ENVIRONMENTAL PROTECTION IN THE CZECH REPUBLIC

EXPERIENCE AND KNOW-HOW

Ministry of the Environment
of the Czech Republic

▼ Dam Přísečnice in the Krušné mountains.

Contents

The Krkonoše mountains in winter. ▸

1. Introduction

The Ministry of the Environment of the Czech Republic, as the central state administration authority and supreme checking authority in environmental affairs and climate change, plays a crucial role in environmental protection, one of the major pillars of sustainable development. A good state of the environment is a basic prerequisite for ensuring high quality of life and human well-being as well as an integral part of sustainable economic growth.

As a result of tremendous efforts of the Ministry of the Environment together with other important actors including relevant ministries, the scientific community, business, industry and civil society organisations and other stakeholders, also with the assistance of foreign partners on the European and global level, the environment in the Czech Republic has dramatically improved over the past 30 years, in particular in the field of greenhouse gas emissions, air quality, water protection, and waste management. The transition process in our country sparkled new ideas about protecting the environment and allowed a strong boost for investments into environmental protection (see Figure I below).

We are aware of this unique experience and of our share of responsibility towards maintaining a healthy environment not only for the present but also for future generations. Therefore, the Ministry of the Environment is keen on promoting its potential in the field of bilateral cooperation with foreign partners, taking advantage of **Czech environmental experience and know-how**.

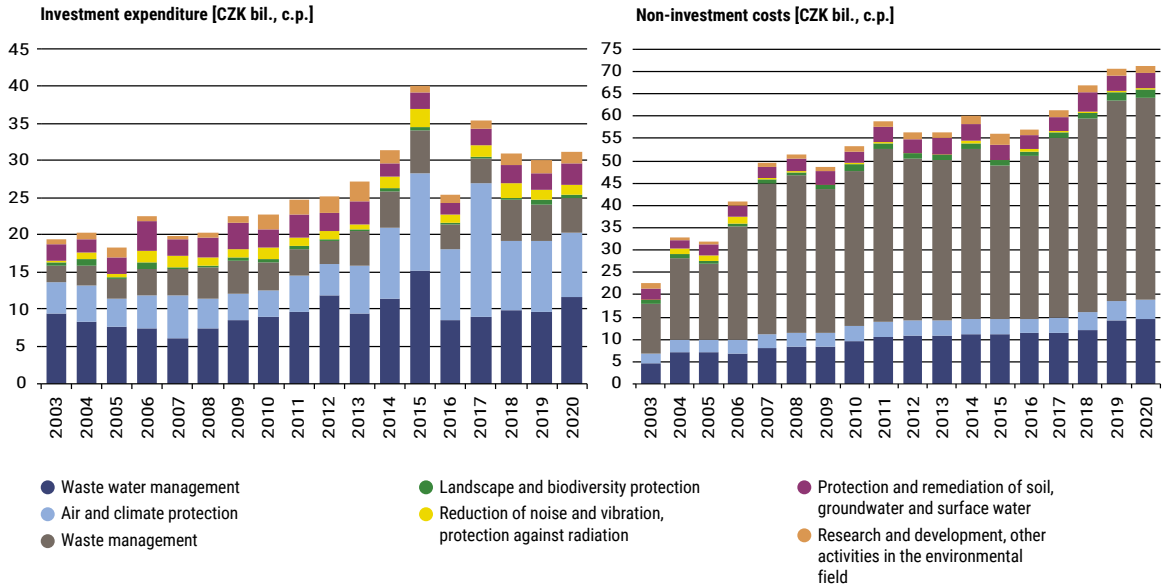
This informative brochure aims to present the basic facts about selected environmental areas and to focus on sharing our experience and know-how with partners. For further information please see the following links.

Compared with the EU average, the Czech Republic invests above-average finances into environmental protection in the long terms, both within the public and industrial sectors.[1]

[1] Source: Report on the Environment of the Czech Republic 2020.

▲ České Švýcarsko in autumn.

Figure I: Investments and non-investment costs for environmental protection in the Czech Republic, according to the programme focus [CZK bil., current prices], 2003–2020.



Source: Czech Statistical Office

2. Specialized institutions of the Ministry of the Environment

Following organisations within the jurisdiction of the Ministry of the Environment are open to cooperation:

Czech Hydrometeorological Institute www.chmi.cz

The Czech Hydrometeorological Institute (CHMI) serves as a central governmental institution in the field of air quality, hydrology, water quality, climatology, meteorology, and is providing services primarily for the state administration. CHMI operates a national monitoring and observation network for monitoring qualitative and quantitative conditions of the atmosphere, including the ozone layer, the hydrosphere, and the causes leading to their pollution or deterioration.

The main activities of the CHMI include:

- Establishment and operation of national monitoring and observing networks for monitoring the qualitative and quantitative conditions of the atmosphere, hydrosphere, and sources resulting in pollution or harmful effects;
- Professional evaluation of the results of observation, measurements, and monitoring, following the principles of the EU legislation;
- Establishment and operation of databases on state and quality of the air and sources of its pollution, as well as on state and development of the atmosphere and quantity and quality of water according to the requirement of the EU legislation and international agreements;
- Provision of information on characteristics and regimes of the atmosphere and hydrosphere;
- Provision of operational information on the state of the atmosphere and hydrosphere, forecasts and warnings on hazardous meteorological and hydrological phenomena;
- Carrying out technical development of the monitoring, communication, and information technologies, scientific and research activities in its field of expertise including design activities;
- Performing, under the authorisation or permission, other specialized technical activities related to the main activities of the CHMI, listed in the Charter of the Institute;
- Organizing technical courses, excursions, trainings, and other educational events for the public, including teaching, environmental education, and services of a specialised library.

In line with its Charter, the CHMI is organised as a multidisciplinary institution with close interdisciplinary links and cooperation.

The CHMI conducts an expert analysis of the obtained measurements, creates and manages databases, provides forecasts and warnings, and implements and coordinates scientific research activities. The CHMI has an extensive experience in international cooperation, especially in regard to the monitoring of air quality, and the ozone layer (implementation of the Montreal Protocol), as well as the hydrological and meteorological services.

The CHMI, as a national weather service provider, cooperates with the international meteorological community within the official structure of the World Meteorological Organization and other functional groupings (EUMETNET, ECMWF, RC LACE, or ACCORDConsortium). The CHMI contributes to the collecting and sharing of data and shares the capacity development, especially in the field of numerical modelling and weather forecast.

Climatological database (CLIDATA) developed by the CHMI is currently being used in more than 36 countries on 4 continents, and regular trainings are taking place in the Czech Republic and abroad.

Nature Conservation Agency of the Czech Republic

www.nature.cz

The Nature Conservation Agency of the Czech Republic (NCA) is a governmental body, providing nature conservation and landscape protection at the national level. NCA manages 24 Protected Landscape Areas (PLA), 104 National Nature Reserves (NNR), and 122 National Nature Monuments (NNM), where it performs state/public administration in nature conservation, and implements various conservation measures in the field.[2] In the non-reserved landscape, the authority also supports and manages nature and the landscape through subvention programmes or subsidiary schemes, funded or co-funded both by the state budget and the European Union. At the same time, the NCA provides expertise and other expert/technical activities in nature conservation and landscape protection.

The NCA manages the Nature Conservancy Information System; conducts monitoring of the habitats and species; develops and implements practical measures to conserve nature and protect the landscape; implements action and management plans for threatened species.

The NCA carries out broad international cooperation in nature conservation and landscape protection by implementing the EU legislation and multilateral biodiversity related agreements. For example, the NCA is a Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) National Scientific Authority and a partner of the European Topic Centre on Biological Diversity consortium.

Czech Geological Survey www.geology.cz

The Czech Geological Survey is the state organization that compiles, stores, interprets, and provides expert geological information for the state administration, the private sector, and the public. It is the only institution with the mission to systematically investigate the geological composition of the whole territory of the Czech Republic. The well-established reputation of the Czech Geological Survey is based on the optimum combination of services to the society with top-ranking research in geological science, natural resources, geological hazards, and environmental protection. As an internationally respected scientific institution, it responds to the requirements of society for sustainable development and plays a significant role in education and the popularization of geology.

The main fields of activity are geological research and mapping; rock environments and their protection; mineral resources and the environmental impact of mining; geological hazards, prevention and mitigation of their impact; and geoinformation management and delivery.

Czech Environmental Inspectorate www.cizp.cz

The Czech Environmental Inspectorate (CEI) is a specialized supervisory authority providing for nationwide supervision in the area of environmental legislation enforcement. CEI is an organization subordinate to the Ministry of the Environment and is organizationally divided into Headquarters, 10 regional inspectorates, and two branch offices. CEI was established in 1991 by the act no. 282/1991 Coll., on the Czech Environmental Inspectorate and its competencies in forestry protection. The other environmental areas were gradually assigned and now the CEI´s competence can be divided into five core groups: waste management, air protection, water protection, nature protection (including CITES), and forest protection. Other but no less important areas of supervision are the protection of the Earth's ozone layer, handling of chemical substances, industrial accident prevention, packaging management, genetically modified organisms (GMOs), and integrated pollution prevention and control (IPPC).

