II. AIR POLLUTION

Under authorization by the Ministry of the Environment, the CHMI evaluates the level of air pollution for primary pollutants of anthropogenic origin. The basic background material for this evaluation is the so-called emission inventory, which combines the direct collection of data reported by source operators with model calculations from data reported by source operators or determined in the context of statistical studies performed primarily by the Czech Statistical Office. The resulting emission inventories are presented in the form of emission balances in sectoral and territorial classifications (CHMI 2022a). The accompanying document describing the methodologies for processing emission inventories is also presented on the CHMI website (CHMI 2022b). The current report (CHMI 2022f) presents results of the emission inventory for the period 1990–2020, taking into account recommendations of the team reviewing the inventory methodology of the EU Member States. These relate mainly to a determination of ammonia emissions from applying mineral fertilizers and the inclusion of emissions of the agricultural activities sector (NMVOCs and NO_x).

Emission inventory in the Czech Republic

From the viewpoint of methods for monitoring emissions, air pollution sources are divided into individually monitored sources and collectively monitored sources. Sources listed in Annex No. 2 of the Act No. 201/2012 on 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, its operation, and data on inputs and outputs from these sources. They are also obliged to annually report information on the summary operating records (SPE) through an integrated system of fulfilling reporting obligations (ISPOP). ISPOP data are then collected in the REZZO 1 and REZZO 2 databases. Data collection 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, the surface use of organic solvents, filling stations, coal mining, car and building fires, waste and waste-water treatment, the 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 roads (including NMVOC emissions from vehicle fuel system petrol evaporation and emissions from brake, tyre and road abrasion), rail, water and air transport, and the operation of off-road machinery and equipment (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.

For the model assessment of pollution levels, to determine emissions from domestic heating, emissions factors are applied that

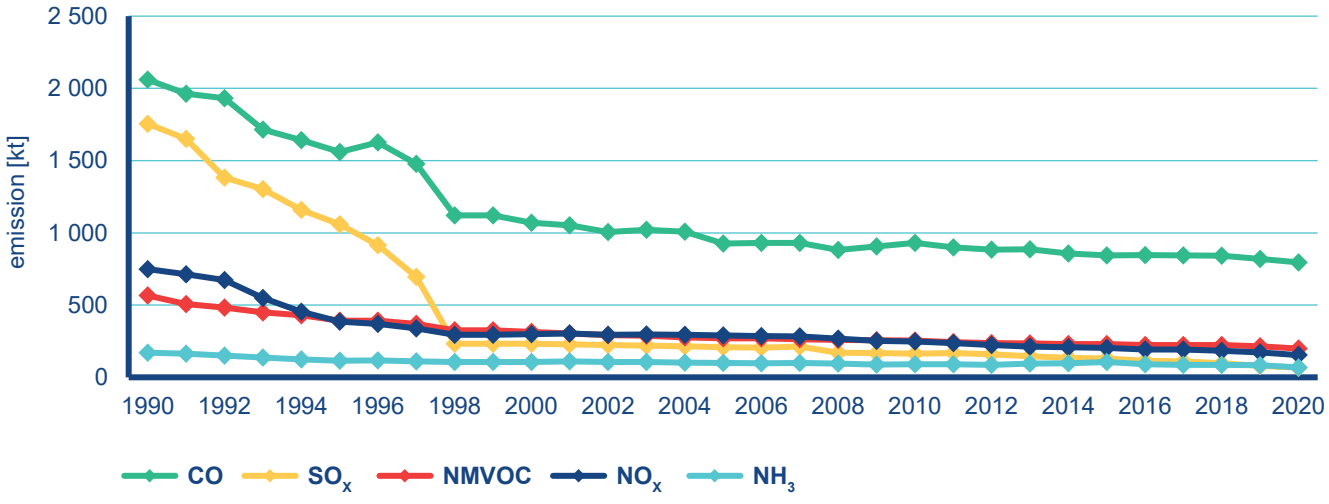

Fig. II.1 Main pollutants total emissions, 1990–2020

represent estimated conditions when boilers are operated for part of the time at reduced output, meaning imperfect combustion and increased emissions (EU 2015). Similarly, emissions from road traffic resuspension are included in the model assessment of pollution levels.

