total CH<sub>4</sub> emissions without CH<sub>4</sub> from LULUCF</b>	0.69	0.67	0.70	0.71	0.72	0.72	0.74	0.77	0.78	0.78	0.78
<b>Total CH<sub>4</sub> emissions with CH<sub>4</sub> from LULUCF</b>	0.69	0.67	0.70	0.71	0.72	0.72	0.74	0.77	0.78	0.78	0.78
<b>Memo items:</b>											
<b>International bunkers</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	NO										
<b>Multilateral operations</b>	NO										
<b>CO<sub>2</sub> emissions from biomass</b>											
<b>CO<sub>2</sub> captured</b>											
<b>Long-term storage of C in waste disposal sites</b>											
<b>Indirect N<sub>2</sub>O</b>											
<b>Indirect CO<sub>2</sub> (3)</b>											

Notes:  
All footnotes for this table are given on sheet 3 of table 1(b).

Table 1(b)  
Emission trends (CH<sub>4</sub>)  
(Sheet 3 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	%								
<b>1. Energy</b>	0.07	0.07	0.07	0.07	0.06	0.07	0.06	0.07	35.30
A. Fuel combustion (sectoral approach)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-45.07
1. Energy industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	632.49
2. Manufacturing industries and construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-7.09
3. Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-90.72
4. Other sectors	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	29.62
5. Other	NO	0.00							
B. Fugitive emissions from fuels	0.05	0.04	0.05	0.05	0.04	0.05	0.05	0.05	223.65
1. Solid fuels	NO	0.00							
2. Oil and natural gas and other emissions from energy production	0.05	0.04	0.05	0.05	0.04	0.05	0.05	0.05	223.65
C. CO <sub>2</sub> transport and storage									
<b>2. Industrial processes</b>	NO	0.00							
A. Mineral industry									
B. Chemical industry	NO	0.00							
C. Metal industry	NO	0.00							
D. Non-energy products from fuels and solvent use	NO	0.00							
E. Electronic industry									
F. Product uses as ODS substitutes									
G. Other product manufacture and use	NO	0.00							
H. Other	NO	0.00							
<b>3. Agriculture</b>	0.64	0.66	0.67	0.64	0.65	0.64	0.64	0.62	-7.28
A. Enteric fermentation	0.54	0.55	0.56	0.53	0.54	0.53	0.53	0.52	-5.66
B. Manure management	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	-14.50
C. Rice cultivation	NO, NA	0.00							
D. Agricultural soils	NA, NO	0.00							
E. Prescribed burning of savannas	NO	0.00							
F. Field burning of agricultural residues	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
G. Liming									
H. Urea application									
I. Other carbon-containing fertilizers									
J. Other	NA	0.00							
<b>4. Land use, land-use change and forestry</b>	NO	0.00							
A. Forest land	NO	0.00							
B. Cropland	NO	0.00							
C. Grassland	NO	0.00							
D. Wetlands	NO	0.00							
E. Settlements	NO	0.00							
F. Other land	NO	0.00							
G. Harvested wood products									
H. Other	NO	0.00							
<b>5. Waste</b>	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	-27.93
A. Solid waste disposal	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	-77.77
B. Biological treatment of solid waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	48.85
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-21.85
D. Waste water treatment and discharge	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	-0.35
E. Other	NO	0.00							
<b>6. Other (as specified in the summary table in CRF)</b>	NO	0.00							
<b>Total CH<sub>4</sub> emissions without CH<sub>4</sub> from LULUCF</b>	0.75	0.77	0.78	0.75	0.74	0.74	0.74	0.72	-5.83
<b>Total CH<sub>4</sub> emissions with CH<sub>4</sub> from LULUCF</b>	0.75	0.77	0.78	0.75	0.75	0.74	0.74	0.72	-5.83
<b>Memo items:</b>									
<b>International bunkers</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	101.32
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	101.32
Navigation	NO	0.00							
Multilateral operations	NO	0.00							
<b>CO<sub>2</sub> emissions from biomass</b>									
<b>CO<sub>2</sub> captured</b>									
<b>Long-term storage of C in waste disposal sites</b>									
<b>Indirect N<sub>2</sub>O</b>									
<b>Indirect CO<sub>2</sub> (3)</b>									

Abbreviations : CRF = common reporting format, LULUCF = land use, land-use change and forestry.

