II. AIR POLLUTION

The CHMI evaluates the level of air pollution under authorisation by the Ministry of the Environment for primary pollutants of anthropogenic origin. The basic background material for this evaluation consists of the "emission inventory" which combines direct collection of data reported by the operators of sources with model calculations of data reported by the operators of sources or determined in the context of statistical studies performed primarily by the Czech Statistical Office. The resulting emission inventories are presented in a form of emission balances in sectoral and territorial classifications (OEZ 2020). The accompanying document describing the methodologies for processing emission inventories is also presented on the CHMI website (CHMI 2020a). The current report (CHMI 2020b) presents the results of the emission inventory for the period 1990–2018 taking into account recommendations of the team reviewing the inventory methodology of the EU Member States. These relate mainly to the conversion of ammonia emissions from the application of mineral fertilizers, and the inclusion of emissions of the agricultural activities sector (NMVOC and NO_x) and food production (NMVOC). Time series for road transport were recalculated due to the update of the used balance COPERT model and new methodological recommendations for performing calculations by model.

Emission inventory in the Czech Republic

From the viewpoint of the means of monitoring emissions, air pollution sources are divided into individually monitored sources and collectively monitored sources. The sources listed in Annex No. 2 of the Act No. 201/2012 on the air protection are monitored individually. Pursuant to Article 17(3)(c), the operators of these sources are obliged to keep operating records of permanent and variable data on stationary sources, describing the source and its operation, and also data on inputs and outputs from these sources. They are also obliged to annually report information on the summary operating records (SPE) through the Integrated system of fulfilling reporting obligations (ISPOP). ISPOP data are then collected in the REZZO 1 and REZZO 2 databases. Reporting of data for the previous year takes place from January to the end of March.

Collectively monitored sources registered in REZZO 3 include emissions from unspecified combustion sources, construction and agricultural activities, surface use of organic solvents, filling stations, coal mining, fires of cars and buildings, waste and waste-water treatment, use of fireworks, etc. Emissions from these sources are determined using data collected by national statistical surveys and emission factors.

Data from mobile sources are also monitored collectively (REZZO 4) and include emissions from road (including VOC emissions from vehicle fuel system petrol evaporation and emissions from brake, tyre and road abrasion), rail, water and air transport, and operation of off-road machinery and mechanisms (agricultural, forest and construction machinery, military vehicles, greenery maintenance, etc.). Emissions from resuspension, i.e. dust swirling during vehicle operation, are not part of the emission inventory.