Emission trends

Trends in air pollution levels are closely connected with economic and social-political conditions, as well as with the development of knowledge about the environment, permitting fuller and more accurate emission inventories. A time series of the 1990–2020 period, separated for the main gaseous pollutants, particulate matter, heavy metals, and POPs, are presented in Figs. II.1 to II.4. During this period, the main pollutant emissions decreased by tens of percent. After an initial decrease in the period up to 2008, benzo[*a*]pyrene emissions again started to increase, and by 2012 approached the level at 2001. Due to a higher rate of black coal consumption in households after 2010, HCB emissions also increased. In 2012, they reached levels 35 % higher than in 2000. Emissions from stationary sources in REZZO 1 and REZZO 2 decreased substantially as a result of the introduction of an air quality control system that uses many instruments (normative, economic, information, etc.) at various levels. The impacts of these instruments appeared to the greatest degree at the end of the 1990s, i.e., at a time when emission limits introduced by then new law came into force. Significant reductions in emission from the most important sources had a positive effect on air quality, especially in industrial areas of Northern Bohemia and Moravia, and there was also a significant reduction in the long-range transport of air pollutants. Despite significant reductions

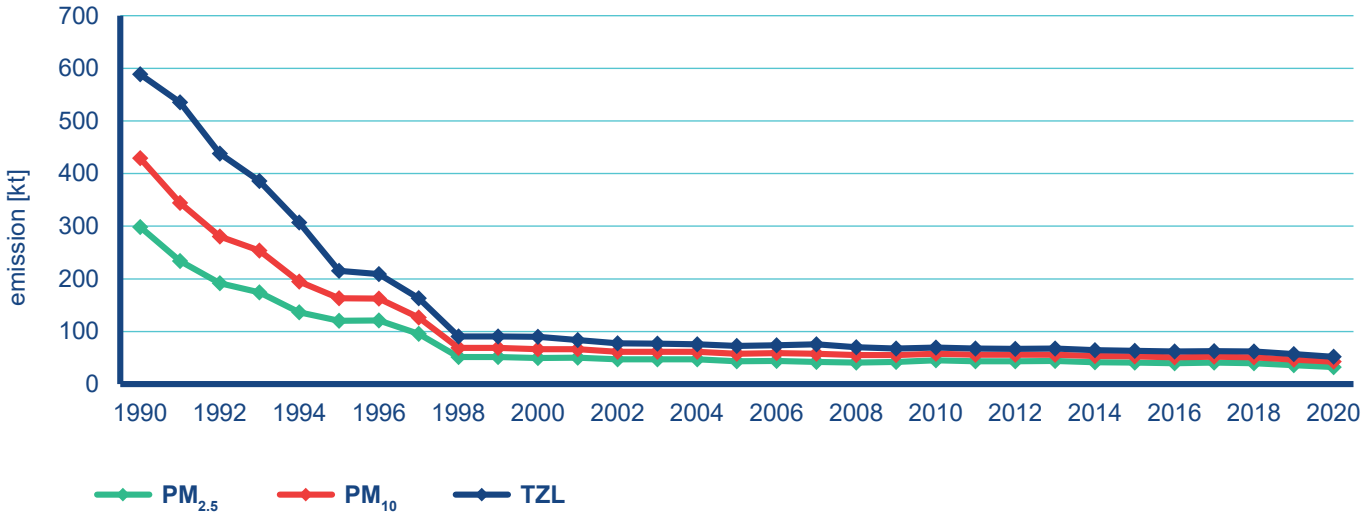

Fig. II.2 Particulate matter total emissions, 1990–2020

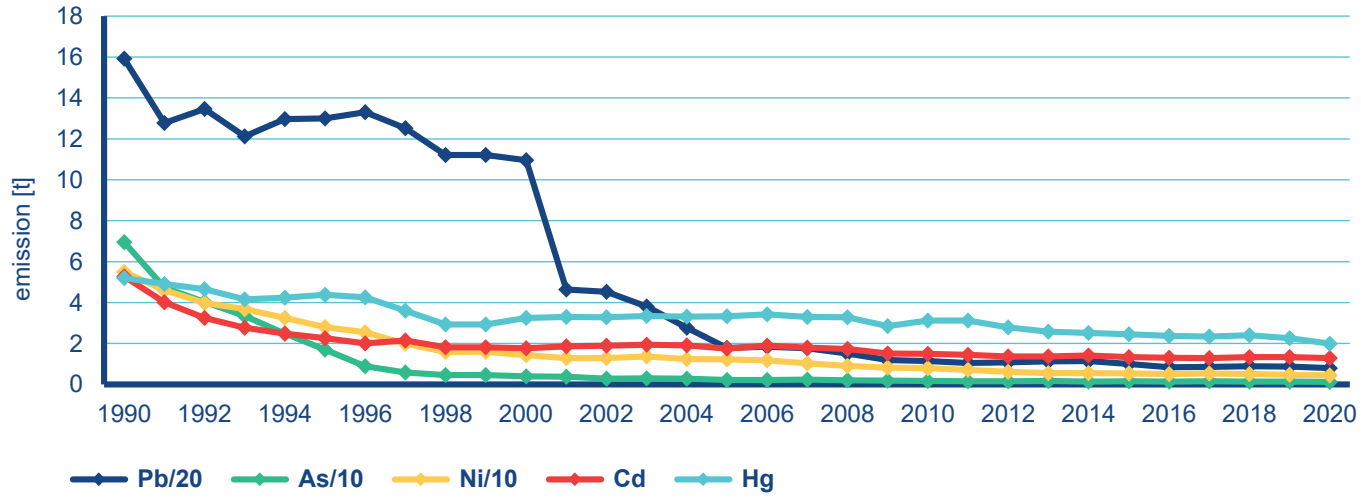

Fig. II.3 Heavy metals total emissions, 1990–2020

in emissions from energy and industrial sources, compliance problems with air quality requirements persist in many places, which is why attention has been focused in recent years on REZZO 3 and REZZO 4 categories. Although there has been a significant reduction in emissions, especially from road transport, the impact of these sources on air quality is significant mainly in municipalities, and no effective country-wide measures have yet been applied to regulate them. For these reasons, among others, revision of the Göteborg Protocol and Directive of the European Parliament and Council (EU) 2016/2284 imposed the obligation on the CR to reduce emissions by 2020 for $PM_{2.5}$ by 17 %, SO_x by 45 %, NO_x by 35 %, NMVOCs by 18 % and NH_3 by 7 % and by 2030 for $PM_{2.5}$ by 60 %, SO_x by 66 %, NO_x by 64 %, NMVOCs by 50 % and NH_3 by 22 %, compared to 2005.

In 1991, Act No. 309/1991 Coll., on air protection, 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 in force from 1998 for the first time in the history of the CR. 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). For 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.

