X. GREENHOUSE GAS EMISSIONS

Greenhouse gases form a part of the Earth's atmosphere and contribute to the so-called greenhouse effect. They are produced both by natural processes in nature, but also by human activities. Monitoring of these so-called anthropogenic greenhouse gas emissions is carried out within the inventory of greenhouse gas emissions and removals. For more on the processing methodology and reporting obligations, see CHMI 2020a.

Total greenhouse gas emissions including their removals from the Land use, land use change and forestry (LULUCF) sector, expressed in carbon dioxide equivalent (CO_2 eq.), decreased in the Czech Republic from 193 million tonnes in 1990 to 134 million tonnes in 2018 (Tab. X.1). Emissions alone (excluding LULUCF) decreased from 199 million tonnes to 128 million tonnes, making a decrease of 36% compared to the 1990 reference year. Share of individual sectors in total emissions in CO_2 eq. over the years is shown in Fig. X.1.

The share of CO_2 emissions in total greenhouse gas emissions in CO_2 equivalent (excluding LULUCF) was 82% in 2018, the share of CH_4 emissions reached 10% and the share of N_2O emissions 5%. The share of fluorocarbons in CO_2 equivalent in 2018 was 3% (CHMI 2020b).

As already mentioned, the emissions trading system is an important part of data sources in the preparation of background data for the inventory of greenhouse gas emissions (CHMI 2020a). Emissions reported in the EU ETS in 2018 reached 66.9 Mt CO_2, which is less than 64% of the total CO_2 emissions of the Czech Republic (Tab. X.2).

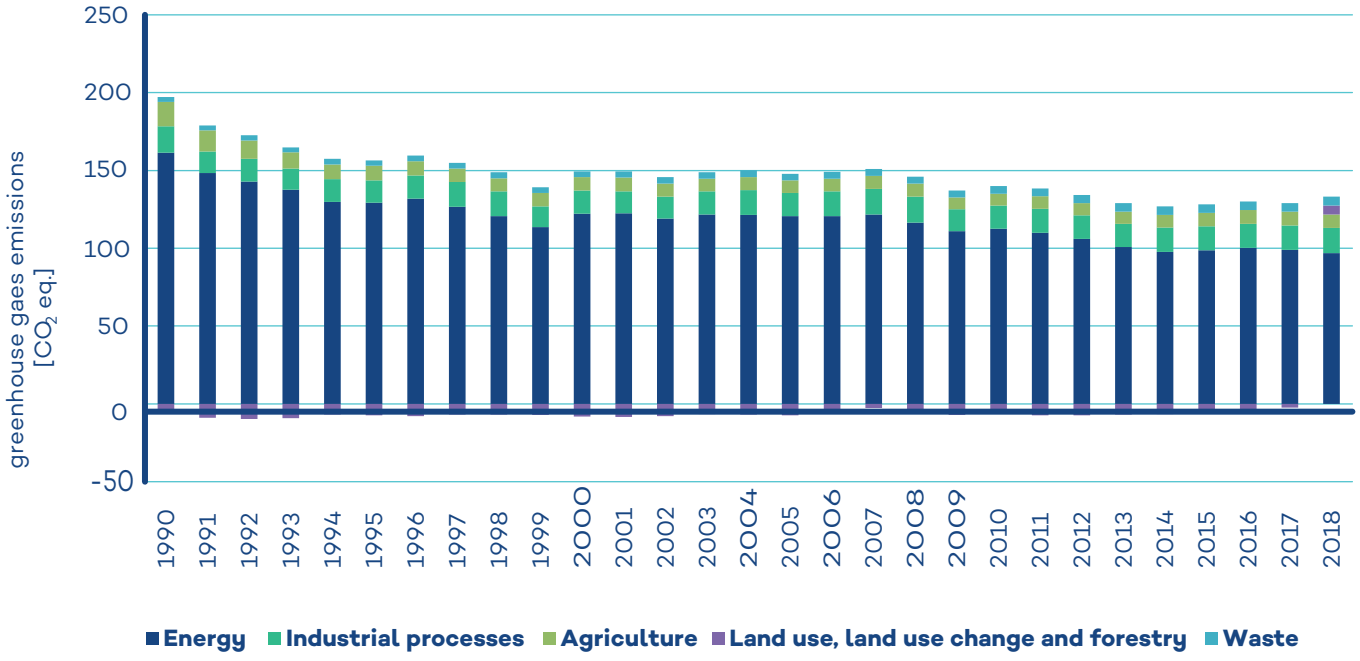

Fig. X.1 Share of individual sectors on total greenhouse gas emissions for 1990–2018 time-series