Overview of CEI´s competences:
- Supervise compliance with environmental legislation;
- Carry out inspections in all the above areas of competence;

[2] National parks are managed by the National Park Administrations, see p. 11.

- Impose measures to remedy identified shortcomings and sanctions for non-compliance environmental legislation;
- Confiscate illegally acquired endangered animal and plant species and products made from them;
- Restrict or stop the activity if it poses a serious threat to the environment;
- Participate in resolving historical environmental burdens and handling environmental accidents;
- Collaborate with inspection authorities of the EU countries and the EU network of inspection bodies (IMPEL);
- Elaborate position statements for other authorities;
- Resolve complaints, notices, and inputs from the public, organizations, and other institutions of the state and municipal administration;
- Provide information upon requests by applicable law;
- Inform public, media, and state administration authorities about environmental data gathered in inspection work.

STATE ENVIRONMENTAL FUND OF THE CZECH REPUBLIC

State Environmental Fund of the Czech Republic

www.sfzp.cz

A dense network of consultants and skilled, highly qualified project managers, the fair evaluation of applications, and quick payment of approved subsidies – these quality services are provided by the State Environmental Fund (SEF) to all subsidy applicants and project contractors in the field of environmental improvement.

The SEF offers financial support in the form of subsidies, loans, and contributions to partial interest coverage. The fund obtains financial resources from the European Union, namely the Cohesion Fund, the European Regional Development Fund, and The Next Generation EU Fund, from the state budget, and from fees collected from polluters – including wastewater discharge fees, fees for reclassifying agricultural land, air pollution fees and fees under the Waste Act.

The fund's main activities include providing consulting and advisory services, receiving and evaluating aid applications, preparing groundwork materials for approving aid and the contractual agenda for aid provision, disbursing financial resources to aid beneficiaries and continually auditing their use, conducting a final evaluation of the use of provided resources and accomplished environmental effects, and occasionally imposing and enforcing sanctions in cases of non-compliance with the contractual conditions for granting aid. The Fund's agenda also includes the administration of fees for the discharge of wastewater into surface waters, for the abstraction of groundwater, and for landfilling.

The State Environmental Fund administers a large number of subsidy programmes. In the long term, it is responsible for the Operational Programme Environment, in the third programming period 2021–2027 of which, 2.4 billion EUR from the Cohesion Fund and the European Regional Development Fund are available to applicants. The programme aims to support projects related to energy savings, the development of renewable energy sources, the building of water infrastructure, and waste prevention, as well as projects to strengthen biodiversity and implement climate change adaptation measures.

▼ Passive standard family house construction in Brušperk.

The State Environmental Fund also plays the role of administrator in the case of the New Green Savings Programme, which is very popular among the Czech public. During the 2014–2021 programming period, 77,000 beneficiaries benefited from its support and were paid a total of 11 billion CZK. The programme focuses on reducing the energy consumption of residential buildings (through insulation), construction or purchase of houses with very low energy consumption, environmentally friendly heating methods, renewable energy sources, and currently also adaptation and mitigation measures in response to ongoing climate change. The source of funding in the new programming period is The Next Generation EU Fund, through the National Recovery Plan. The State Environmental Fund of the Czech Republic is involved in the practical implementation of the National Recovery Plan by being the administrator of selected components within this plan (e.g. clean mobility, air protection, or a circular economy).

In addition to the above-mentioned subsidy programmes, the State Environmental Fund of the Czech Republic is also responsible for the administration of the Modernisation Fund, the Norway Grants, and the Operational Programme Fair Transformation, which is intended for regions most affected by the shift away from coal, in order to mitigate the social, economic and environmental impacts of this transformation.

At least 150 billion CZK are available to the Czech Republic in the aforementioned Modernisation Fund, which will be used primarily for projects aimed at reducing dependence on coal combustion. The purpose of the investments is to help accelerate the take-up of renewable energy sources and new technologies and thus help meet national emission and climate targets in terms of reducing CO2 emissions and improving overall air quality.

Finally, the Fund is responsible for the administration of the National Programme Environment. This is an instrument of financial support for environmental projects in areas that cannot benefit from EU funds.

T. G. Masaryk Water Research Institute www.vuv.cz

The T. G. Masaryk Water Research Institute (TGM WRI), a public research institution, was established as one of the first research institutes in the independent Czechoslovak Republic. The Institute was founded as the State Hydrological Institute by a resolution of the Ministerial Council of 9th December 1919. Since then it has worked without any interruption until now.

The main purpose of the TGM WRI is basic and applied research of the state, use and changes of aquatic ecosystems and their links to landscape and related environmental risks, waste and packaging management, as well as professional support for water protection, water scarcity, prevention of hydrological extremes (floods and droughts) and circular economy.

Key areas of the research are focused on the following areas:

- Hydrology and hydraulics – solutions for surface and groundwater. Quantification and protection of water resources, research of water flow in natural and artificial environments, development and application of methods for measuring and monitoring water movement in watercourses and water reservoirs.

- Climate change – systematic preparation of conceptual and strategic documents, development of methodological tools for identification and evaluation of flood hazard and flood risk, and participation on real flood events assessment. Research in this area very often includes also solutions for mitigation of the climate change impacts.

- Research and protection of hydrosphere – relations and processes in water environment, focused on impacts of human pressures, the sustainable use and protection of the hydrosphere, and legislative tools.

- Waste water including sewage treatment plants – evaluation of existing technologies and development of new methods in order to increase the efficiency of substance removal from waste water. Research of comprehensive technologies for waste water treatment (stabilization ponds, bio-filters, irrigation by wastewater, etc.), incl. research in the field of methods for analysis of wastewater and sewage sludge. Using waste water as a predictive medium for epidemiological detection (research and analysis of a wastewater sample for the presence of specific regions of the genome of the pathogen COVID-19) and for evaluation of drugs and pharmaceuticals.

- Waste management – research on the protection of the environment and sustainable development (prevention and minimization of waste quantity and its assessment) with a focus on the circular economy.

- Data processing, databases, and GIS – development of new information tools (systems, applications, programs, websites, and interactive applications) using the latest technologies (satellite data, drones, etc.), including utilization of databases and information resources for research conducted in TGM WRI.
- Other – laboratory certification, calibration of water meter propellers, processing of expert opinions, education, and publishing, etc.

Cave Administration of the Czech Republic www.caves.cz

The mission of the Cave Administration of the Czech Republic is to protect and care for show caves and other underground spaces according to the nature and landscape protection regulations and State Mining Authority regulations. The Cave Administration arranges steps according to the nature protection demands and ensures the technical protection after the state Mining Authority rules. It also cares for exploration, monitoring, documentation, and guide services for the public. It provides state-wide evidence and documentation of caves and other speleological objects.

The Cave Administration cares for 14 Show caves and one mining locality containing cave spaces. It guarantees their protection according to the maintenance plan. In terms of the revitalization programme, the Cave Administration eliminates negative impacts of previous activities and exploitation of caves as well as renovates their real estate and technical furnishing. External tourist premises are being restored and educational exhibitions are being prepared for them, informative and scientific publications are published.

There are 4000 caves registered in the Czech Republic; starting with small caverns to large systems of many kilometres. Show caves are the representative sample of the most remarkable caves in Bohemia and Moravia, and they are utilized for educational and entertainment purposes.

Silva Tarouca Research Institute for Landscape and Ornamental Gardening www.vukoz.cz

The Institute deals with the issue of rescue and utilisation of plant gene pool, research on the application of vegetation in different types of landscape (agroforestry and ecosystem services of woody species in agricultural landscape), biomonitoring of current and historical landscape burdens, investigation of natural development of unmanaged forests, growing of suitable plants for biomass as an alternative source of energy, cultivation of new varieties of plants and research of new methods of effective plant reproduction, research on harmful factors for ornamental plants and tree species, monitoring and diagnostics of selected plant viruses and virus-like organisms, research and verification of a pilot biomass plant as an alternative energy source. The institute runs a garden in a naturally land designed style within an area of 80 hectares. With about 5000 planted taxa the garden belongs to the most important plant genetic resources of woody and ornamental species in Central Europe.

Czech Environmental Information Agency www.cenia.cz

Czech Environmental information Agency's (CENIA) mission is the collection, evaluation and interpretation of environmental information and their provision to the professional and wider public. CENIA closely cooperates with all the providers of data sources within the field of the environment, and also with a variety of research, scientific and university institutions. CENIA also has rich experience with the development and provision of map services and operates many information systems. CENIA plays an important role within the processing of waste management data and uses its professional knowledge during the preparation of national evaluation documentation.

In the Czech Republic CENIA is the contact point for the European Environment Agency (EEA), participates in ETCs and is linked into the European Environment Information and Observation Network (EIONET). Currently CENIA is also the national contact point for INSPIRE (Infrastructure for Spatial Information in Europe) and the representing organisation for the European Ecolabeling Programme – Ecolabel EU, and finally for the programme EMAS (Eco Management and Audit Scheme). Individual teams of CENIA's employees cooperate in national and international projects, CENIA also has made a name for itself and is well regarded in the field of science and research.