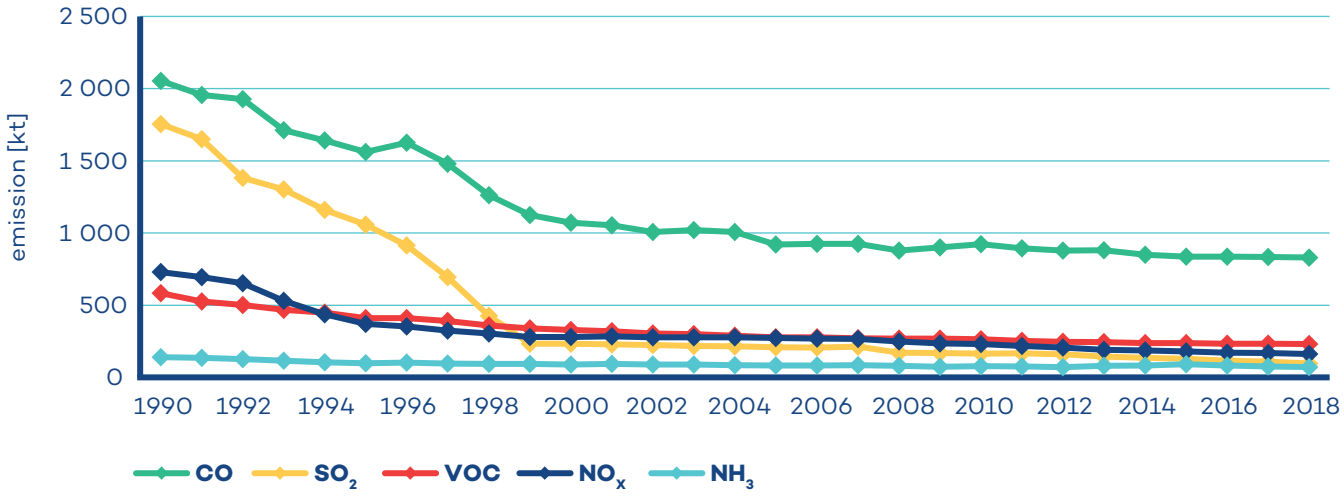

Fig. II.1 The development of main pollutants total emissions, 1990–2018

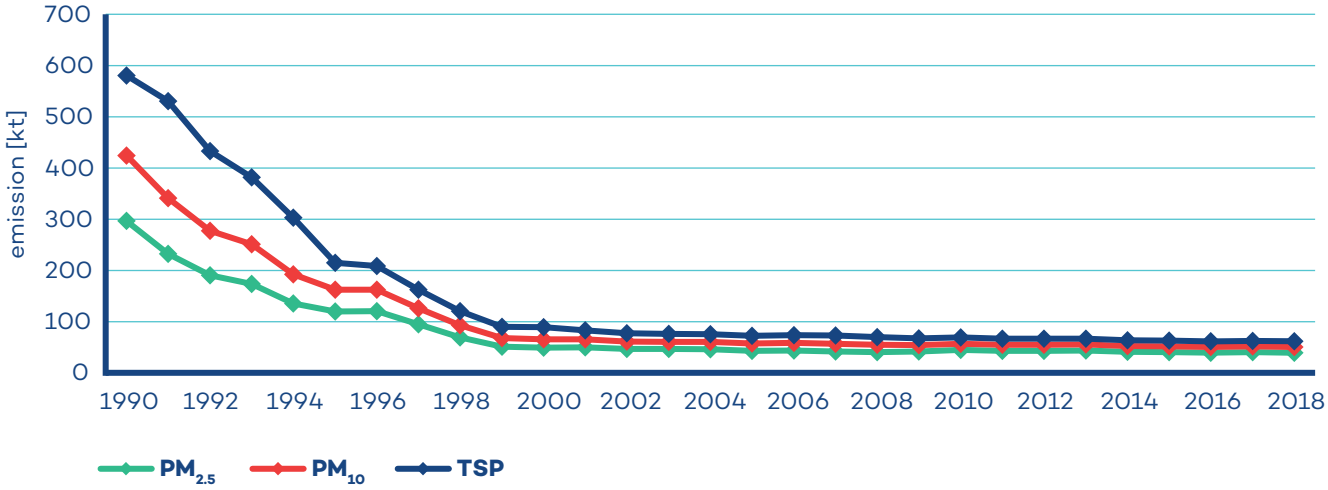

Fig. II.2 The development of particulate matter total emissions, 1990–2018

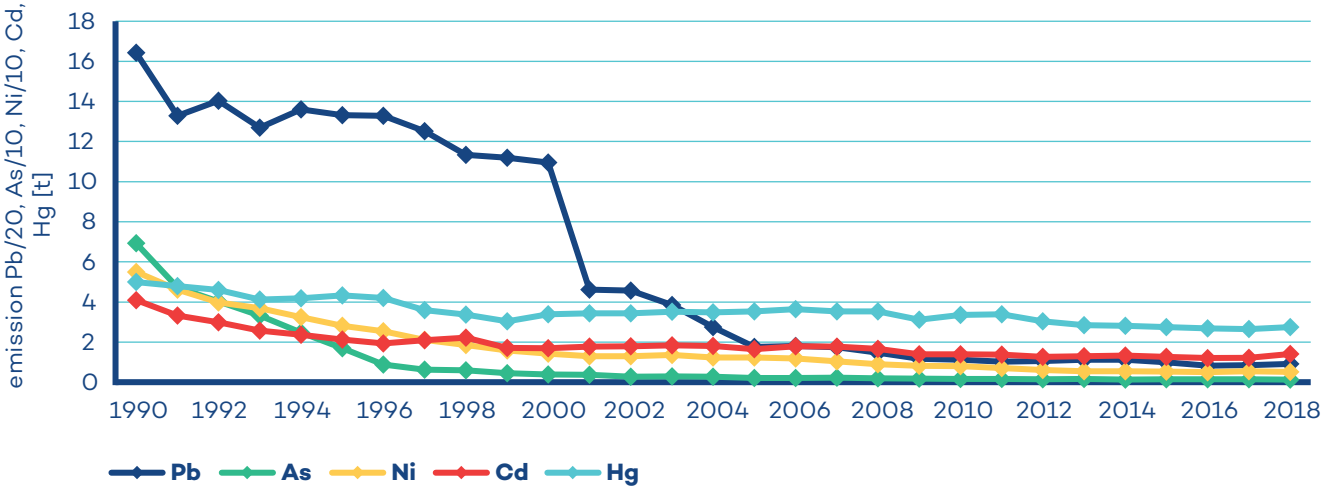

Fig. II.3 The development of heavy metals total emissions, 1990–2018

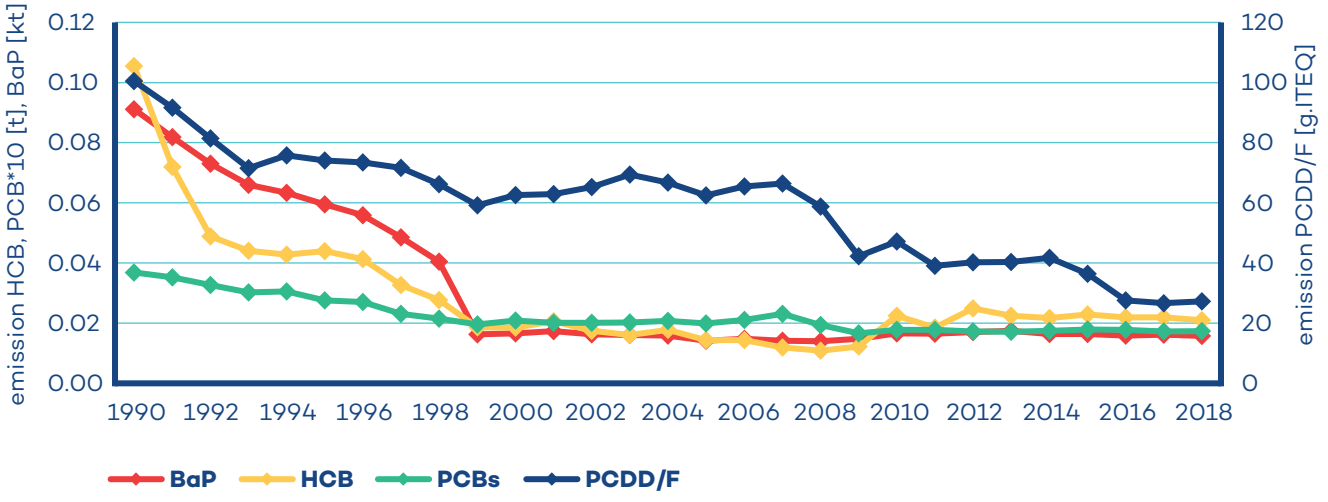

Fig. II.4 The development of POP emissions, 1990–2018

For the model assessment of pollution levels and display of emission densities (Chapter IV), emission factors are applied to determine emissions from domestic heating, that represent the estimated state when boilers are operated for part of the time at reduced output, meaning imperfect combustion and increased emissions (EU 2015).