Tab. X.1 Trend in greenhouse gas emissions for 1990–2018 time-series

	CO_2 incl. net CO_2 from LULUCF	CO_2 incl. net CO_2 from LULUCF	CH_4	N_2O	F-gases	Sum emissions incl. LULUCF	Sum emissions excl. LULUCF
	Mt	Mt	Mt	Mt	Mt	Mt (CO_2 eq.)	Mt (CO_2 eq.)
1990	158.43	164.20	23.57	9.43	0.08	193.38	199.07
1991	139.92	148.89	21.99	8.08	0.08	171.74	180.65
1992	134.96	144.62	20.66	7.24	0.09	164.52	174.10
1993	129.34	138.64	19.76	6,50	0.09	157.22	166.44
1994	125.34	132.38	18.64	6.38	0.09	151.93	158.89
1995	124.14	131.61	18.21	6.67	0.10	150.57	157.96
1996	127.10	134.96	18.08	6.44	0.17	153.20	160.96
1997	123.81	130.73	17.68	6.42	0.27	149.56	156.37
1998	118.31	125.32	16.98	6.30	0.34	143.26	150.18
1999	109.39	116.62	16.25	6.09	0.40	133.37	140.52
2000	118.95	127.07	15.42	6.52	0.53	142.59	150.63
2001	118.55	126.96	15.18	6.76	0.68	142.30	150.63
2002	115.86	123.90	14.76	6.37	0.84	138.90	146.85
2003	120.83	127.38	14.78	5.91	1.00	143.58	150.03
2004	121.10	128.11	14.36	6.59	1.09	144.14	151.07
2005	118.25	125.67	14.73	6.40	1.20	141.64	148.97
2006	121.34	126.45	14.97	6.28	1.49	145.19	150.19
2007	125.39	128.26	14.55	6.35	1.89	149.24	151.98
2008	116.84	122.94	14.66	6.41	2.18	141.13	147.12
2009	108.03	115.19	14.30	5.56	2.26	131.12	138.19
2010	111.16	117.50	14.50	5.44	2.55	134.64	140.88
2011	107.74	115.06	14.50	6.06	2.78	132.05	139.32
2012	103.47	110.96	14.49	5.92	2.89	127.68	135.12
2013	99.59	106.43	13.90	5.69	3.01	123.01	129.80
2014	97.33	104.05	13.91	5.80	3.16	121.00	127.67
2015	98.94	104.82	13.98	6.20	3.37	123.28	129.09
2016	101.92	106.63	13.49	6.52	3.52	126.21	130.90
2017	103.30	105.64	13.29	6.43	3.72	127.46	129.78
2018	110.16	104.41	13.18	6.09	3.81	133.93	128.14

Tab. X.2 Trend in greenhouse gas emissions in emission trading scheme for 2010–2018 time-series

	Combustion of fuels	Refining of mineral oil	Production of pig iron or steel	Production of cement clinker, lime, or calcination of dolomite/ magnesite	Manufacture of glass and mineral wool	Manufacture of ceramics	Production of pulp, paper and cardboard	Total CO_2 in EU ETS	Total CO_2 in the Czech Republic	Share of CO_2 from EU ETS
	Mt CO_2	Mt CO_2	Mt CO_2	Mt CO_2	Mt CO_2	Mt CO_2	Mt CO_2	Mt CO_2	Mt CO_2	%
2010	62.05	1.05	6.08	3.37	0.66	0.43	0.65	75.58	118.48	63.79
2011	60.63	0.99	5.92	3.75	0.63	0.47	0.59	74.19	116.02	63.94
2012	56.25	0.95	5.86	3.42	0.65	0.45	0.59	69.31	111.87	61.96
2013	54.56	0.82	5.92	3.14	0.63	0.43	0.50	67.71	107.24	63.14
2014	53.24	0.91	5.90	3.37	0.67	0.40	0.48	66.70	104.86	63.60
2015	53.28	0.93	5.70	3.49	0.73	0.40	0.48	66.63	105.60	63.09
2016	53.87	0.71	6.06	3.72	0.73	0.40	0.46	67.52	107.39	62.87
2017	53.61	1.00	5.45	3.82	0.81	0.41	0.46	66.98	106.36	62.97
2018	52.96	0.92	5.79	4.15	0.80	0.42	0.48	66.91	105.10	63.67