National Park Administrations

National parks are extensive territories unique according to national and/or international standards. A considerable part of these parks consists of natural ecosystems or ecosystems little affected by human activities, where plants, animals, and inanimate nature are of exceptional scientific and educational significance. All utilisation of national parks must comply with the preservation of natural conditions, and must conform with the scientific and educational aims sought after in the proclamation of national parks.

There are 4 national parks in the Czech Republic:

Giant Mountains National Park www.krnap.cz

- area 363 km^2 and 184 km^2 (buffer zone)
- the highest mountain range of the Czech Republic
- its attractiveness is due to an unusually diverse landscape plus an abundance and diversity of both flora and fauna

Bohemian Forest Mountains National Park www.npsumava.cz

- area 683 km^2 and 995 km^2 adj. Protected Landscape Area
- in western part, mountain range creates natural boundaries with Bavarian Forest NP
- nearly 80 % of NP is woodland, and 23 % of NP is largely left to spontaneous development
- together with Bavarian Forest NP creates the largest forest region without human intervention in central Europe
- the whole range is scattered with numerous wetlands and raised peatbogs and there are even 3 glacial lakes

Thaya River Basin National Park www.nppodyji.cz

- area 63 km^2 and 29 km^2 respectively (buffer zone)
- uniquely preserved river valley covered with rich forests bordering Austria
- extremely rich biodiversity in a relatively small area, situated at boundaries of two biogeographic areas

Bohemian Switzerland National Park www.npcs.cz

- area 80 km^2
- unique geomorphology of sandstone rocks pillars together with rich biodiversity
- herb-rich beech forests on basalt formations in sharp contrast to acidophilus beech forests and pine forests growing on sandstones

3. Selected areas of the environment of the Czech Republic

3.1. Waste management

Waste management is dynamic growing sector of the national economy. In the Czech Republic, the obligations of physical and legal entities are governed by legislation, which places the emphasis on the prevention of waste material being created, and imposes a duty to prioritise material recycling and energy production over disposal by landfilling.

At present, the crucial trend in waste management is the effort to move towards a circular economy where material flows are closed in long time cycles and the emphasis is put on waste prevention, reuse of products, recycling and conversion to energy instead of extraction of raw materials.

The Czech Republic has adopted a **new waste legislation (Act on Waste, new Act on End-of-Life Products and amendment to the Act on Packaging)** in 2020 which came into force on 1 January 2021.

The aim is also to achieve waste re-use, recycling or energy recovery, which would minimize negative impacts on environment. This involves replacement of natural resources and raw materials or primary energy sources with waste so the Czech Republic makes substantial steps for improvement of waste management performance in line with obligatory European waste hierarchy and towards the transition to a circular economy.

The extended producer responsibility **system for used products** is based on the principle of the individual responsibility of a manufacturer to arrange product disposal after the end of its service life. This is to motivate the manufacturer to design and produce goods with the lowest possible content of hazardous substances and to ensure their subsequent reuse, recovery, or disposal after the end of their life.

The Act on **Packaging** stipulates the rights and obligations of the legal and physical entities with respect to bringing packaging into the market or putting it into circulation. It sets the percentage volume of packaging waste to be recycled or reused, and moreover, it defines the basic rules for returnable packaging treatment.

On 1 October 2022, a law banning single-use plastic products came into force in the Czech Republic. The new legislation includes several types of measures – from a complete ban on the products, to restrictions on their consumption, to mandatory contributions from producers to clean up litter from certain single-use plastic products in municipalities and cities. The Act on limiting the impact of selected plastic products transposes the European Directive on single-use plastics (Directive 2019/904 on the reduction of the impact of certain plastic products on the environment) into Czech law.

Only a part of selected single-use plastic products is directly banned from the market. These are plastic cotton buds, plastic cutlery, plates, straws, stirrers, balloon sticks, also food containers, cups and beverage containers made of expanded polystyrene and all oxo-degradable plastic products.

Total waste generation increased by 19.3 % between the years 2009 and 2020 to 38,503.7 thous. t. It has a significant upward trend in the medium and short term. **Total generation of non-hazardous waste** accounts for a significant share of total waste generation (95.4 % in 2020). This is mainly influenced by the generation of construction and demolition waste. Between 2009 and 2020, the total generation of non-hazardous waste increased by 22.0 % to 36,721.8 thous. t. In the medium and short term, it has a significantly increasing trend, as does the total generation of waste. **Hazardous waste** accounted for 4.6% of total waste generation in 2020. In the 2009–2020 period, the total generation of hazardous waste decreased by 17.6 % to a total of 1,781.8 thous. t. **Total municipal waste generation** increased by 7.6 % in the 2009–2020 period to 5,729.9 thous. t. There is a slight reduction in the generation of mixed municipal waste in the medium term. Between 2009 and 2020, the generation of mixed municipal waste decreased by 15.3 % to a total of 2,780.3 thous. t. **The generation of packaging waste** increased by 48.6 % between the years 2009 and 2020 to 1,328.7 thous. t.

The total waste treatment is dominated by waste recovery, particularly material, the proportion of which has long

been increasing. Between 2009–2020, the share of waste used for material recovery increased to 86.2%. The amount of waste material recovered in 2020 was 33,174.0 thous. t. The share of waste used for energy recovery increased to 3.6%. The amount of waste used for energy recovery in 2020 was 1,382.8 thous. t. The share of waste disposed of by landfilling is reducing (to 9.8 % in 2020) in favour of material and energy recovery. The amount of waste disposed of by landfilling was 3,761.8 thous. t.

Municipal waste treatment is still dominated by landfilling. However, the share of municipal waste landfilled fell from 64.0 % to 47.8 % in the 2009–2020 period, the amount of municipal waste disposed of by landfilling was 2,737.3 thous. t. Thanks to moving away from landfilling, the share of municipal waste used for **material recovery** increased to 38.6% in 2020, and the amount of material recovery of municipal waste was 2,213.8 thous. t. At the same time, the importance of **energy recovery** from municipal waste also increased to 12.6 % in 2020, and the amount of energy recovery from municipal waste was 721.2 thous. t. The current situation in municipal waste treatment in the Czech Republic is not satisfactory (landfilling of municipal waste is above the EU27 average, and recycling is below average).

The treatment of packaging waste is developing positively. It is dominated by material recovery. The rate of recycled packaging waste is increasing, in 2020 it reached 67.9 %. The rate of the total recovery of packaging waste, which in 2020 amounted to 77.3 %, is also growing. The rate of recycling and total recovery of packaging waste in the Czech Republic is above the European average.

The **take-back systems of end of life products** (electrical equipment, batteries and accumulators, and tires) are functional in the Czech Republic and are constantly growing. In terms of treating the **selected end of life products**, a positive development can be observed in the Czech Republic. The rate of material recovery of them is increasing and the strategic objectives for selected products are continuously being met.

Other targets focus on the end of life vehicles, namely, these targets of recycling, reuse, and recovery of selected end of life vehicles, where the Czech Republic fulfills the targets of reuse and recovery at 97.3% and reuse and recycling at 93.3% (2019).

Czech Environmental Information Agency has experience with the creation of an information system on waste and data processing.

Main activities provided by the Waste Management Center of T.G. Masaryk Water Research Institute focuse on waste management and packaging, waste prevention, generation, and utilization. The second research area focuses on methods for the analysis of wastewater and sewage sludge including popular micro and nano plastics.

Czech experience can be shared in the following areas:

- Establishment of take-back system and extended producer responsibility schemes for different products, systems for separate collection of waste, re-use and recovery
- Activities in waste prevention area
- Activities in circular economy area
- Promotion of cooperation among state administration, industry, towns and municipalities
- Technologies for waste management
- Household waste treatment technologies
- Cogeneration units to turn the biomass waste into energy

3.2. Water protection and waste water treatment, incl. Climate Adaptation

The Czech Republic has a vast experience with research and development in the area of **floods, drought and water scarcity management, water protection, rainwater management, water management planning in compliance with Water Framework Directive and Flood Directive, sewage treatment technologies and water treatment plant construction**.

In accordance with the adoption of the amendment to the Water Act at the end of 2020, regional commissions for **drought and water scarcity management** were established at the level of all regions for the operative solution of drought issues in the Czech Republic. In the course of 2022, completely new operational regional plans will be prepared to address the drought and the state of water scarcity, similarly to the already existing flood plans operatively addressing water surplus.

For the regular provision of current information on the development of drought, resp. development of meteorological variables and their impact on hydrology (quantitative status of surface and groundwater), agriculture (soil moisture), and security of water resources (availability of water for permitted abstractions), HAMR forecast system was developed by Czech professional bodies with the support of the Ministry of Environment and it is operated by the Czech Hydrometeorological Institute – https://www.hamr.chmi.cz.

The Czech Republic actively cooperates with all neighbouring countries in the field of water management, which is governed by Agreements and Conventions on the **management of transboundary waters**. The International Commission for the Protection of the Danube River, the International Commission for the Protection of the Elbe River, and the International Commission for the Protection of the Oder River against Pollution were established to achieve the goals of water management set by the Conventions, including the protection and rational use of surface waters and ground-waters, reduction of hazards originating from accidents involving the release of substances hazardous to water, floods and ice-hazards, drought and also international water management plans and international water-related strategies.