Emission trends

The trends in air pollution levels are closely connected with economic and social-political conditions and with development of knowledge about the environment permitting more complete and accurate emission inventories. A time series of the 1990–2018 period separated for the main gas polluting substances, solid polluting particles, heavy metals and POPs is presented in Fig. II.1 to Fig. II.4. The emissions of all the main polluting substances decreased in this period by tens of percent. After an initial decrease in the period up to 2008, the benzo[*a*]pyrene emissions started again to increase and by 2012 came close to the level of 2001. Due to higher rate of consumption of black coal in households after 2010 HCB emissions also increased. In 2012, they reached 35% higher levels than in 2000. Emissions from stationary sources in categories REZZO 1 and REZZO 2 decreased substantially as a result of introduction of an air quality control system which employs a number of instruments at various levels (normative, economic, information, etc.). The impacts of these instruments were manifested to the greatest degree at the end of the 1990s, i.e. at a time when the emission limits introduced by the then new legislation came into force. A substantial reduction in the production of emissions from the most important sources manifested positively on air quality, especially in the industrial areas of Northern Bohemia and Moravia, and there was, among other things, a significant reduction in the long-distance transmission of pollutants. Despite significant reductions in emissions from energy and industrial sources, compliance problems with air quality requirements persist in many

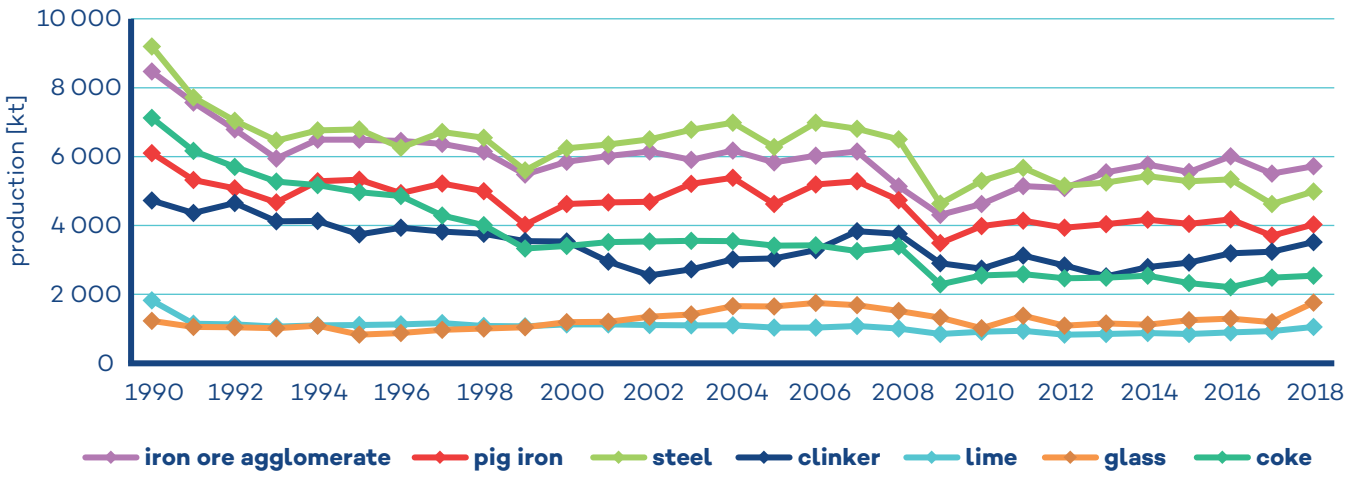

Fig. II.5 The output of basic industrial products, 1990–2018

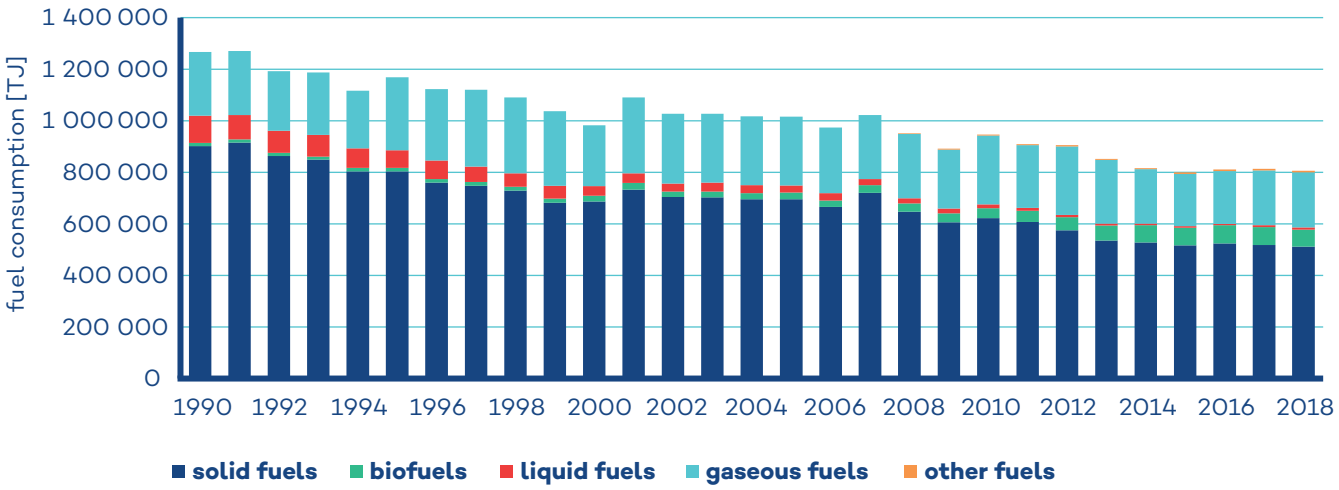

Fig. II.6 Fuel consumption in REZZO 1 and REZZO 2 sources, 1990–2018