Carbon dioxide

CO_2 emissions originate mainly from combustion of fossil fuels. Other contributing processes include, in particular, desulphurisation, decomposition of carbonates in production of lime, cement and glass, and metallurgical and chemical production. Emissions and removals (CO_2 absorption) occur in the LULUCF sector. As can be seen from Fig. X.2, CO_2 removals from LULUCF predominated until 2017, however in 2018, emissions already predominate. This situation is caused by excessive drought and bark beetle calamity which require logging in forests that would otherwise capture CO_2. In other areas, such as industrial processes, CO_2 capture is not yet performed in the Czech Republic. The combustion of solid fuels contributes the most to CO_2 emissions from combustion processes, and to a lesser extent also the combustion of liquid and gaseous fuels. In the last five years, there have been changes in the structure of fuels used, the share of natural gas and biomass combustion has been increasing, while the use of solid fuels has been declining. Even so, solid fuels still predominate in the Czech Republic (CHMI 2020b) (Fig. X.3).

Between 1990 and 2018, CO_2 emissions decreased by 30% (Fig. X.2), mainly due to a decrease in the Energy sector - in the production of electricity and heat for production plants and services, households and other consumers. The decrease in combustion emissions in manufacturing companies in the early 1990s was a result of the slowdown and restructuring of some industries; at the end of the period, the decrease in emissions was reached by savings and the introduction of new technologies. Reductions in emissions from services and households can be attributed to more economical use of energy (increasing energy efficiency, especially thermal insulation of buildings, and more economical energy management). On the contrary, the opposite trend is evident in transport, namely in increase of emissions. However, it has been halted in recent years and emissions tend to fluctuate, which is due to the generally more efficient options for burning fuels and also to the change in the composition of fuels burned. As already mentioned above, since 2018, the Land use and land use change and forestry sector (CHMI 2020b) has also had its share in CO_2 emissions.

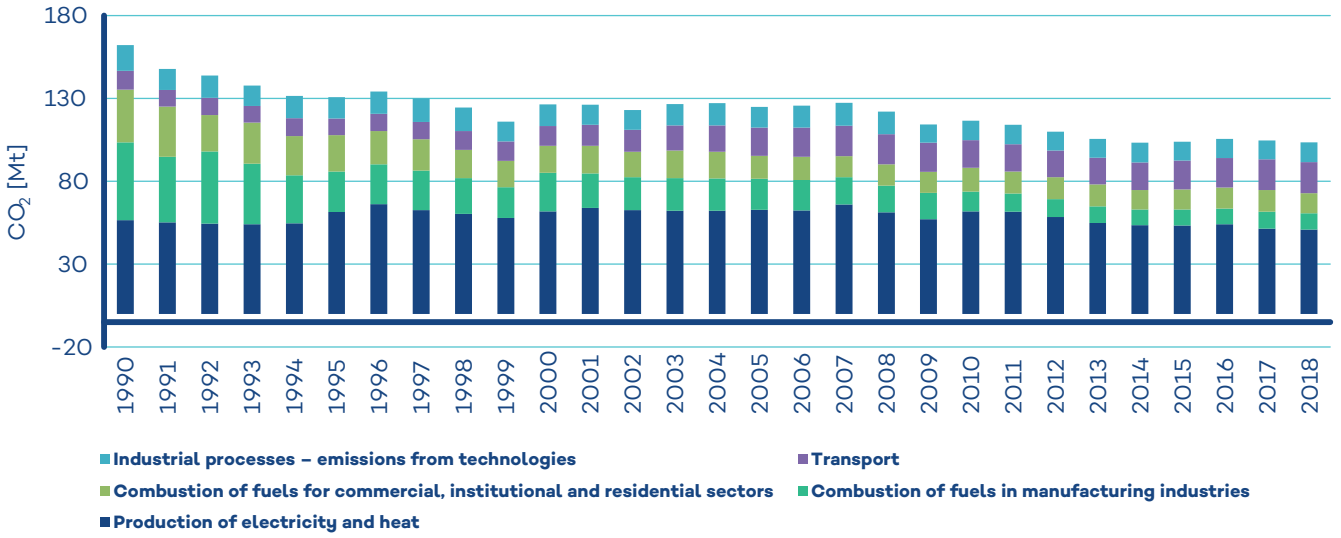

Fig. X.2 Share of individual sectors on total CO_2 emissions for 1990–2018 time-series