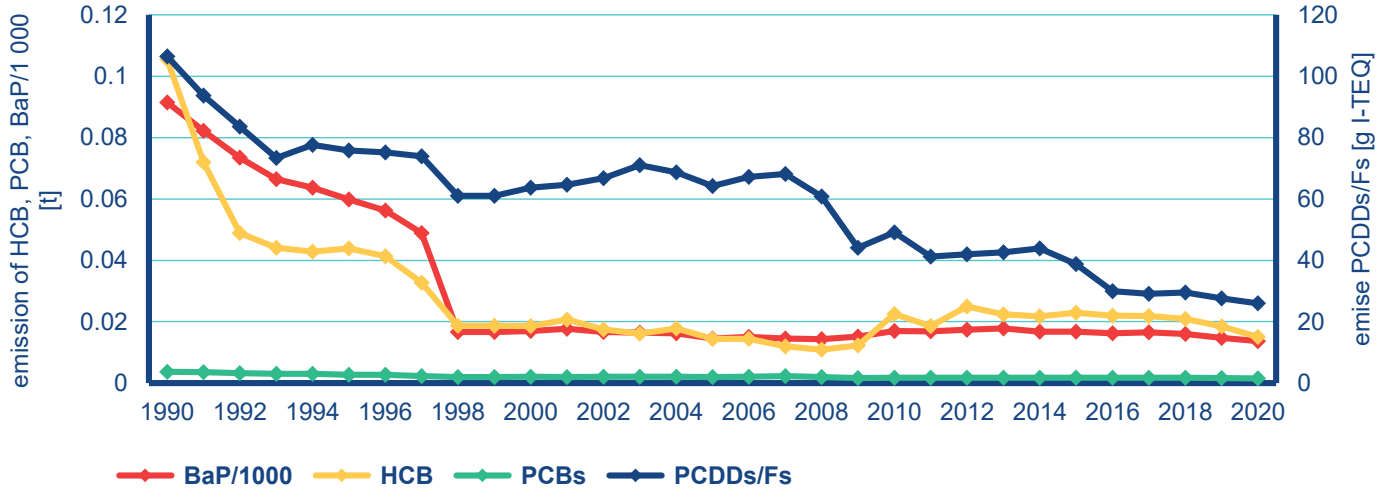

Fig. II.4 POP emissions, 1990–2020

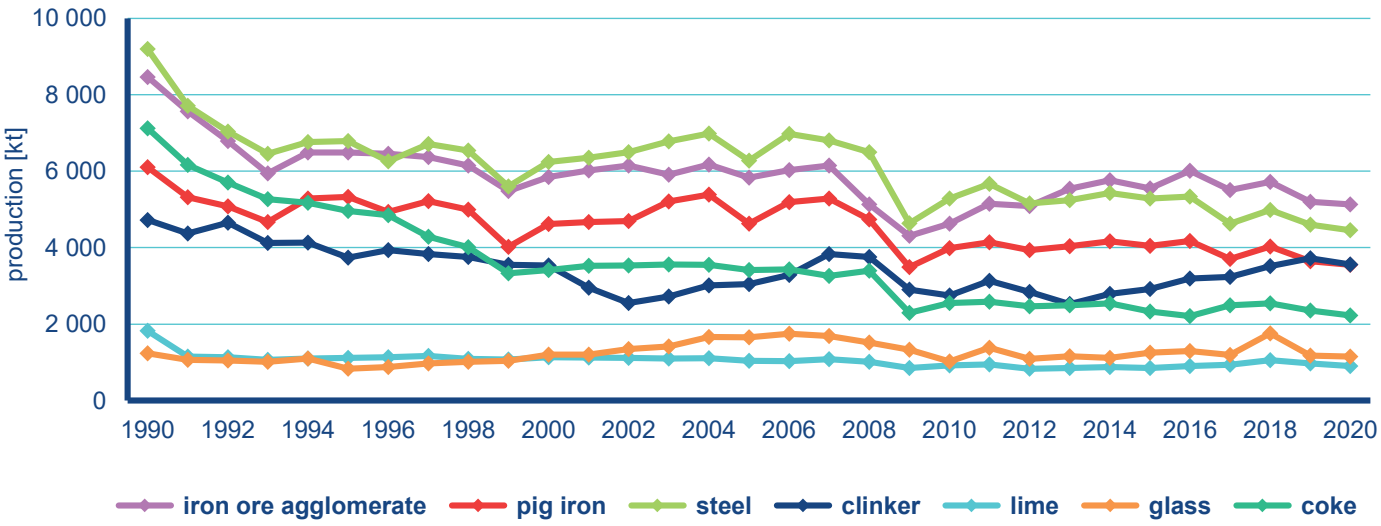

Fig. II.5 The output of basic industrial products, 1990–2020

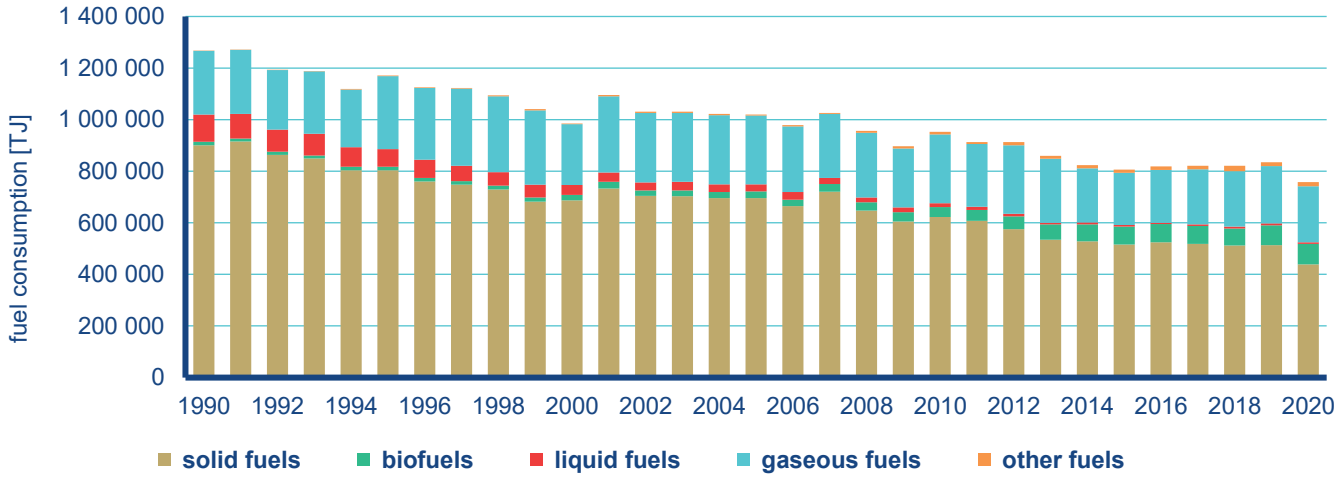

Fig. II.6 Fuel consumption in REZZO 1 and REZZO 2 sources, 1990–2020

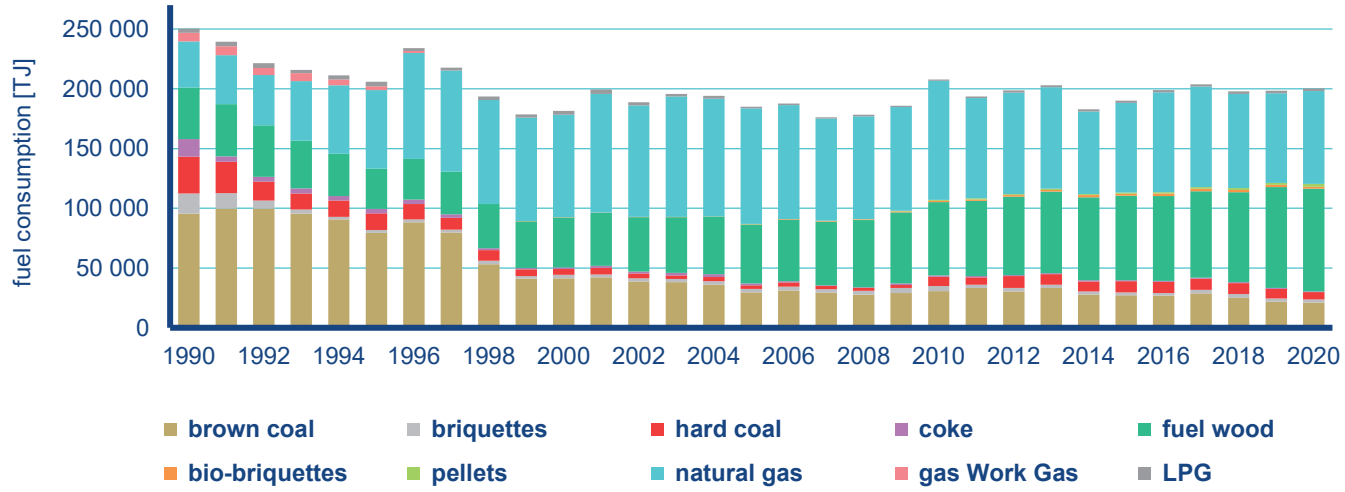

Fig. II.7 Fuel consumption in REZZO 3 sources (households), 1990–2020

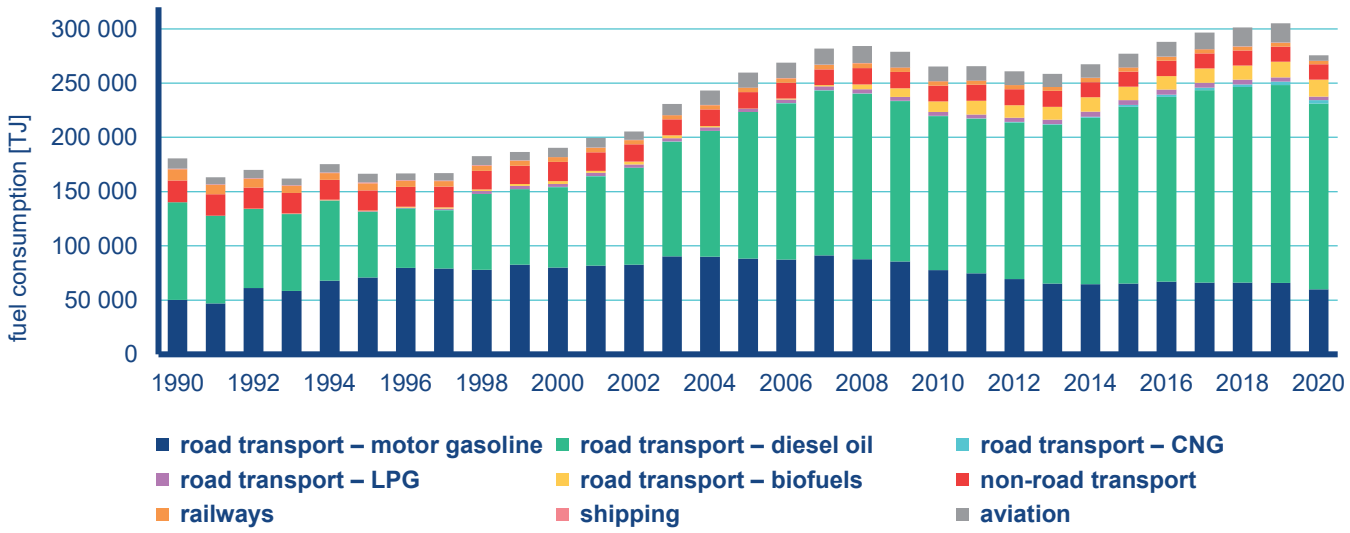

Fig. II.8 Fuel consumption in REZZO 4 sources, 1990–2020

The consumption of household fossil fuels in 2001 was 67 % lower than in 1990 (Fig. II.7). Emissions of the main pollutants from REZZO 4 sources decreased due to regular vehicle fleet renewal. Termination of the sale of leaded petrol in 2001 led to a substantial decrease in 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, 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 solid fuels in households, particularly firewood, increased again (Fig. II.7). During 2009–2012, the Green Light for Savings programme helped in insulating buildings and replaced non-ecological heating with low-emission sources. Emissions of the main pollutants from REZZO 4 sources decreased due to introducing stricter emission standards for new vehicles brought to market. The impact of increased intensity of transport and consumption of diesel fuel led to an increase in emissions 