places, and the attention has also been focused in recent years on REZZO 3 and REZZO 4 sources. Although there has been a significant reduction in emissions, especially in road transport, the impact of these sources on air quality is significant, especially in municipalities, and effective measures have not yet been applied throughout all the territory to regulate them. For these reasons, among other, the revision of the Göteborg Protocol and Directive of the European Parliament and Council (EU) 2016/2284 imposes on the Czech Republic the obligation to reduce the emissions by 2020 for $PM_{2.5}$ by 17%, SO_2 by 45%, NO_X by 35%, VOC by 18% and NH_3 by 7% and by 2030 for $PM_{2.5}$ by 60%, SO_2 by 66%, NO_X by 64%, VOC by 50% and NH_3 by 22% compared to 2005.

In 1991, Act No. 309/1991 Coll., on protection of the air, came into force, supplemented by Act No. 389/1991 Coll., on state administration in air protection and fees for pollution thereof, which introduced emission limits with validity from 1998 for the first time in the history of the Czech Republic. As a result of the restructuring of the economy and the modernization of resources, there has been a significant decline in production in a number of sectors since 1990 (Fig. II.5). In combustion sources with lower heat output (heating plants/boiler rooms), solid and liquid fossil fuels were gradually replaced by natural gas (Fig. II.6).

Emissions from local household heating decreased most in the 1993–1997 period as a result of conversion to gas heating in municipalities and state support for heating with electricity. The consumption of household fossil fuels in 2001 was 67% lower compared with 1990 (Fig. II.7). Emissions of the main polluting substances and particulates of the REZZO 4 sources decreased due to natural vehicle fleet renewal. Termination of sale of leaded petrol in 2001 led to a substantial decrease of Pb emissions into the air (Fig. II.3).