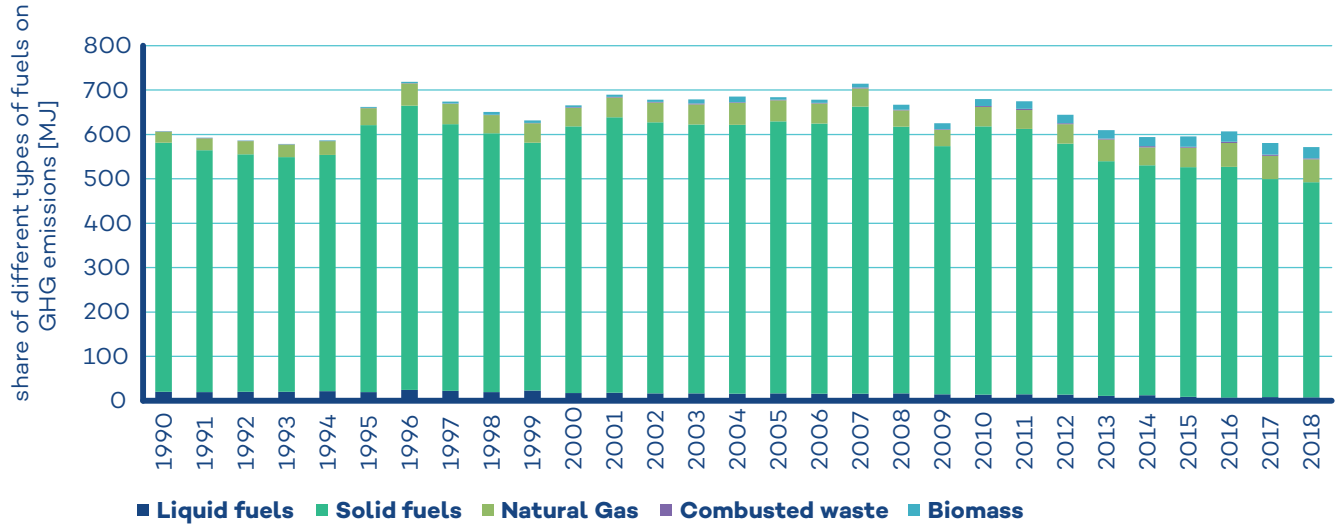

Fig. X.3 Share of different types of fuels combusted for 1990–2018 time-series

Methane

Methane is the second most important greenhouse gas in terms of production in the Czech Republic. Anthropogenic emissions of methane (CH_4) in the Czech Republic come mainly from the extraction and mining, treatment and distribution of fuels; these types of emissions are classified as fugitive emissions (emissions freely escaping into the atmosphere). Animal breeding, anaerobic decomposition of biological waste in landfills and wastewater treatment are further important sources of CH_4 emissions. In the breeding of animals, this gas is generated during digestive processes (especially in cattle) and decomposition of excrements of animal origin. Changes in these areas are also reflected in trends in methane emissions; in recent years, for example, there has been a noticeable change in fugitive emissions from the extraction and processing of fuels in connection with the closure of some mines in the Ostrava region (CHMI 2020b).

In the 1990–2018 period, CH4 emissions were reduced by 44% (Fig. X.4), particularly as a consequence of reduction of coal mining and livestock numbers and, to a lesser extent, by reduced solid fuel consumption in households. The increase in emissions in the Waste sector was reduced by utilisation of landfill gases and biogas for energy production purposes.

Nitrous oxide

The greatest amounts of emissions of nitrous oxide (N_2O) originate from agricultural activities, especially denitrification of nitrogen added to the soil in the form of artificial fertilizers or organic material. The production of nitric acid and other chemical industries, to a lesser extent, also transport (vehicles with catalytic converters) are also important sources (CHMI 2020b).

There was a reduction in N_2O emissions by 35% in the 1990–2018 period (Fig. X.5), particularly as a consequence of reduced use of artificial fertilizers in agriculture, a reduction in livestock numbers and, recently, also as a result of targeted introduction of technologies to eliminate nitrous oxide emissions in the production of nitric acid.