Further, within the bilateral commissions on transboundary water management set by the Agreements with Austria, Germany, Slovakia, and Poland, working groups on issues of implementation of the Water Framework Directive (2000/60/EC) on transboundary waters were established to implement the requirements of the Water Framework Directive mainly in the area of water management planning and water protection.

Czech experience can be shared in the following areas:

- Adaptation planning, incl. floods, and droughts protection
- Water protection (groundwater protection, reduction of chemical pollution)
- Methodologies for water quality requirements and water management planning
- Development of law background, preparation of supporting programmes, including technical and economic aspects (this could be established by funds which provide financial support to partial interest coverage)
- Bilateral and multilateral cooperation in transboundary water management

The **Czech Hydrometeorological Institute** (CHMI) is the National Hydrological Service of the Czech Republic. As such, CHMI monitors all aspects of the water cycle. Monitoring of surface water and groundwater quantities is done to the extent of the approved quantitative water monitoring programmes and it includes all the basic activities in the operation of the national monitoring networks, data collection and quality control, database management, and provision of real-time data as well as verified historical and regime information. Field work, data quality control and processing are carried out by regional offices.

In respect of water quality monitoring, the CHMI is responsible for the situational and operational monitoring of the chemical pollution of groundwater. The CHMI also carries out surface water quality monitoring of solid matrices. In line with the approved monitoring programme, the CHMI's employees sample suspended load, sediments, and biota (macrozoobenthos, Dreissena, biofilm, adult and juvenile fish), install passive samplers and floats for organism exposure.

▲ Aerial view of public sewage treatment plant for 22, 000 inhabitants of Klatovy city in Czech Republic.

Sediment sampling is coordinated with River basin authorities. The daily concentration of suspended load is monitored at 39 stations and analysed in the Institute's laboratory.

The CHMI operates national databases of water quantity and quality. According to the national Water Act 254/2001 CHMI is entrusted with the duty to compile an annual hydrological budget of surface and groundwater quantity, groundwater, and surface water quality. Water budget assessments are prepared as inputs into the reports, yearbooks, and statistics of the Ministry of the Environment and other institutions. The CHMI provides relevant water quality data and results of assessments through the Information System of Public Services (ISVS), where it also provides maps of hydrological networks, watershed divides and hydrogeology regions (https://isvs.chmi.cz/).

CHMI is the only organisation authorized to prepare expert hydrological reports (design hydrological data) and hydrological studies based on users' demands.

Important responsibility of CHMI stated by the Water Act is flood forecasting service realized by the provision of real-time hydro-meteorological data, hydrological forecasts and warnings, and other reports. The real-time data on stream flows and floods are posted on CHMI's website (http://hydro.chmi.cz/hpps). Hydrological forecasting models are operated at all forecasting offices; forecasts are delivered directly to key users and publicly presented on the Internet, including the probabilistic forecasts of flood level exceedance. Forecasts are shared with neighbouring countries, and in the case of the Morava River (a tributary to the Danube) a joint Czech-Slovak-Austrian forecasting system is operated by the Brno regional office of the CHMI. A special tool Flash Flood Indicator is operated during the convective season to provide local authorities and the public with estimates of flash flood hazards based on soil saturation as well as with real-time alerts on flash flood threat based on radar precipitation estimates.

CHMI also performs measurement and assessment of water content of snow cover for the needs of reservoir operation control and provides information about various monitored and modelled aspects of droughts (https://hamr.chmi.cz/).

In addition, the CHMI operates the Flood Information System (POVIS, www.povis.cz) developed by the Ministry of the Environment, which also includes the Digital Flood Plan of the Czech Republic (www.dppcr.cz). CHMI is responsible for the compilation of Flood Risk Management Plans at the national level according to the Directive 2007/60/EC and contributes to the implementation of the Water Framework Directive 2000/60/EC.

The Institute also participates in research activities and projects in the field of hydrology and water quality and operates several experimental basins.

Concerning international cooperation, CHMI carries out various tasks stemming from conferences of government commissioners for cooperation on borderline streams and the tasks in International commissions for the protection of the rivers Labe, Odra and Danube and relevant UN activities including programmes and initiatives of WMO, UNESCO-IHP and UNDRR.

The Czech Republic, like other countries, is facing the consequences of climate change, which is shown in more frequent occurrence of floods, lack of rainfall and subsequent drought and water scarcity. **T. G. Masaryk Water Research Institute** (WRI) proposes a comprehensive system of water protection, including tools for

▲ Vltava river in the national park Šumava.

The Czech Hydrometeorological Institute can provide expertise for:

- Field practice and training in hydrological flow measurements and data quality control
- Quality Management Framework systems in hydrology
- Research cooperation and knowledge transfer in the field of hydrology including data statistical processing and assessment, hydrological extremes, historical hydrology, water quality, and forecasting

evaluating the consequences of all extremes, including measures to predict the risk of floods and droughts. This comprehensive system includes:

- system of hydrological classification of watercourses
- register of the natural flow affection (water withdrawals and discharges)
- register of surface water quality affection (pollution discharged)
- register the area with stringent water protection (used for drinking water supply, recreation, and nature conservation)
- monitoring of pollutants (hazardous substances) in watercourses
- system of management measures in water protection
- possibilities of utilisation of economic instruments for water protection
- design of administrative unit cooperation on complex water protection
- system design of State Water Register (surface water and groundwater abstraction)
- discharge of waste water – including the general scheme of industrial and municipal waste water production and discharge)
- economic, financial, and pricing instruments for regulation and support of innovations in water protection and sustainable water use in the integrated river basin management
- draught and scarcity prediction a few months in advance to allow river basin authorities, municipals, farmers, and public to get ready in time.

The Water Research Institute deals with themes related to the impacts of climate change on water resources, and possible adaptation measures to mitigate these impacts. Most importantly, research on extreme events associated with climate changes (floods, droughts) is conducted and measures are proposed to eliminate risks from the effects of extreme conditions in sectors of water management, agriculture, and forestry, including impacts on water quality. Specific attention is paid to the study of minimum residual flows.

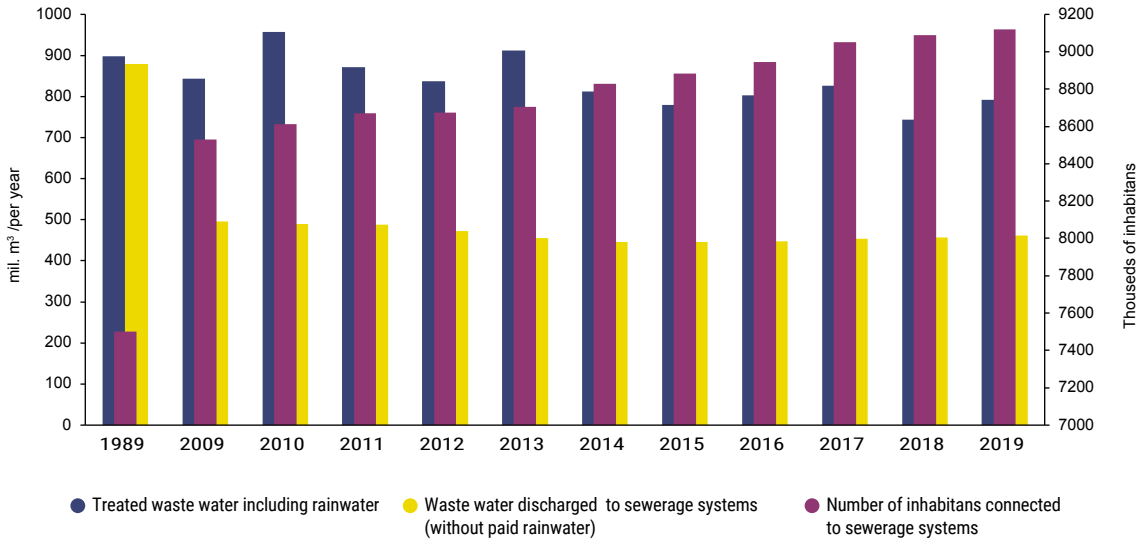
New software tools for drought and water scarcity prediction, hydrological modelling, and balance calculations were developed because the existing practices do not reflect the current conditions influenced by climate change. Hydraulic research is concentrated on the assessment of new hydraulic structures (weirs, dams, waterways, fishways, water power stations, etc.). Physical models are built on a suitable scale and the research is conducted in large hydraulic laboratories. Hydraulic research is highly efficient and significantly reduces the financial cost of the planned construction. Part of the hydraulic research also presents mathematical modeling which focuses on the determination

of flood plain area, flood risk mapping, water quality in open channels, and evaluation of potential flood damages in urban areas using 1, 2, or even 3D modelling tools.

The Institute focuses its activities also on the quality of surface and groundwater and their protection, on contaminated sites and their survey, monitoring and evaluation, and the risk assessment process. It is deeply interested in diffuse pollution sources from agriculture and the determination of nitrate vulnerable zones. It has great experience with the enrichment of groundwater resources for drinking water purposes through artificial groundwater recharge methods.

