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 not only by natural processes, 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. More about the processing methodology and reporting obligations can be found under the reference CHMI (2022d).

Total greenhouse gas emissions including 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 (CR) from 190 million tonnes in 1990 to 126 million tonnes in 2020 (Tab. X.1). Emissions alone (excluding LULUCF) decreased from 199 million tonnes to 113 million tonnes, a decrease of 43 % compared to the 1990 reference year. The Czech Republic has thus complied with the second commitment period of the Kyoto Protocol; to reduce emissions by 20 % by 2020 compared to the base year 1990. The proportion of particular sectors in total emissions in CO_2 eq. over the years is shown in Fig. X.1.

The proportion of CO_2 emissions in total greenhouse gas emissions in CO_2 equivalent (excluding LULUCF) was 81 % in 2020, the proportion of CH_4 emissions reached 10 % and the proportion of N_2O emissions 5 %. The proportion of fluorocarbons in CO_2 eq. in 2020 was 4 % (CHMI 2022c).

The emissions trading system (ETS) is an important source of data for preparation of background data for the inventory of greenhouse gas emissions (CHMI 2022c). Emissions reported under the EU ETS in 2020 reached 54.6 Mt CO_2, representing 59 % of the total CO_2 emissions of the CR (Tab. X.2).

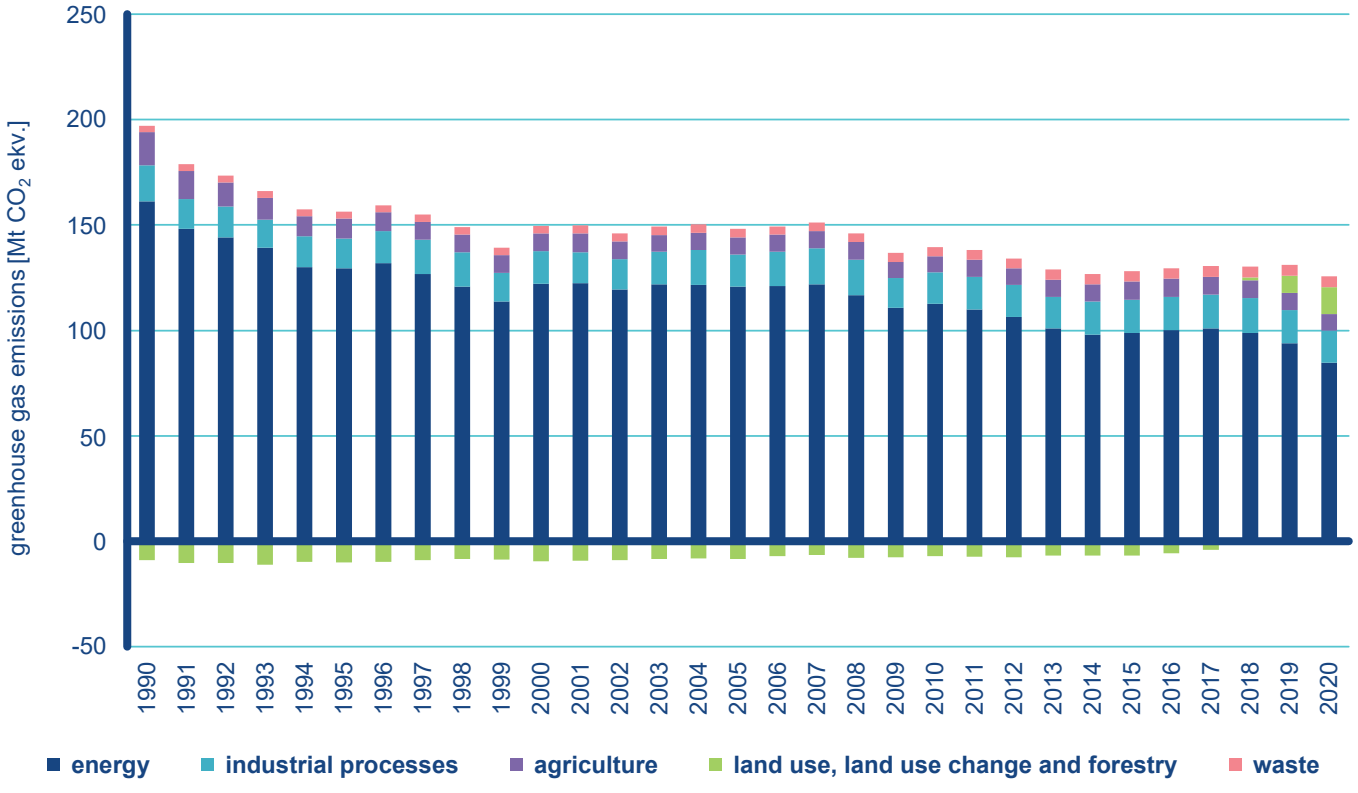

Fig. X.1 Share of individual sectors on total greenhouse gas emissions for 1990–2020 time-series

Tab. X.1 Trend in greenhouse gas emissions for 1990-2020 time-series

	CO_2 excl. net CO_2 from LULUCF	CO_2 excl. net CO_2 from LULUCF	CH_4	N_2O	F-gases	Sum emissions incl. LULUCF	Sum emissions excl. LULUCF