The favourable trend in reducing consumption of fossil fuels in the local household heating sector did not continue after 2001,

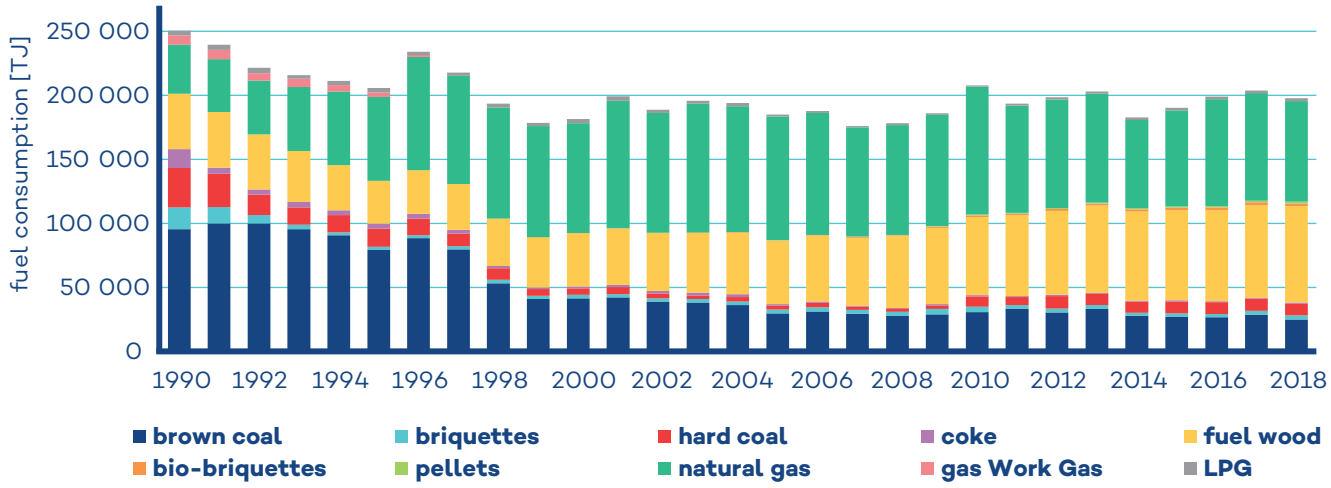

Fig. II.7 Fuel consumption in REZZO 3 sources (households), 1990–2018

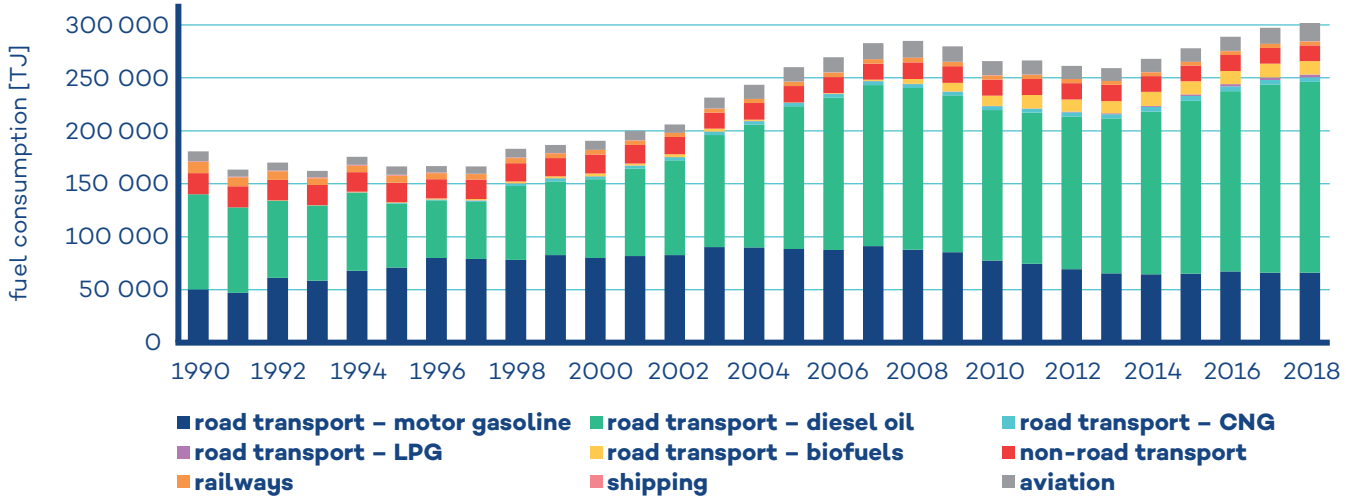

Fig. II.8 Fuel consumption in REZZO 4 sources, 1990–2018

mainly because of the increasing prices of natural gas and electricity. In the 2002–2008 period, the consumption of coal slightly decreased and was replaced by increasingly popular heating with wood. After 2009 the consumption of fossil fuels in households, particularly firewood, started again to increase (Fig. II.7). In 2009–2012, the Green Light for Savings programme helped in buildings being insulated and environmentally unsound heating being replaced by low-emission sources. Emissions of the main polluting substances and emission of particulates of the REZZO 4 sources decreased due to introduction of stricter emission standards for new vehicles placed on market. The impact of increased intensity of transport and consumption of diesel fuel led to increase of emission of heavy metals and POPs (Fig. II.8).

In 2012, the Act No. 201/2012 Coll. on air protection came into force, introducing stricter emission limits for sources pursuant to Directive 2010/75/EU on industrial emissions. The most important technical measures to reduce emissions in the 2013–2016 period included installation of sulphur-removal and nitrogen-removal equipment for combustion products (most power plants and larger heating plants) or installation of bag filters on the existing electrostatic separators (e.g. at metallurgical plants in the Moravian-Silesian region).

The new legislation concentrated more also on reducing emissions from the local household heating sector by introducing minimum emission parameter values for combustion sources with overall rated thermal input of up to 300 kW when placing the equipment on the market since 2014 and 2018. From 1 September 2022, it will be possible to operate only boilers complying with emission class 3 in this group of sources, which should lead to removal of old types of boilers and their replacement by more modern equipment with lower emissions. Replacement of boilers is taking place gradually and, together with reducing the energy demands of buildings, these measures are supported by the subsidy policies at national and regional levels.