T. G. Masaryk Water Research Institute is ready to cooperate in national and international R&D projects and consultant activities regarding the harmonisation of human activities (water management, recreation, fisheries, and aquaculture) with aquatic ecosystem conservation and achievement of sustainable development goals (SDGs).

Figure III: Development in the number of inhabitants living in buildings connected to sewerage systems and the quantity of discharged and treated wastewaters in 1989 and 2009–2019



Source: CZSO

3.3. Remediation of ecological burdens and management of chemicals

The activity of the industrial enterprises during the last 100 years led to contamination of soils, surface, and ground water at thousands of sites in the Czech Republic. Also, army bases, especially airports, were often heavily contaminated. The most serious contaminants include petroleum hydrocarbons, chlorinated hydrocarbons, polychlorinated biphenyls, pesticides, radionuclides, heavy metals, and other toxic substances.

The subject of environmental burdens from the past began to be broadly discussed in the Czech Republic at the beginning of 1990 in connection with the departure of the former Soviet Army and with burdens related to the privatisation of the state enterprises (Law No. 92/1992 Coll., in the wording of later laws, on conditions for the transfer of state property to other persons).

In the Czech Republic, the strategy for elimination of environmental burdens from the past is based on the principles of the environmental policies of the Ministry of the Environment. One of the basic principles includes finding a socially acceptable level of environmental and health risks. This approach is based on the fact that attaining of "zero risk" (e.g. absolute elimination of the contamination) is not always necessary from the standpoint of the environment and is usually associated with extremely high costs. A second important principle is based on future use of the territory (i.e. so that it is "suitable for use"). In some cases where decontamination is technically difficult to solve or financially unacceptable, consideration can even be given to an approach in which it is necessary to modify the subsequent use of the site.

Principle documents governing remedial of contaminated sites in the privatisation process are the Government Regulation No. 51/2001 and Directive of MoE an MoF 4/2017. These documents form the basic framework for the process of remediation works. Czech Republic, however, as the former proprietor is responsible for remediation of contaminated sites, which contamination occurred before they were privatised. For this purpose, environmental contracts are concluded. The Czech Environmental Inspectorate, as the independent administrative body of the MoE, on the basis of the results of risk analysis, issues a site-specific remedial order, in which the extent of the environmental burden is specified and the site clean-up standards and deadlines are delimited.

Another source of funding for the remediation process are EU Structural funds that can be used to remediation of sites owned by municipalities and sites contaminated by non-existent polluters (e.g. bankrupt companies, closed mines, brownfields etc.). In the years 2007–2020, the Operational Programme Environment provided funds in total amount exceeding 557 mil. € to implement more than 300 projects of old ecological burdens in the Czech Republic.

In order to provide additional resources from the year 2015 the MoE declared a National environmental program, which is designed, among other things, to clean up illegal landfills and old ecological burdens owned by individuals.

Since 2005, the database information about contaminated sites in the Czech Republic is available in the Contaminated Sites Database System (SEKM). The SEKM is freely accessible for the public and is fully compatible with all requirements of the European Environmental Agency. Priority evaluation and risk profile of each contaminated site is included in the SEKM. The database also includes the register of closed landfills and register of sites contaminated by POPs. The database is found on the website www.sekm.cz and is being regularly updated by new data on environmental damages. Since 2020, the Ministry of the Environment has been running a new version of the SEKM. ELD cases (according to **Environmental liability Directive 2004/35/CE**) can also be inserted into SEKM.

The **Czech Geological Survey (CGS)** and their associated staff play a fundamental role in the qualification of geological risks caused by exogenic dynamic processes. The problems of rock avalanches and landslides, triggered by different processes, comprise a major part of the activities of the engineering geology team. Their research activities have resulted in the recommendation of mitigation measures after the catastrophic flooding in Moravia and Bohemia in 1997, 2002, 2006, 2010, 2013 and 2014. Engineering geologists are also assessing the risks of catastrophic gravitational slope movements in the Labe (Elbe) River valley of the České středohoří Mts. (highway D8 Dobkovičky locality), and slope stability around the dams along the Vltava River valley. In the Vltava River valley, they estimate hazard risks to the City of Prague from possible flood waves triggered by landslides on unstable slopes. The long-time experience of CGS engineering geologists is being successfully applied to aid projects in developing countries (for instance, in Central America).

Czech experience can be shared in the following areas:

- Investigation of contaminated site
- Risk assessment study
- Feasibility study
- Detailed remediation design
- Soil and groundwater remediation including the following remediation methods: crushing, screening and sorting, solidification/stabilization, soil vapour extraction, washing, incineration, thermal desorption, chemical oxidation, chemical reduction, neutralization, bioremediation, bioventing, phyto-remediation, landfilling, reprocessing, containment construction, capping, bioremediation, biological reductive dechlorination, biological reduction, bio-slurping, hydraulic barriers, reactive barriers, monitored/enhanced attenuation, underground cut-off walls, air sparing, pumping and subsequent treatment by: gravity separation, stripping (by air or stream), coagulation, flocculation, reverse osmosis, chemical oxidation, chemical reduction, neutralisation
- Supervision of clean-up projects
- Post-remedial monitoring
- Contaminated sites evidence

▲ Dobsonian spectrophotometer D074 (right) and Brewer spectrophotometers B098 and B184 (left) in Hradec Králové.

3.4. Air quality protection

Immense funds were invested in emission reductions (mainly from large power plants and household heating as well as from industrial installations) in the Czech Republic during the last two decades, resulting in a significant improvement in the air quality.

The Czech Republic has implemented and regularly updates a complex air protection policy that includes Air Protection Act, National Emission Reduction Programme, Air Quality Plans[3] and financing programs (e.g. Operational Program Environment, New Green for Savings). These policies contain measures aiming at improving the air quality on a national, regional, and local level.

The Czech Republic has also established additional air quality measures that can be used voluntarily by municipalities – low emission zones to limit air pollution caused by road traffic and the possibility for municipalities to ban the use of certain solid fuels in boilers not meeting emission criteria.

The Czech Republic has established an air quality monitoring network which provides publicly available information about air pollution levels. The air quality monitoring network provides inline UpToDate data and also summary annual data[4].

[3] https://www.mzp.cz/en/air_quality
[4] https://www.chmi.cz/?tab=2&l=en

The Czech Republic is a very densely populated area with a very dense traffic network. Many households are heated individually by obsolete solid fuel boilers that have an adverse impact on the air quality.

The Ministry of the Environment focuses, therefore, among others, on subsidising the replacement of the obsolete hand-filled boilers burning solid fuels with new efficient low-emission boilers or heat pumps. To improve technical state and operation of solid fuel boilers and heaters in households, compulsory checks on these installations were introduced in 2016 and a ban on the operation of the most obsolete boilers comes into force in September 2022. This is also accompanied by awareness raising campaign that includes brochures, websites, TV spots, and videos, and a dedicated road-show.

Czech experience can be shared in the following areas:

- Construction and functioning of the monitoring network
- Calibration services for air quality monitoring instruments
- Development and operation of air quality and emission databases, compilation of emission inventories and projections
- Air quality modelling and assessment
- Consultancy in the field of air protection policy and promotion of clean air technologies can be offered (with experience from previous twinning and TAIEX projects)

The **Ministry of the Environment**[5] can provide expertise in air protection legislation, policies and strategies, air quality management, subsidy programs, and designing air improvement measures.

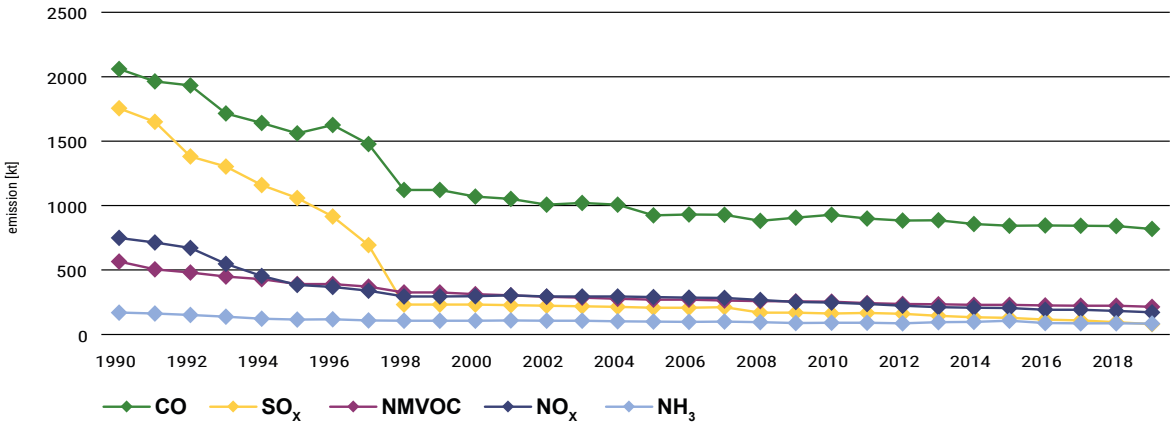
The **Czech Hydrometeorological Institute** can provide expertise for the operation and maintenance of the National Monitoring Network for the air quality of the ambient environment (accredited by European Standard 1702[5]). Moreover, it has extensive knowledge in the field of ambient air quality assessment and modelling. The CHMI also provides the public with current air quality data. This service is very important for the functioning of the Smog Warning and Regulatory System. CHMI is the National Air Quality Reference Laboratory and is experienced in the collection of emission data and compilation of emission inventories and projections.