	Mt	Mt	Mt (CO_2 ekv.)	Mt (CO_2 ekv.)	Mt (CO_2 ekv.)	Mt (CO_2 ekv.)	Mt (CO_2 ekv.)
1990	157	166	23	9	0	190	199
1991	140	151	22	8	0	170	180
1992	137	147	20	7	0	165	175
1993	131	142	20	6	0	157	168
1994	124	134	18	6	0	149	159
1995	123	133	18	7	0	148	158
1996	126	136	18	6	0	151	161
1997	123	132	17	6	1	148	156
1998	118	127	17	6	1	142	150
1999	109	118	16	6	1	132	140
2000	119	128	15	6	1	141	151
2001	119	128	15	7	1	142	151
2002	116	125	15	6	1	138	147
2003	120	129	15	6	1	142	150
2004	121	129	14	6	2	143	151
2005	118	127	15	6	2	141	149
2006	120	128	15	6	2	143	151
2007	123	129	14	6	2	146	152
2008	116	124	14	6	2	139	147
2009	108	116	14	6	3	130	138
2010	111	118	14	5	3	133	141
2011	109	116	14	6	3	132	139
2012	105	112	14	6	3	128	135
2013	101	108	13	6	3	123	130
2014	98	105	13	6	3	121	128
2015	99	106	13	6	4	122	129
2016	102	107	13	6	4	124	130
2017	104	108	13	6	4	127	131
2018	108	107	12	6	4	131	129
2019	110	102	12	6	4	132	124
2020	105	92	12	5	4	126	113

Tab. X.2 Trend in greenhouse gas emissions in emission trading scheme for 2010–2020 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	62.53	1.05	6.08	3.35	0.67	0.41	0.65	75.26	118.47	63.53
2011	61.12	0.99	5.92	3.74	0.63	0.44	0.59	73.82	116.15	63.55
2012	56.73	0.95	5.86	3.40	0.65	0.42	0.59	68.94	112.20	61.44
2013	55.06	0.82	5.91	3.12	0.64	0.39	0.50	67.50	107.53	62.77
2014	53.65	0.91	5.90	3.35	0.67	0.39	0.48	66.44	105.05	63.24
2015	53.63	0.93	5.70	3.46	0.72	0.38	0.48	66.37	105.79	62.73
2016	54.20	0.71	6.06	3.70	0.73	0.40	0.46	67.31	107.42	62.67
2017	53.88	1.00	5.45	3.82	0.75	0.41	0.46	66.84	108.47	61.62
2018	53.22	0.92	5.79	4.15	0.74	0.43	0.48	66.80	107.03	62.41
2019	49.28	0.98	5.29	4.14	0.73	0.45	0.52	62.43	101.67	61.40
2020	41.96	0.80	5.36	3.92	0.72	0.41	0.51	54.60	92.40	59.09