The preliminary emission assessment for 2019 shows further reductions for all major pollutants (Tab. II.1). Of the listed REZZO 1-2 sources, emissions decreased the most concerning SO_2 by 17 kt, CO by 7.4 kt and NO_x by 6.5 kt. The evaluation of the trend of reported emissions of the most important production facilities, especially combustion sources for the production of electricity and supply of heat, metallurgy and oil processing sector, shows a reduction in SO_2 emissions by almost 25% and NO_x by 10.5%. In the case of collectively monitored stationary REZZO 3 sources, the decrease in SP emissions (by 2.8 kt) is mainly due to domestic heating and then other stationary sources, including coal mining which decreased by 4.4% year-on-year for lignite coal and by almost 25% for black coal. The results of the model evaluation of domestic heating include the available information on the ongoing replacement of boilers for domestic heating (the existing stages of replacement concerning approx. 48,800 boilers were included). The results show that despite a slight increase in the number of degree-days in the heating period in 2019 compared to 2018 (by about 4%), the estimation of emissions mainly affected the modernization of the composition of combustion equipment in households due to legislative measures documented in the Ministry of Industry and Trade statistics (MIT 2020). The preliminary assessment indicates a small reduction in total household heating emissions for all pollutants except SO_2 (a slight increase in the average sulphur content of lignite coal) and NH_3 (an increase in the use of biomass). A slight increase in fuel consumption was almost not reflected in the change in emissions from transport (REZZO 4). A more detailed evaluation of time variation of pollutant emissions, especially for the listed sources, can be found in the individual subchapters of Chapter IV.

Projections of emissions

Within the framework of reporting in relation to the Czech Republic's international obligations (CLRTAP) and Directive 2016/2284/EU, the CHMI provides projections based on emission inventories, trends of socio-economic indicators, legislation valid in the projection horizon and further emission reduction measures.