In addition, the CHMI operates AQIS (Air Quality Information System) which joins together data about ambient air quality, emissions from individual sources, and information about greenhouse gasses. AQIS is the main source of air quality information including important metadata management. It is being continuously developed and upgraded.

The **Silva Tarouca Research Institute for Landscape and Ornamental Gardening** in the framework of the European cooperative programme UNECE ICP-Vegetation (http://icpvegetation.ceh.ac.uk/) is monitoring the atmospheric deposition rates at about 200 permanent forest plots across the Czech Republic using moss analysis for about 25 years.

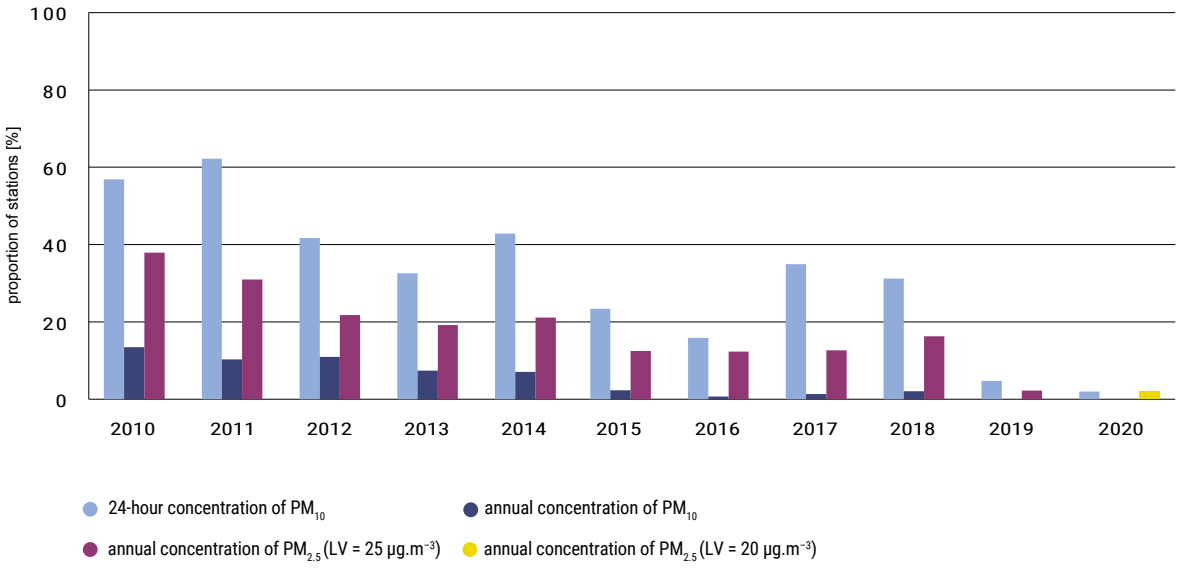
[5] https://www.mzp.cz/en/air_protection

Figure IV: Main pollutants total emissions, 1990–2019



Source: Czech Hydrometeorological institute

Figure V.: Ratio of stations where the pollution limit level of 24-hour average PM10 concentration and of annual average PM10 and PM2.5 concentration was exceeded, 2010–2020



Source: Czech Hydrometeorological institute

▲ Fire salamander sitting on a mushroom, forest in Carpathians.

3.5 Nature conservation

The Czech Republic harbours a significant part of the European natural heritage. Thanks to its unique geographic location, variety of geomorphological and natural conditions, and cultural-historical development, the Czech Republic is characterized by the great richness of wild plant and animal species and their habitats. In addition, it also encompasses many unique landscapes, natural sites, and areas.

However, the overall state of nature and biodiversity continues to decline, similarly to global trends. This is mainly due to unsustainable agricultural practices and the development of urban and transport infrastructure. These factors lead to homogenisation and fragmentation of landscape and to the conversion of natural land to developed or intensively agriculturally cultivated areas. Moreover, in recent years, the Czech Republic has been facing an unprecedented increase in bark beetle damage. It has been facilitated by historical homogenous spruce plantations in unsuitable sites, warmer temperatures, increased spread of the disease, and heightened drought stress. As a consequence, ecosystem functions and services deteriorate as well. Therefore, a strong effort is still needed for efficient nature protection and restoration in the Czech Republic.

As set out by current legislation, above all Act no. 114/1992 Coll., on Nature and Landscape Protection, as amended, nature and landscape protection is divided into general/special site/species protection. The fundamental EU regulations on nature and landscape protection (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora, Directive 2009/147/EC on the conservation of wild birds; or the Habitats and Birds Directives) were transposed into the Nature and Landscape Protection Act upon the Czech Republic's accession to the EU.

There are **4 National Parks** (the Giant Mountains, Bohemian Forest Mountains, Thaya River Basin and Bohemian Switzerland), **26 Protected Landscape Areas (PLA), 119 National Nature Monuments (NNM), 108 National Nature Reserves (NNR), 1531 Nature Monuments and 814 Nature Reserves**, in total covering 16.8 % of the country´s territory. The Natura 2000 network is formed by **41 Bird Areas** and **1,113 Sites of European Importance** and accounts for 14% of the territory of the Czech Republic.

Based on information on recent developments and current data, a management plan for each specially protected area is established. It defines measures to preserve or improve the status of target features. For the Natura 2000 sites, similar documents called sets of conservation measures are prepared.

Nature conservation and landscape protection outside the protected areas is also very important, aiming at restoring and maintaining as healthy and resilient ecosystems as possible to be able to provide people with essential ecosystem services and contribute to their well-being.

As mentioned above, the Nature Conservation Agency (NCA) of the Czech Republic maintains, together with the National Park Administrations, the most valuable parts of nature and landscape in the Czech Republic. In addition to territorial conservation in PLA, NNR and NNM, it also implements action plans/recovery programmes for the most threatened wild plant and animal species, carries out monitoring of the target wild species and natural habitats across the whole country and gather, analyses, handle and provide data on state and on changes and trends in species and habitats. At present, the Species Occurrence databases managed by the NCA, include more than 17.4 million records and it is supported not only by professionals but also by citizen science.

Species protection plays significant role in nature conservation inside and outside of protected areas. Special species protection in the Czech Republic is focused on more than 840 species of plants, animals and fungi threatened on a national level as well as European level. Currently, there are **9 action plans** (e.g. *Pulsatilla patens or Zamenis longissimus*) with more to come and **3 management plans** (*Lutra lutra, Castor fiber,* and *Canis lupus*) for specially protected species. The plans are prepared and implemented on the results of applied research. Management plans for other large carnivores are also in preparation as well as an action plan for *Austropotamobius torrentinum*. Moreover, a series of **Red Lists** for all groups of organisms (based on IUCN international criteria) were updated in 2017 by the NCA.

In the Czech Republic, there is a long tradition of research concerning invasive species. Close cooperation between research institutions and nature protection authorities results in invaluable experience in invasive species management. Nevertheless, the implementation of Regulation (EU) No. 1143/2014 on the prevention and management of the introduction and spread of invasive alien species is a great challenge for the future.

Conservation and management planning go hand in hand with monitoring. The NCA has developed a sophisticated system of obtaining information about the natural features in a form of monitoring of species and habitat types, including the system of regular habitat mapping of the whole territory of the Czech Republic. The NCA has accomplished to set a system for the management of data about Czech nature, including verification and sharing of the data with research institutions and nature conservation authorities.

Concerning the international trade in endangered species protected by CITES Convention, the Czech Republic can share its experience and best practices regarding the implementation of this Convention and related EU Wildlife Trade Regulations, particularly with a focus on legislation (including stricter domestic measures), national CITES e-permitting system for facilitation of issuing CITES permits and also on CITES enforcement to prevent and combat illegal wildlife trafficking.

The Czech State Nature Conservancy staff and scientists have extensive experience and knowledge of nature conservation, landscape protection, and biodiversity preservation and management.