Carbon dioxide

CO_2 emissions originate mainly from the combustion of fossil fuels. Other contributing processes include, in particular, desulphurisation, decomposition of carbonates in the production of lime, cement and glass, and metallurgical and chemical production. Emissions and removals (CO_2 absorption) occur in the LULUCF sector. As shown in Fig. X.1, CO_2 sinks from LULUCF prevailed until 2017, but since 2018, emissions have already predominated. This was caused by a bark beetle calamity, which required logging in forests that would have otherwise captured CO_2. In other areas, such as industrial processes, CO_2 capture is not yet registered in the CR. CO_2 emissions from combustion processes arise mostly from the combustion of solid fuels, and to a lesser extent from the combustion of liquid and gaseous fuels. In the last years, there have been changes in the structure of fuel use, with the proportion of natural gas and biomass combustion increasing and the use of coal fuels declining. Even so, lignite and other coal fuels still predominate in the CR (CHMI 2022c) (Fig. X.3).

Between 1990 and 2020, CO_2 emissions decreased by 44 % (Fig. X.2). This was mainly due to a decrease in the Energy sector – 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 due to 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 the increase of emissions. However, this has ceased in recent years and emissions have tended to fluctuate, which is due to the generally more efficient options for combustion processes and also to changes in the composition of fuels burned. As already mentioned, the LULUCF sector (CHMI 2022c) has also contributed to CO_2 emissions since 2018.

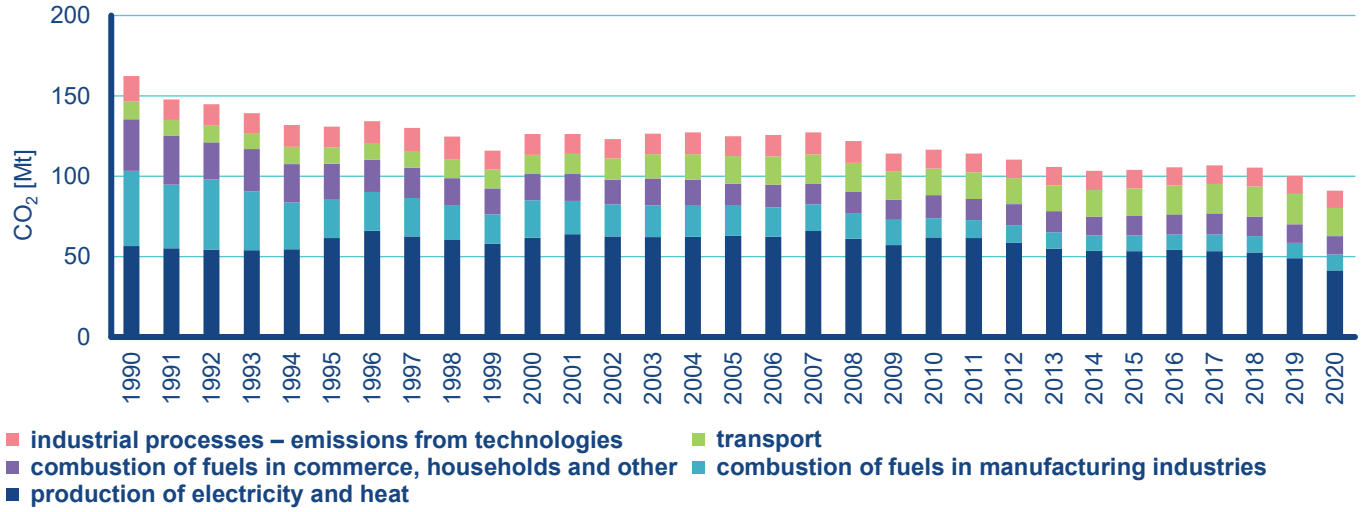

Fig. X.2 Share of individual sectors on total CO_2 emissions for 1990–2020 time-series