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 combustion sources pursuant to Directive 2010/75/EU on industrial emissions. The most important technical measures to reduce emissions in the 2013–2020 period included the installation of sulphur-removal and nitrogen-removal equipment from combustion products (most power plants and larger heating plants) or the installation of fabric filters on existing electrostatic separators (e.g., at metallurgical plants in the Moravian-Silesia region).

The new law has also been focused on reducing emissions from the local household heating sector by introducing minimum emission parameter values for combustion sources with an overall rated thermal input of up to 300 kW for equipment brought to market since 2014 and 2018. From 1 September 2024, for these sources, it will only be possible to operate boilers complying with emission class 3, which should lead to removing of old types of boilers and replacing them with more modern equipment with lower emissions. The replacement of boilers takes place gradually and, together with reducing building energy demands, is supported by subsidy policies at national and regional levels.

The preliminary emission assessment for 2021 (Tab. II.1) shows an expected increase in all emissions except for SO_x. The increase occurred mainly in emissions from household heating, resulting from the colder heating season, leading to an increase in fuel consumption and emissions by approximately 8 %. Compared to 2020, during which there was a slowdown in industrial production, provision of services, and consumption of fuels in almost all sectors, there was another increase in 2021, which was reflected in the increase in emissions of REZZO 1 and REZZO 2 sources (NO_x by approx. 6 % and CO by about 8 %). For TSP, NMVOC and NH_3 emissions, this increase was nearly not reflected. Year-on-year, emissions decreased only for SO_x, by approx. 7 kt, while the biggest proportion in the decrease resulted from the ORLEN refinery complex operation in Litvínov (approx. 3 kt), the end of operation of the Prunéřov I power plant on 30 June 2020 (approx. 1 kt), and the reduction from other important sources for the production of electricity and heat by approx. 2.7 kt. The increase in fuel consumption by approx. 6 % of REZZO 4 category resulted in the increase in emissions of all pollutants. In total emissions, compared to previous year, a decrease only occurred in SO_x emissions by approx. 8.5 %, on the contrary, the highest increase in total emissions was for CO and NMVOCs by more than 7 %. A more detailed evaluation of the proportion of individual categories of sources in total emissions and the development of emissions of pollutants, particularly for the listed sources, can be found in the subsections of Chapter IV.