\* The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

Table 1(c)  
Emission trends (N<sub>2</sub>O)  
(Sheet 1 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
<b>1. Energy</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
A. Fuel combustion (sectoral approach)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
1. Energy industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing industries and construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Other sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive emissions from fuels	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C. CO <sub>2</sub> transport and storage										
<b>2. Industrial processes</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Mineral industry										
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>3. Agriculture</b>	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
A. Enteric fermentation										
B. Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Rice cultivation										
D. Agricultural soils	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
G. Liming										
H. Urea application										
I. Other carbon containing fertilizers										
J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>4. Land use, land-use change and forestry</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Forest land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Settlements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Other land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Harvested wood products										
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Solid waste disposal										
B. Biological treatment of solid waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste water treatment and discharge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total direct N<sub>2</sub>O emissions without N<sub>2</sub>O from LULUCF</b>	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03
<b>Total direct N<sub>2</sub>O emissions with N<sub>2</sub>O from LULUCF</b>	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
<b>Memo items:</b>										
<b>International bunkers</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Multilateral operations</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>CO<sub>2</sub> emissions from biomass</b>										
<b>CO<sub>2</sub> captured</b>										
<b>Long-term storage of C in waste disposal sites</b>										
<b>Indirect N<sub>2</sub>O</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Indirect CO<sub>2</sub> (S)</b>										

Notes:  
All footnotes for this table are given on sheet 3 of table 1(c).

Table 1(c)  
Emission trends (N<sub>2</sub>O)  
(Sheet 2 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>1. Energy</b>	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Fuel combustion (sectoral approach)	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Energy industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Manufacturing industries and construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Other sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Other	NO										
B. Fugitive emissions from fuels	NO, NA										
1. Solid fuels	NO										
2. Oil and natural gas and other emissions from energy production	NO, NA										
C. CO <sub>2</sub> transport and storage											
<b>2. Industrial processes</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Mineral industry											
B. Chemical industry	NO										
C. Metal industry	NO										
D. Non-energy products from fuels and solvent use	NO										
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H. Other	NO										
<b>3. Agriculture</b>	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
A. Enteric fermentation											
B. Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Rice cultivation											
D. Agricultural soils	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
E. Prescribed burning of savannas	NO										
F. Field burning of agricultural residues	NO, NA										
G. Liming											
H. Urea application											
I. Other carbon containing fertilizers											
J. Other	NA										
<b>4. Land use, land-use change and forestry</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Forest land	NO										
B. Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Settlements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Other land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Harvested wood products											
H. Other	NO										
<b>5. Waste</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Solid waste disposal											
B. Biological treatment of solid waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste water treatment and discharge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Other	NO										
<b>6. Other (as specified in the summary table in CRF)</b>	NO										
<b>Total direct N<sub>2</sub>O emissions without N<sub>2</sub>O from LULUCF</b>	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
<b>Total direct N<sub>2</sub>O emissions with N<sub>2</sub>O from LULUCF</b>	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.04	0.04	0.04	0.04
<b>Memo items:</b>											
<b>International bunkers</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	NO										
<b>Multilateral operations</b>	NO										
<b>CO<sub>2</sub> emissions from biomass</b>											
<b>CO<sub>2</sub> captured</b>											
<b>Long-term storage of C in waste disposal sites</b>											
<b>Indirect N<sub>2</sub>O</b>	NO										
<b>Indirect CO<sub>2</sub> (3)</b>											

Notes:  
All footnotes for this table are given on sheet 3 of table 1(c).

Table 1(c)