The emission projection for the period 2020–2030 (Fig. II.9) was prepared according to the WM (without additional measures) and

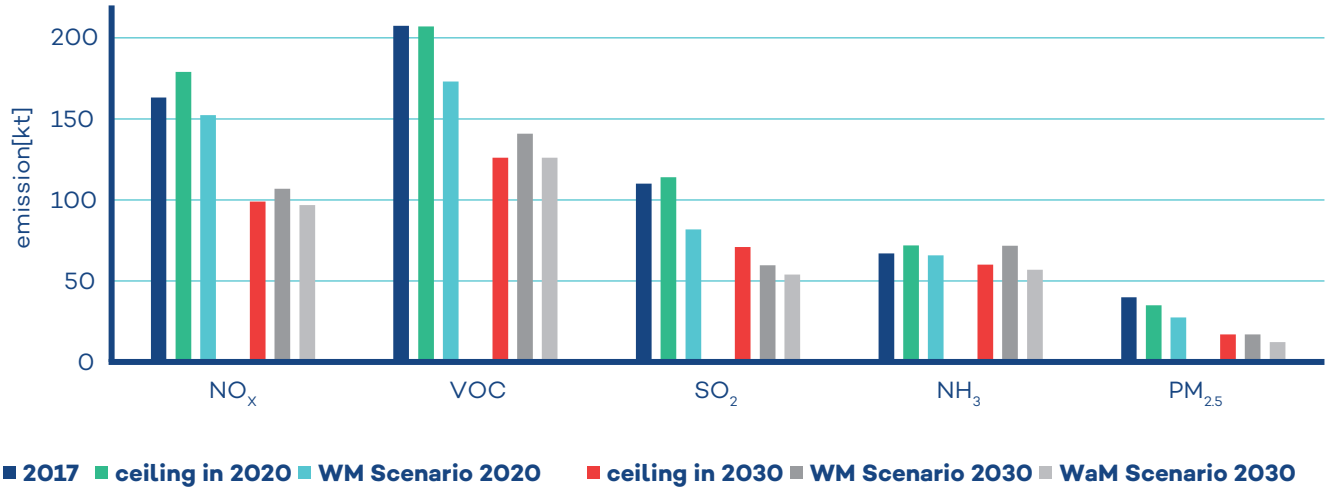

Fig. II.9 Comparison of emission ceilings and emission projection scenarios of basic air pollutants

WaM (with additional measures) scenarios for the purpose of updating the National Emission Reduction Programme (MŽP 2019). The projections for NO_X, VOC, SO_2, NH_3, and $PM_{2.5}$ particles are based primarily on expert evaluation of future emissions and activity data for significant source categories such as energy, transport, agriculture, solvent use or waste management.

By 2030, it is anticipated that emissions of all pollutants will be reduced, resulting from the replacement of heating facilities in the sector of the local household heating, vehicle fleet renewal including support for low-emission and zero-emission vehicles, greater support for renewable energy, tightening of obligations for the storage and application of fertilizers and other measures.

Tab. II.1 The comparasion of emissions of main pollutants, 2018–2019 (preliminary data)

Emission source category	TZL		SO_2		NO_x		CO		VOC		NH_3	
	kt.year^{-1}											
Year	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
REZZO 1–2	7.4	6.7	76.7	59.6	74.2	67.7	166.8	159.4	21	20.3	0.7	0.6
REZZO 3	47.2	45.1	19.6	20.1	16.6	16.6	555.7	552.2	193.1	191.5	70	69.8
TOTAL stationary sources	**54.6**	**51.8**	**96.3**	**79.7**	**90.8**	**84.3**	**722.5**	**711.6**	**214.1**	**211.8**	**70.7**	**70.4**
REZZO 4	7.1	7.1	0.2	0.2	70.8	69.5	108.1	102.6	16.8	16.7	1	1
TOTAL	**61.7**	**58.9**	**96.5**	**79.9**	**161.6**	**153.8**	**830.6**	**814.2**	**230.9**	**228.5**	**71.7**	**71.4**