Tab. II.1 The comparasion of emissions of main pollutants, 2020–2021 (preliminary data)

Emission source category	TSP		SO_x		NO_x		CO		VOC		NH_3	
	kt·year^{-1}											
Year	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
REZZO 1-2	5.8	5.8	52.0	45.0	60.3	63.9	159.6	172.4	19.6	19.5	0.7	0.7
REZZO 3	39.7	41.9	14.4	15.6	31.5	32.6	541.9	587.1	165.6	179.1	67.0	67.5
TOTAL stationary sources	**45.5**	**47.7**	**66.4**	**60.6**	**91.8**	**96.5**	**701.5**	**759.5**	**185.2**	**198.6**	**67.7**	**68.2**
REZZO 4	6.3	6.5	0.1	0.2	62.0	62.2	94.1	97.9	13.7	15.3	0.8	0.8
TOTAL	**51.8**	**54.2**	**66.5**	**60.8**	**153.8**	**158.7**	**795.6**	**857.4**	**198.9**	**213.9**	**68.5**	**69.0**

Projections of emissions

Within the framework of reporting concerning 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, law valid for the projected time horizon and further emission reduction measures.

An emission projection for the period 2020–2030 was prepared (Fig. II.9) according to the scenario with valid measures (WEM) and with additional measures (WAM) for the purpose of updating the National Emission Reduction Programme (MŽP 2019). This projection was updated as a report preparation under international obligations in March 2021. The projections for NO_x, NMVOCs, SO_x, NH_3, and $PM_{2.5}$ particles are based primarily on expert evaluations of future emissions and activity data for significant source categories such as energy, transport, agriculture, solvent use and waste management.

By 2030, it is anticipated that emissions of all pollutants will decrease. It results from replacing heating facilities in the local household heating sector, 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.

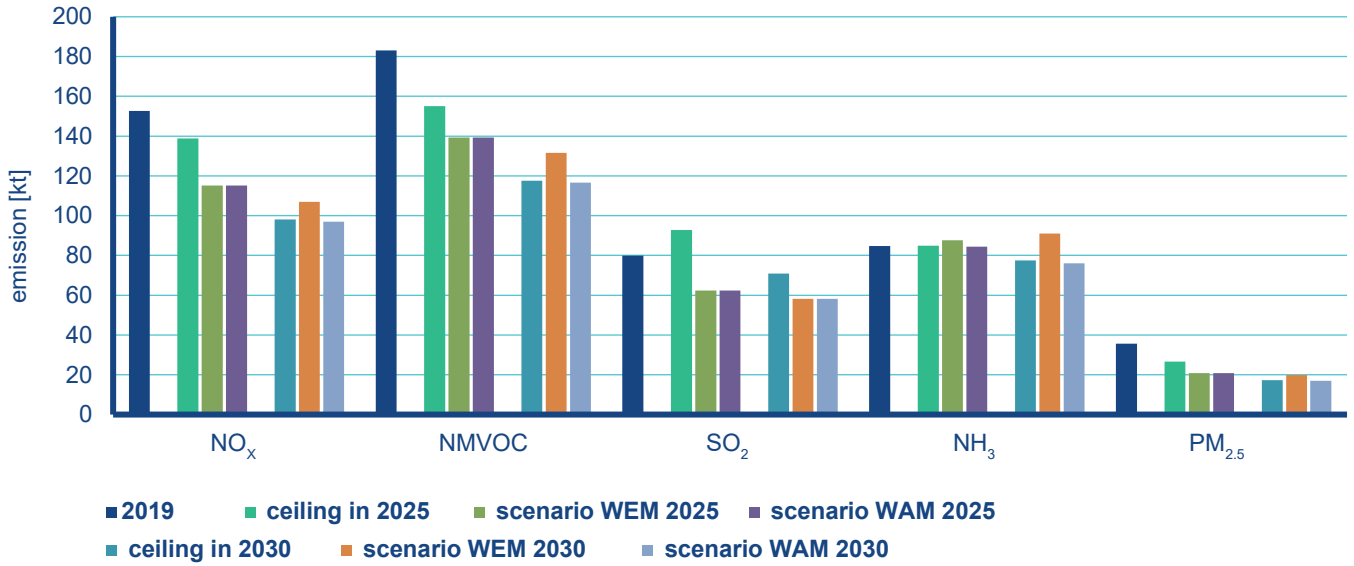

Fig. II.9 Comparison of emission limits and emission projection scenarios of basic pollutants (including subtraction of NO_x and NMVOC emissions of categories NFR 3B and NFR 3D)