**Emission trends (N<sub>2</sub>O)**  
(Sheet 3 of 3)

LIE\_BR4\_v0.2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year	
	%									
<b>1. Energy</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-24.09	
A. Fuel combustion (sectoral approach)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-24.09	
1. Energy industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-81.75	
2. Manufacturing industries and construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.32	
3. Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-52.29	
4. Other sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.88	
5. Other	NO	0.00								
B. Fugitive emissions from fuels	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NA, NO	NO, NA	NO, NA	0.00
1. Solid fuels	NO	0.00								
2. Oil and natural gas and other emissions from energy production	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NA, NO	NO, NA	NO, NA	0.00
C. CO <sub>2</sub> transport and storage										
<b>2. Industrial processes</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-54.62	
A. Mineral industry										
B. Chemical industry	NO	0.00								
C. Metal industry	NO	0.00								
D. Non-energy products from fuels and solvent use	NO	0.00								
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-54.62	
H. Other	NO	0.00								
<b>3. Agriculture</b>	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	-9.14	
A. Enteric fermentation										
B. Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.94	
C. Rice cultivation										
D. Agricultural soils	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-12.68	
E. Prescribed burning of savannas	NO	0.00								
F. Field burning of agricultural residues	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NA, NO	NO, NA	NO, NA	0.00
G. Liming										
H. Urea application										
I. Other carbon containing fertilizers										
J. Other	NA	0.00								
<b>4. Land use, land-use change and forestry</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.02	
A. Forest land	NO	0.00								
B. Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	104.56	
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	384.88	
D. Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	314.01	
E. Settlements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	
F. Other land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	150.01	
G. Harvested wood products										
H. Other	NO	0.00								
<b>5. Waste</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.73	
A. Solid waste disposal										
B. Biological treatment of solid waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.85	
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-21.85	
D. Waste water treatment and discharge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.14	
E. Other	NO	0.00								
<b>6. Other (as specified in the summary table in CRF)</b>	NO	0.00								
<b>Total direct N<sub>2</sub>O emissions without N<sub>2</sub>O from LULUCF</b>	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	-10.80	
<b>Total direct N<sub>2</sub>O emissions with N<sub>2</sub>O from LULUCF</b>	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	-9.56	
<b>Memo items:</b>										
<b>International bunkers</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	101.32	
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	101.32	
Navigation	NO	0.00								
Multilateral operations	NO	0.00								
<b>CO<sub>2</sub> emissions from biomass</b>										
<b>CO<sub>2</sub> captured</b>										
<b>Long-term storage of C in waste disposal sites</b>										
<b>Indirect N<sub>2</sub>O</b>	NO	0.00								
<b>Indirect CO<sub>2</sub> (3)</b>										

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

\* The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

Table 1(d)  
Emission trends (HFCs, PFCs and SF<sub>6</sub>)  
(Sheet 1 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
<b>Emissions of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	0.00	0.00	0.01	0.09	0.20	0.52	1.37	1.74	2.14	2.74
<b>Emissions of HFCs - (kt CO<sub>2</sub> equivalent)</b>	0.00	0.00	0.01	0.09	0.20	0.51	1.37	1.73	2.14	2.74
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-32	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-152	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-152a	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00
HFC-161	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-236cb	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-365mfc	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of HFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Emissions of PFCs - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CF <sub>4</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>2</sub> F <sub>6</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>3</sub> F <sub>8</sub>	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C <sub>4</sub> F <sub>10</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C <sub>3</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>2</sub> F <sub>12</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>3</sub> F <sub>14</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C10F18	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C3F6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of PFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of HFCs and PFCs - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Emissions of SF<sub>6</sub> - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF <sub>6</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Emissions of NF<sub>3</sub> - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Notes:  
All footnotes for this table are given on sheet 3 of table 1(d).

Table 1(d)  
Emission trends (HFCs, PFCs and SF<sub>6</sub>)  
(Sheet 2 of 3)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>Emissions of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	3.36	4.12	4.96	5.50	6.25	7.11	7.44	7.91	8.58	9.22	9.21
<b>Emissions of HFCs - (kt CO<sub>2</sub> equivalent)</b>	3.35	4.11	4.94	5.48	6.21	7.06	7.38	7.83	8.50	9.13	9.14
HFC-23	NO										
HFC-32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NO										
HFC-43-10mee	NO										
HFC-125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-134	NO										
HFC-134a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-143	NO										
HFC-143a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-152	NO										
HFC-152a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-161	NO										
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236cb	NO										
HFC-236ea	NO										
HFC-236fa	NO										
HFC-245ca	NO										
HFC-245fa	NO										
HFC-365mfc	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unspecified mix of HFCs(4) - (kt CO <sub>2</sub> equivalent)	NO										
<b>Emissions of PFCs - (kt CO<sub>2</sub> equivalent)</b>	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.08	0.08	0.08	0.07
CF <sub>4</sub>	NO										
C <sub>2</sub> F <sub>6</sub>	NO										
C <sub>3</sub> F <sub>8</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C <sub>4</sub> F <sub>10</sub>	NO										
c-C <sub>3</sub> F <sub>8</sub>	NO										
C <sub>2</sub> F <sub>12</sub>	NO										
C <sub>3</sub> F <sub>14</sub>	NO										
C10F18	NO										
c-C3F6	NO										
Unspecified mix of PFCs(4) - (kt CO <sub>2</sub> equivalent)	NO										
Unspecified mix of HFCs and PFCs - (kt CO <sub>2</sub> equivalent)	NO										
<b>Emissions of SF<sub>6</sub> - (kt CO<sub>2</sub> equivalent)</b>	0.00	0.09	0.17	0.24	0.25	0.26	0.26	0.06	0.11	0.35	0.14
SF <sub>6</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Emissions of NF<sub>3</sub> - (kt CO<sub>2</sub> equivalent)</b>	NO										
NF <sub>3</sub>	NO										