Czech experience can be shared in the following areas:

- Protected area management including the Natura 2000
- Sustainable tourism
- Forest, grassland, and wetland management
- Communication, education, and public awareness
- Biodiversity data gathering, analysis, and handling
- Preparation of action plans and management plans for threatened species
- Implementation of CITES and its enforcement
- Conservation planning
- Ecological network set up and management
- System of monitoring of the habitat types and species of Community interest

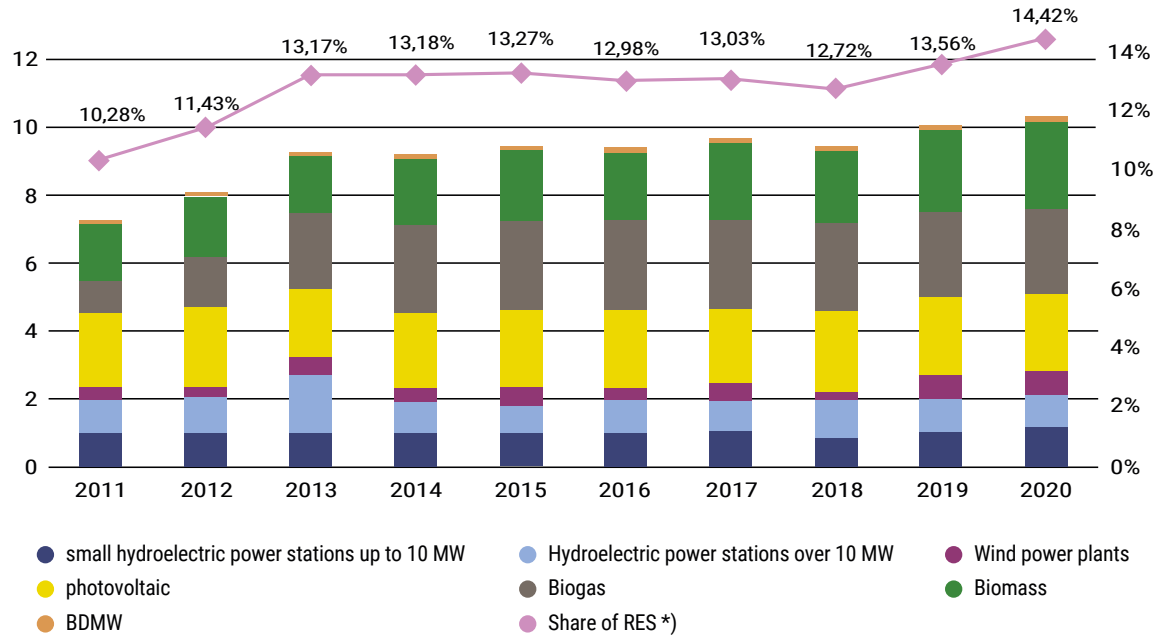
3.6. Energy efficiency, clean energy, and climate mitigation

Energy efficiency represents a challenge and priority for the Czech Republic. The energy intensity is steadily decreasing in the Czech Republic due to better technologies, insulation of buildings, and energy savings in households. Moreover, the application of the best available techniques and technologies as well as energy from low carbon-emission sources has been significantly promoted during the last years in order to help to achieve all three climate and energy targets for GHG emission reductions, energy efficiency, and renewable energy by 2020 and 2030 based on EU policies and legislation. The Climate Protection Policy of the Czech Republic (Policy) from 2017 summarizes short and long term goals and includes key policies and measures which contribute to those goals' fulfilment. The Policy will be updated and submitted to the government by the end of 2023.

To meet our climate and energy goals, the Czech Republic needs to use the Operational Programmes (OP) funded mainly from the EU Structural Funds. Due to the OP, the application of the best available techniques and technologies in the industry, as well as clean energy sources have been promoted significantly during the last several years.

From National Programmes the New Green Savings Programme has become one of the most successful and it has delivered a significant contribution toward the energy efficiency goal of the Czech Republic to achieve 51,1 PJ of new energy savings by 2020.

Figure VI: Electricity generation from renewable energy sources (RES) in the Czech Republic [TWh] and its share in the national gross consumption, 2011–2020.



Source: Energy Regulatory Office

The New Green Savings Programme

Website: (English version): https://www.sfzp.cz/en/administered-programmes/new-green-savings-programme/

The New Green Savings Programme (NGSP) of the Ministry of the Environment is administered by the State Environmental Fund of the Czech Republic and is one of the most effective programmes in the Czech Republic focused on energy savings in family houses and apartment buildings. The main objective of the programme is to improve the state of the environment by reducing the production of pollutants and greenhouse gas emissions (in particular CO2 emissions). It builds on the existing Programme of green energy savings. The first phase of NGSP took place from 2014–2021. As of 31 December 2021, 74.8 thousand applications were approved for almost CZK 20.7 billion, which are in various levels of administration, with 58.7 thousand applications for almost CZK 13.5 billion already being paid.

The new phase of NGSP for the period until 2030 was launched in late 2021. The financial source of the new phase is the EU Recovery and Resilience Facility under NextGenerationEU and the share of proceeds from auctioning EUA emission allowances within the EU ETS. The total allocation of NGSP 2021–2030 is approximately CZK 36 billion, of which CZK 16 billion is allocated for the continuation of NGSP from the National Recovery and Resilience Plan.

NGSP contributes to addressing the challenges of reducing energy and water consumption in residential buildings, improving quality of living in these buildings, reducing emissions of greenhouse gases and other pollutants by replacing solid fuel-fired boilers, adapting residential buildings to the effects of climate change, constructing new buildings, increasing the number of recharging points for electric vehicles in residential buildings, as well as awareness-raising regarding energy savings, the use of renewable energy sources and adaptation to climate change in the residential sector.

The NGSP is conceived as a growth-enhancing measure to support the economy of the Czech Republic with other social and environmental benefits, such as improving the quality of housing for citizens, improving the appearance of Czech cities and towns, the long-term trend of progressive reduction of emissions of greenhouse gases and local air pollution, reduction of energy consumption from non-renewable primary resources and increasing heat production from renewable energy sources.

Figure VII: Distribution of investment subsidies programmes in the areas of RES and energy efficiency.

Situation in the Czech Republic				
	Single family houses	Appartment buildings	Public buildings	Commercial buildings
Renovation in Prague	New green savings programme	New green savings programme	OP Environment OP Prague	
Renovation out of Prague	New green savings programme	Integrated Regional OP	OP Environment	OP Enterpreneurship and Innovation for Competitiveness
New building	New green savings programme	New green savings programme	OP Environment	OP Enterpreneurship and Innovation for Competitiveness
Replacing sources	OP Environment Priority Axis 2 New green savings programme	Integrated regional OP New green savings programme	OP Environment	OP Enterpreneurship and Innovation for Competitiveness
Others		Panel Jessica	Efekt	Efekt

Source: Chance for Buildings

▲ Meteorological station at the Lysá hora Mt. in the Beskydy Mts.

3.7. Meteorology and Climatology

The tradition of systematic monitoring of the atmosphere on the territory of the Czech Republic belongs to the longest in the world and reaches back to the year 1752, when meteorological measurements at the Clementinum station in Prague began.

Nowadays, the Czech Republic operates, as a member state of the World Meteorological Organization (WMO), through the Czech Hydrometeorological Institute (CHMI), a wide network of meteorological and climatological stations including systems for remote sensing of the atmosphere and participates in international exchange of meteorological and climatological information.

The **CHMI** as national meteorological service is responsible for meteorological measurement and observation, archiving, processing, and presenting the results of such measurements in a way that benefits society as a whole.

Meteorological and climatological data are used to create various forecasting and warning products (including special types, e.g. by combining rain gauges measurement with radar-based precipitation information); along with the data received from abroad enters the numerical weather forecasting model ALADIN. The meteorologists also prepare specialized forecasts for the safety of civil aviation, drought and fire risk, the operation of nuclear plants, or road maintenance, especially during the winter.

The CHMI closely cooperates with the Integrated Rescue System, supplying crucial information for crisis management decisions, and helping to respond to potential dangers in connection with, e.g. storm, torrential rain, heat waves, extreme frost, strong wind, changes in the ozone layer and solar radiation, floods, or smog.