Fluorinated gases

Emissions of fluorinated gases increased from 102 kt CO_2 equiv. in 1995 to 3811 kt CO_2 equiv. in 2018 (Fig. X.6). Consequently, the contribution of fluorinated gases to the total aggregate emissions from industrial processes also increased (from 0.72% in 1995 to 23.4% in 2018). These substances are not manufactured in the Czech Republic and their total use is covered by import. They are used especially in refrigeration technology (namely HFCs), in electrical engineering (namely SF_6 and newly, since 2010, also NF_3) as well as in a number of other areas (e.g. in plasma etching, filling of fire extinguishers, aerosol propellants, and blowing agents). The emissions are generated mainly by releases from the facilities in which they are used. The increase in these emissions is caused by their use in replacing substances depleting the Earth's ozone layer (CFC, HCFC — mainly as refrigerants), greater use of modern technologies (air conditioning) and the manufacturing focus of the Czech Republic (production of cars and air conditioning units). The rapid increase of F-gases emissions in the context of their high potential of the global warming (GWP, Global Warming Potential) lead globally to the increased attention to monitoring of the level of emissions and consequently to regulation of F-gases use. These regulations deal mainly with applications for which there are available alternative technologies, more effective in terms of economy and having lower or no impact to the Earth climate system. The effect of the legislative measures has already been demonstrated, for example, in the use of fluorinated gases as inter-window insulation, blowing agents, or as refrigerants to refrigeration technologies designed for households, where these gasses are not used any more. In recent years, fluorinated gases with high GWP have been replaced by gases with low GWP. Nevertheless, their emissions to the atmosphere still appear due to long lifetime of the related equipment

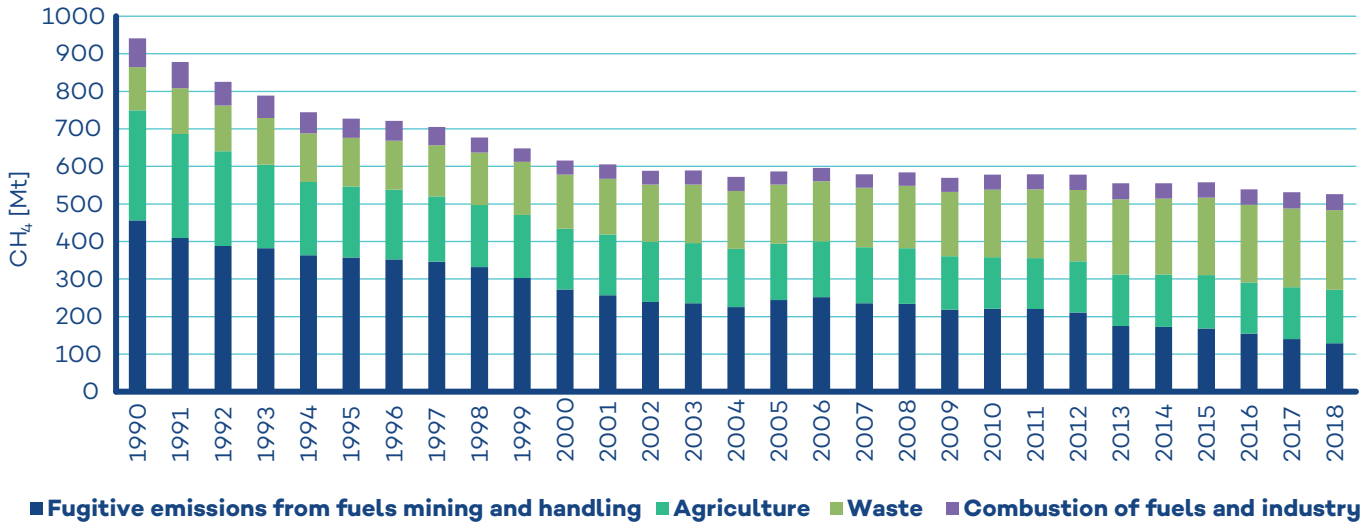

Fig. X.4 Share of individual sectors on total CH_4 emissions for 1990–2018 time-series