Notes:  
All footnotes for this table are given on sheet 3 of table 1(d).

Table 1(d)  
Emission trends (HFCs, PFCs and SF<sub>6</sub>)  
(Sheet 3 of 3)

LIE\_BR4\_v0.2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year %
<b>Emissions of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	9.78	10.04	10.44	10.71	10.70	10.48	10.58	10.71	10,249,791.18
<b>Emissions of HFCs - (kt CO<sub>2</sub> equivalent)</b>	9.71	9.98	10.38	10.65	10.66	10.45	10.56	10.69	10,233,665.56
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-134a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4,471,537.38
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-143a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-152	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-152a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-161	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-236cb	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-236ea	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-245fa	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-365mfc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Unspecified mix of HFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Emissions of PFCs - (kt CO<sub>2</sub> equivalent)</b>	0.07	0.06	0.06	0.06	0.04	0.04	0.03	0.02	100.00
CF <sub>4</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C <sub>2</sub> F <sub>6</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C <sub>2</sub> F <sub>8</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
C <sub>2</sub> F <sub>10</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
c-C <sub>3</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C <sub>3</sub> F <sub>12</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C <sub>3</sub> F <sub>14</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C10F18	NO	NO	NO	NO	NO	NO	NO	NO	0.00
c-C3F6	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Unspecified mix of PFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Unspecified mix of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Emissions of SF<sub>6</sub> - (kt CO<sub>2</sub> equivalent)</b>	0.02	0.01	0.00	0.17	0.12	0.04	0.01	0.05	100.00
SF <sub>6</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
<b>Emissions of NF<sub>3</sub> - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

<sup>a</sup> The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

<sup>b</sup> Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO<sub>2</sub> equivalent emissions.

<sup>c</sup> In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO<sub>2</sub> equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.)

## CTF tables related to projections

Table 5  
Summary of key variables and assumptions used in the projections analysis<sup>d</sup>

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Key underlying assumptions		Historical <sup>b</sup>										Projected			
Assumption	Unit	1990	1995	2000	2005	2010	2015	2016	2017	2018	2020	2025	2030		

<sup>a</sup> Parties should include key underlying assumptions as appropriate.

<sup>b</sup> Parties should include historical data used to develop the greenhouse gas projections reported.

Table 6(a)

LIE\_BR4\_v0.2

Information on updated greenhouse gas projections under a 'with measures' scenario<sup>a</sup>