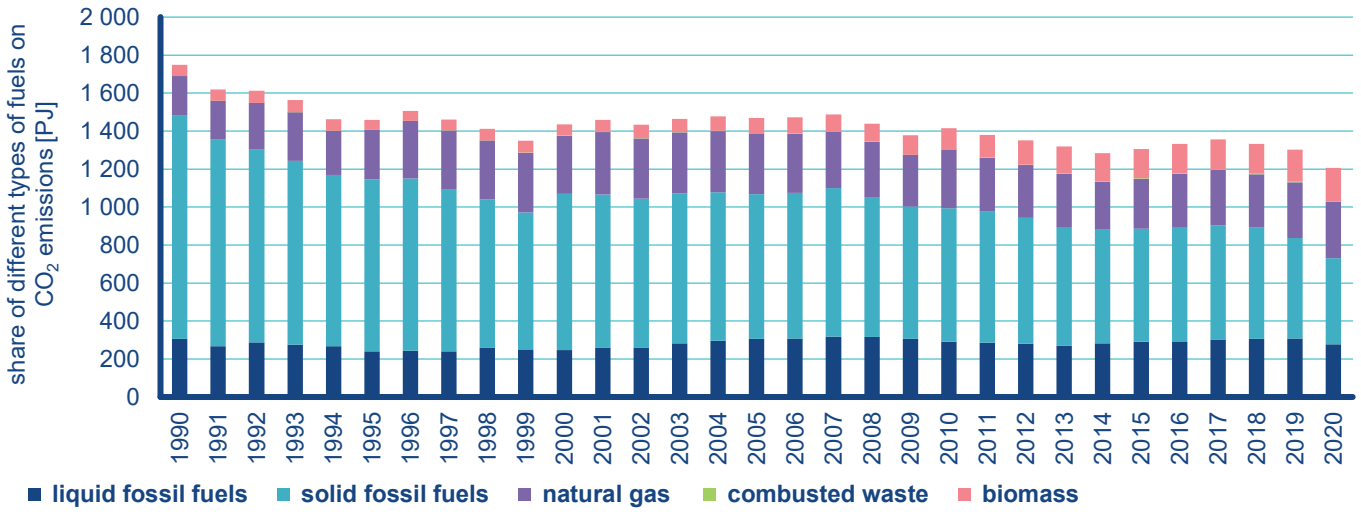

Fig. X.3 Share of different types of fuels combusted for 1990–2020 time-series

Methane

In terms of production, methane (CH_4) is the second most important greenhouse gas in the CR. Anthropogenic emissions of CH_4 in the Czech Republic come mainly from mining, and 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 the decomposition of excrement of animal origin. Changes in these areas are also reflected in trends in CH_4 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 2022c).

In the 1990–2020 period, CH_4 emissions were reduced by 51 % (Fig. X.4), particularly as a consequence of reductions in coal mining and livestock numbers, and to a lesser extent by reduced solid fossil fuel consumption in households. The increase in emissions in the Waste sector was mitigated by the utilisation of landfill gases and biogas for energy production purposes.

Nitrous oxide

The greatest amounts of nitrous oxide (N_2O) emissions originate from agricultural activities, especially the denitrification of nitrogen added to the soil in the form of artificial fertilizers or organic material. Other important sources are the production of nitric acid and other chemical industries, and to a lesser extent transport (vehicles with catalytic converters) (CHMI 2022c).

There was a reduction in N_2O emissions by 43 % in the 1990–2020 period (Fig. X.5), particularly as a consequence of the reduced use of artificial fertilizers in agriculture, a reduction in livestock numbers, and recently also as a result of the targeted introduction of technologies to eliminate nitrous oxide emissions in the production of nitric acid.