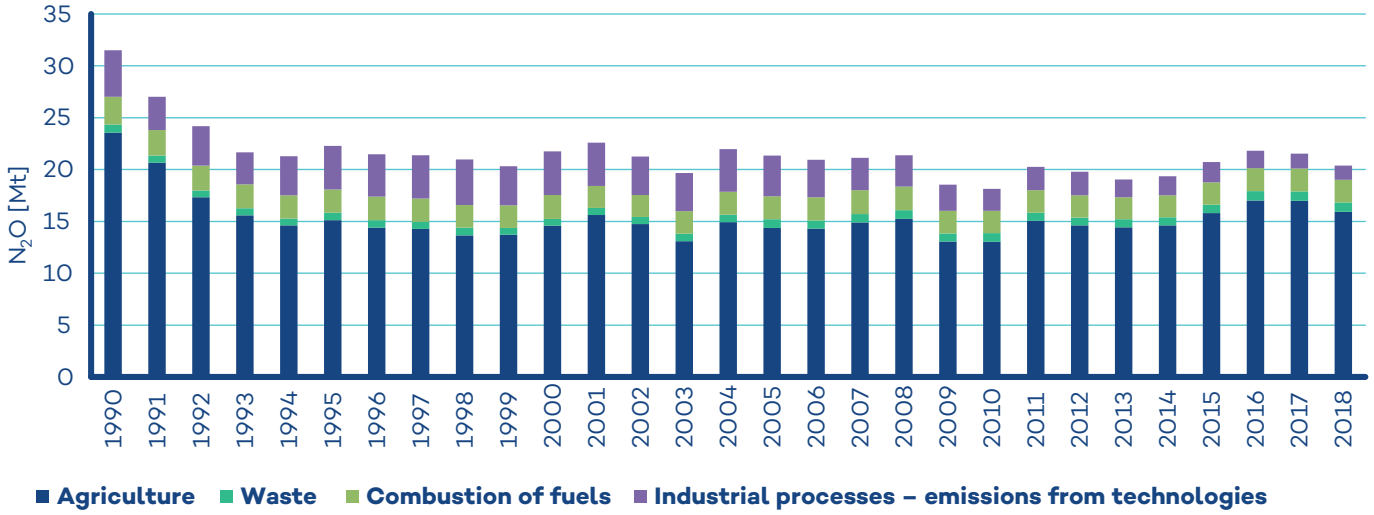

Fig. X.5 Share of individual sectors on total N_2O emissions for 1990–2018 time-series

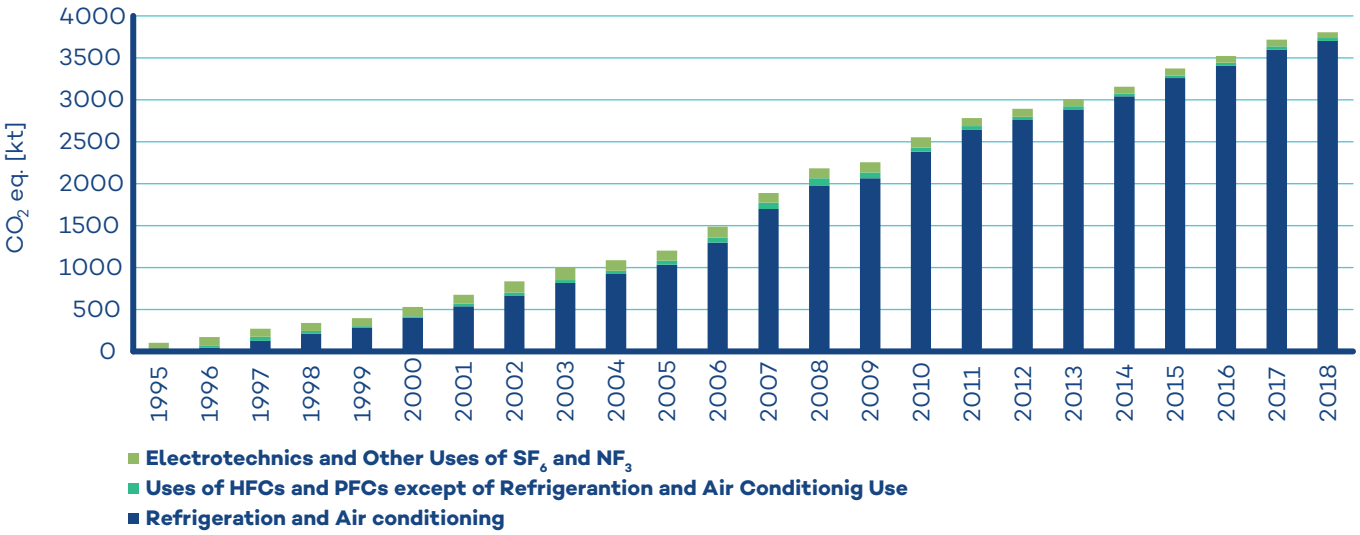

Fig. X.6 Share of individual sectors on total F-gas emissions for 1995–2018 time-series