Sector <sup>d,e</sup>	GHG emissions and removals <sup>b</sup>								GHG emission projections	
	(kt CO <sub>2</sub> eq)								(kt CO <sub>2</sub> eq)	
	Base year (1990)	1990	1995	2000	2005	2010	2015	2017	2020	2030
Energy	124.42	124.42	125.00	128.48	149.69	115.70	100.12	97.18	79.78	68.91
Transport	76.64	76.64	81.79	91.29	81.77	77.63	61.12	60.29	59.73	54.04
Industry/industrial processes	0.65	0.65	1.89	4.64	8.13	10.16	10.86	11.09	10.41	8.09
Agriculture	25.51	25.51	23.68	21.48	23.56	24.19	24.09	23.48	23.17	22.93
Forestry/LULUCF	6.95	6.95	4.61	24.82	8.48	20.25	11.06	10.55	12.79	12.79
Waste management/waste	1.77	1.77	1.74	1.79	1.84	1.78	1.60	1.58	1.67	1.67
Other (specify)										
<b>Gas</b>										
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	205.61	205.61	208.51	241.33	237.06	210.65	169.57	165.27	149.62	133.18
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	198.97	198.97	204.20	216.85	228.97	190.81	158.93	155.14	137.34	120.90
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	19.12	19.12	17.91	16.74	18.42	18.85	18.41	18.00	17.78	17.57
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	19.12	19.12	17.91	16.74	18.42	18.85	18.41	18.00	17.78	17.57
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	11.22	11.22	10.93	10.23	10.28	10.41	10.35	10.14	10.06	9.84
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	10.91	10.91	10.63	9.88	9.89	10.00	9.92	9.73	9.56	9.33
HFCs	0.00	0.00	1.37	4.11	7.38	9.71	10.45	10.69	10.03	7.80
PFCs	NO	NO	0.00	0.00	0.07	0.07	0.04	0.02	0.02	0.01
SF <sub>6</sub>	NO	NO	NO	0.09	0.26	0.02	0.04	0.05	0.04	0.03
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other (specify)										
<b>Total with LULUCF<sup>f</sup></b>	235.95	235.95	238.72	272.50	273.47	249.71	208.86	204.17	187.55	168.43
<b>Total without LULUCF</b>	229.00	229.00	234.11	247.67	264.99	229.46	197.79	193.63	174.77	155.64

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

<sup>a</sup> In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

<sup>b</sup> Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

<sup>c</sup> 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

<sup>d</sup> In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

<sup>e</sup> To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

<sup>f</sup> Parties may choose to report total emissions with or without LULUCF, as appropriate.

Table 6(c)

LIE\_BR4\_v0.2

Information on updated greenhouse gas projections under a 'with additional measures' scenario<sup>a</sup>

Sector <sup>d,e</sup>	GHG emissions and removals <sup>b</sup>								GHG emission projections	
	(kt CO <sub>2</sub> eq)								(kt CO <sub>2</sub> eq)	
	Base year (1990)	1990	1995	2000	2005	2010	2015	2017	2020	2030
Energy	124.42	124.42	125.00	128.48	149.69	115.70	100.12	97.18	79.78	62.54
Transport	76.64	76.64	81.79	91.29	81.77	77.63	61.12	60.29	59.73	49.44
Industry/industrial processes	0.65	0.65	1.89	4.64	8.13	10.16	10.86	11.09	10.11	7.68
Agriculture	25.51	25.51	23.68	21.48	23.56	24.19	24.09	23.48	23.17	21.43
Forestry/LULUCF	6.95	6.95	4.61	24.82	8.48	20.25	11.06	10.55	12.79	12.79
Waste management/waste	1.77	1.77	1.74	1.79	1.84	1.78	1.60	1.58	1.68	1.68
Other (specify)										
<b>Gas</b>										
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	205.61	205.61	208.51	241.33	237.06	210.65	169.57	165.27	149.62	122.31
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	198.97	198.97	204.20	216.85	228.97	190.81	158.93	155.14	137.34	110.02
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	19.12	19.12	17.91	16.74	18.42	18.85	18.41	18.00	17.78	16.54
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	19.12	19.12	17.91	16.74	18.42	18.85	18.41	18.00	17.78	16.54
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	11.22	11.22	10.93	10.23	10.28	10.41	10.35	10.14	10.06	9.26
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	10.91	10.91	10.63	9.88	9.89	10.00	9.92	9.73	9.56	8.76
HFCs	0.00	0.00	1.37	4.11	7.38	9.71	10.45	10.69	9.74	7.40
PFCs	NO	NO	0.00	0.01	0.07	0.07	0.04	0.02	0.02	0.01
SF <sub>6</sub>	NO	NO	NO	0.09	0.26	0.02	0.04	0.05	0.04	0.03
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other (specify)										
<b>Total with LULUCF<sup>f</sup></b>	235.95	235.95	238.72	272.51	273.47	249.71	208.86	204.17	187.26	155.55
<b>Total without LULUCF</b>	229.00	229.00	234.11	247.68	264.99	229.46	197.79	193.63	174.48	142.76

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

<sup>a</sup> In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

<sup>b</sup> Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

<sup>c</sup> 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

<sup>d</sup> In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

<sup>e</sup> To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

<sup>f</sup> Parties may choose to report total emissions with or without LULUCF, as appropriate.