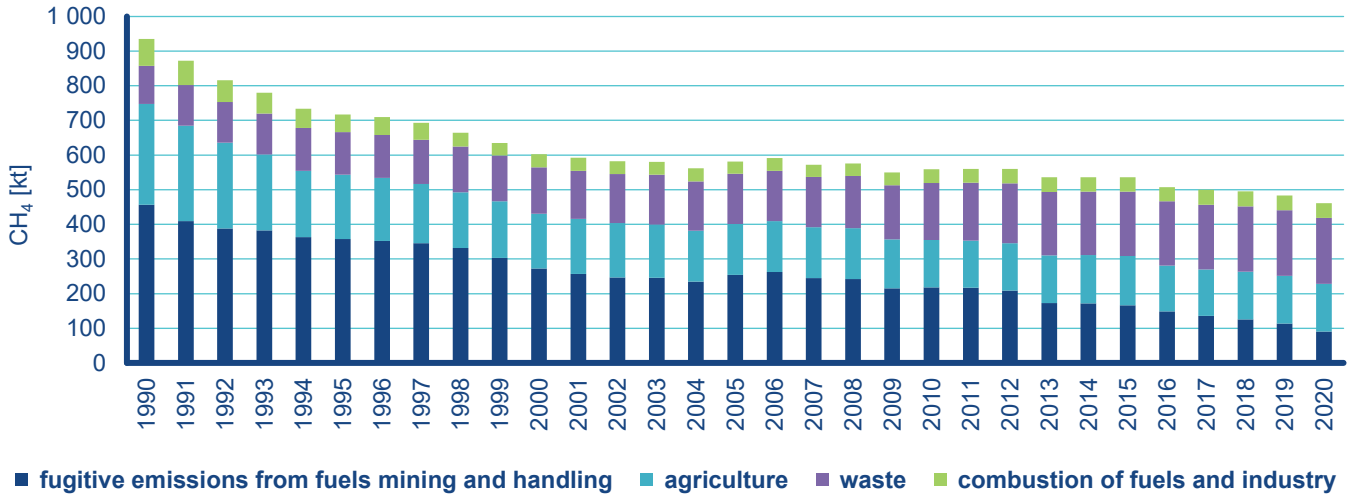

Fig. X.4 Share of individual sectors on total CH_4 emissions for 1990–2020 time-series

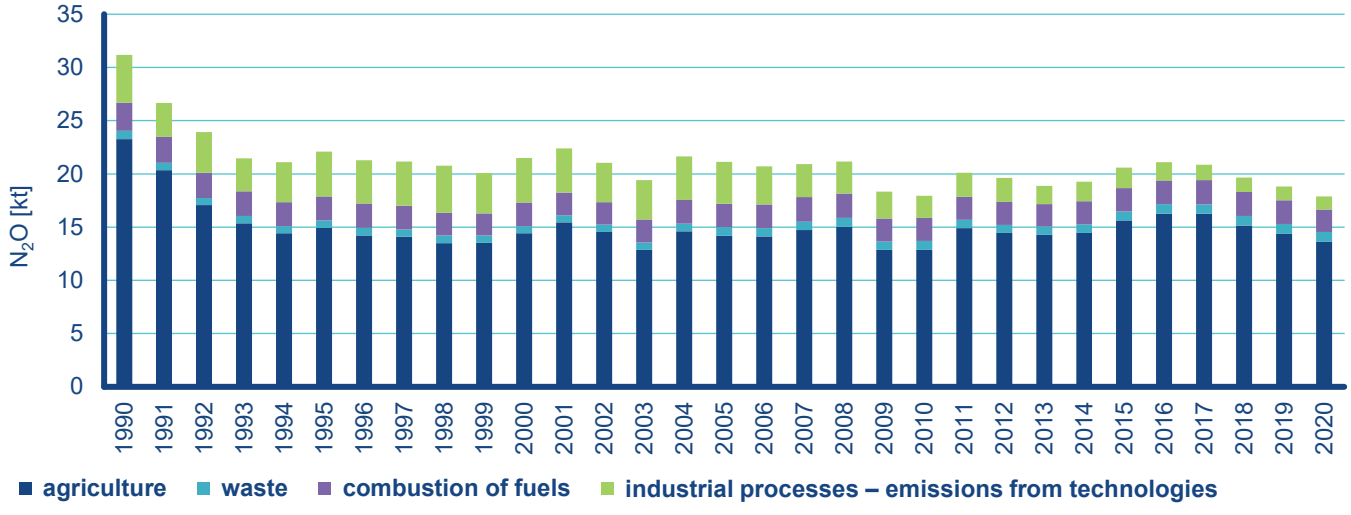

Fig. X.5 Share of individual sectors on total N_2O emissions for 1990–2020 time-series

Fluorinated gases

Emissions of fluorinated gases increased from 184 kt CO_2 eq. in 1995 to 4 088 kt CO_2 eq. in 2020 (Fig. X.6). Consequently, the contribution of fluorinated gases to the total aggregate emissions from industrial processes also increased (from 1.3 % in 1995 to 26.8 % in 2020). These substances are not manufactured in the CR and are imported for all uses. They are used mainly in refrigeration and air conditioning technologies (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 equipment in which they are used. The increase in these emissions is caused by their use as replacements for substances that deplete the Earth's ozone layer (CFC, HCFC — mainly as refrigerants), the increased use of modern technologies (air conditioning) and the manufacturing focus of the CR (production of cars and air conditioning units) (CHMI 2022c). The rapid increase of fluorinated gas emissions in the context of their higher global warming potential (GWP) has led globally to increased attention on monitoring their emissions levels and consequently to their regulation. These regulations deal mainly with applications for which there are available alternative technologies that are more effective in terms of economy and have lower or no impact on the Earth's climate system. Thus, in recent years, high GWP fluorinated gases have been replaced by low GWP gases. Thanks to legislative measures, fluorinated gases are also no longer used in insulating glass windows, blowing agents or as refrigerants in household refrigeration technologies. Nevertheless, their emissions to the atmosphere still continue, due to long lifetime of the related equipment.

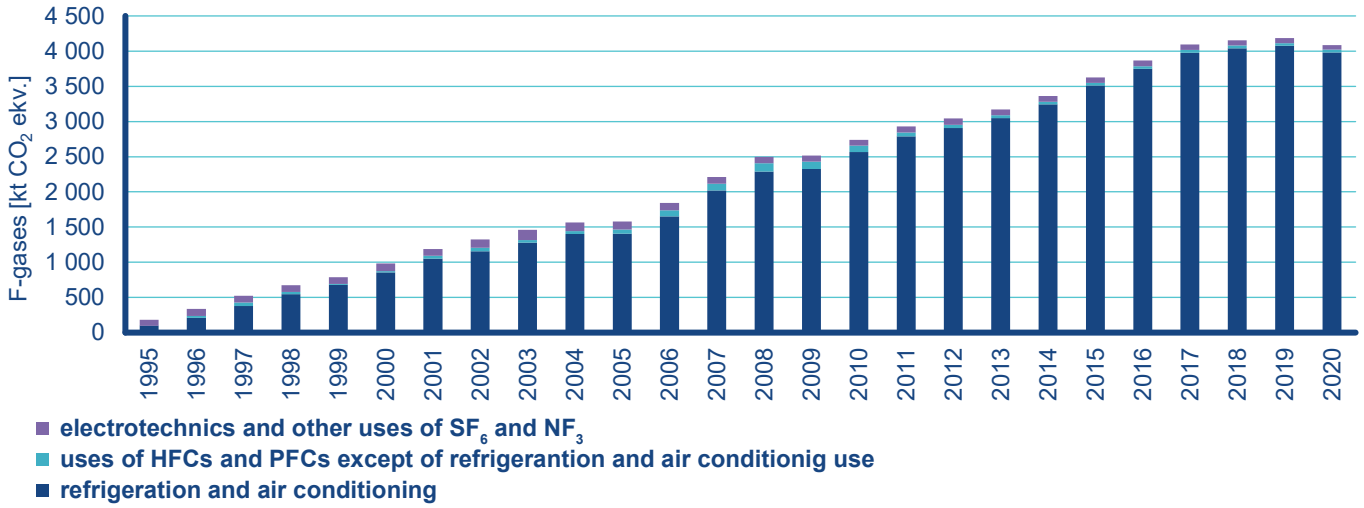

Fig. X.6 Share of individual sectors on total F-gas emissions for 1995–2020 time-series