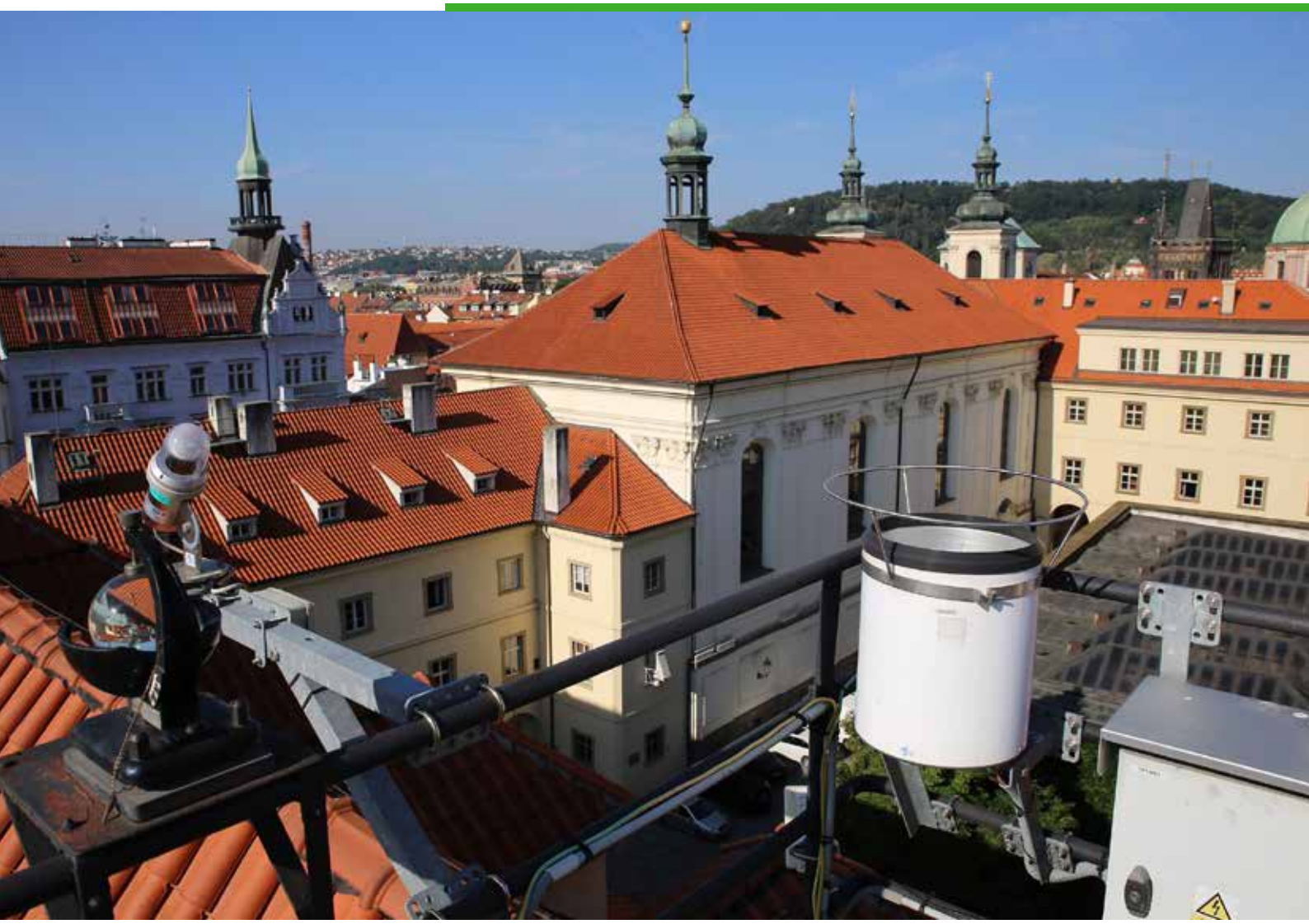
Climatologists from the CHMI prepare long-term statistics and climate characteristics of the Czech Republic, which are used for many purposes (e.g. agriculture planning, land use, preparing the state's energy policy, climate change studies, etc.). Climatological database (CLIDATA) developed by the CHMI is currently being used in more than 36 countries.

The CHMI monitors the ozone layer and its condition over the Czech Republic under the WMO GAW (Global Atmosphere Watch) programme and posts daily the total ozone and UV radiation on the CHMI's website. Monitoring of components of solar radiation in the Czech Republic is running in the CHMI's radiation network. Digitised long-term homogenised

global radiation data series, together with records of sunshine measurements from certain stations, were stored in the CLIDATA climate database.

The CHMI actively contributes to meteorological and climatological research and development abroad. The CHMI represents the Czech Republic in a number of international organizations, whose mission is to cooperate in the field of meteorology and share data, such as WMO, EUMETSAT (an intergovernmental organisation supplying weather and climate-related satellite data, images, and products), EUMETNET (the association of European meteorological services, whose product is e.g. the Meteoalarm system (https://meteoalarm.org/), designed to present warnings across all of Europe), and ECMWF (the European Centre for Mid-Range Weather Forecasts). Experts from the CHMI also serve as appointed representatives of the Czech Republic in other organizations and groups, such as GEO (Group on Earth Observations), the IPCC (the Intergovernmental Panel on Climate Change), etc.

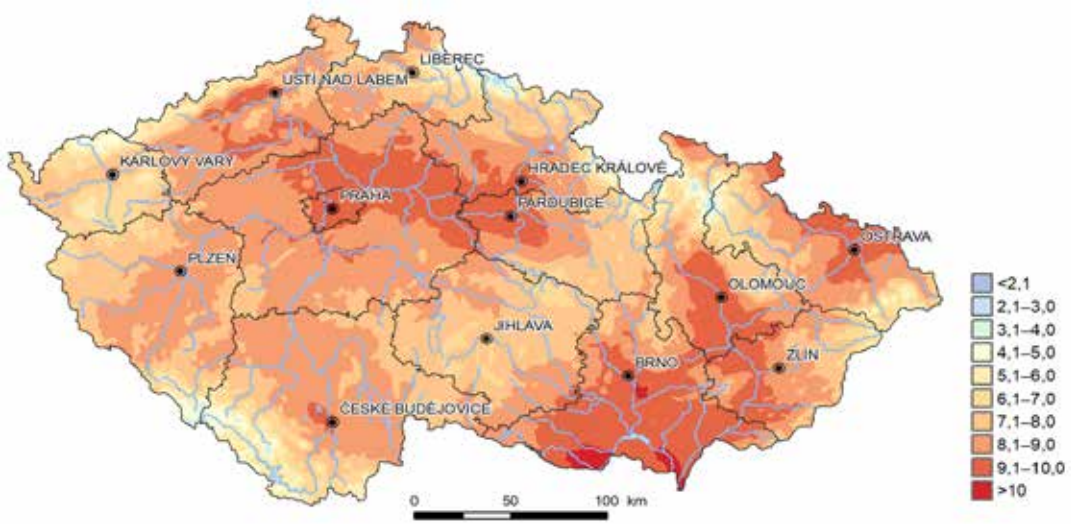
▾ Meteorological station at the Klementinum.



The Czech Hydrometeorological Institute can provide expertise for:

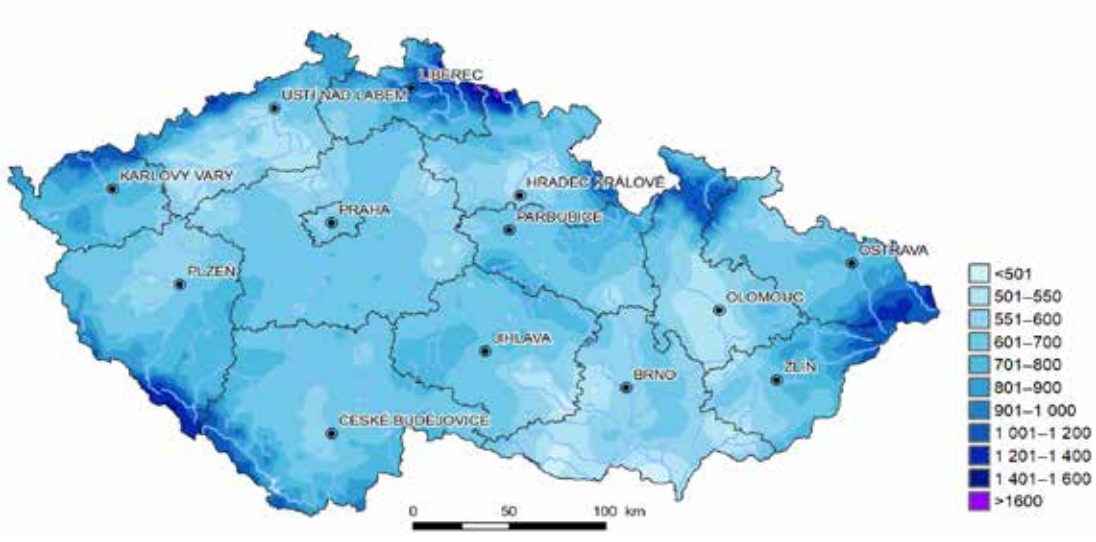
- Monitoring of meteorological atmospheric parameters and phenomena
- Long-term monitoring of components of solar radiation and ozone
- Training on the climatological database (CLIDATA) developed by the CHMI
- Training on numerical weather predictions (ALADIN model)
- Remote sensing data processing and visualization
- Calibration of meteorological equipment (accredited by European Standard 17025)

Figure VIII: Average annual temperature in 2021 [° C]



Source: Czech Hydrometeorological Institute

Figure IX: Total annual precipitation in 2021 [mm]



Source: Czech Hydrometeorological Institute

3.8. Mineral resources

A significant part of the Czech Geological Survey's applied research deals with the investigation and supply of necessary resources for a wide spectrum of use, from minerals for daily life up to minerals for high technologies. The research activities of economic geologists are part of the Strategic Research Plan of the Czech Geological Survey and their assessment and expert activities fulfil the mission of performing tasks of the state geological survey about this specialized field.

Their activities are concentrated mainly on deposits of critical and strategic metals, industrial minerals, and energy minerals (coal and uranium) and the use of mineral resources, particularly construction minerals, in land use planning. Particular attention was also paid to the impacts of mining and processing of raw materials on the environment and human health, primarily in areas of mining districts. Work activities also included legislative support for state authorities in preparing the raw materials policy of the CR, development of new methods of studying mineral deposits, mining heritage research, and work abroad focusing primarily on environmental issues in developing countries. During economic geology projects, they cooperated with a number of top research institutes at the national as well as international level and participated in the education of students and professionals.

▾ Quarry in Černá in Pošumaví.

The most important is research of the **critical raw materials (CRM) sources** of the EU in the territory of CR. Project **CEEMIR**, finished in 2019 and supported by Technology Agency of the Czech Republic (TA ČR), laid the foundations for next investigations in the field of ore mineralogy, ore processing (as part of the project´s implementation was by CGS developed the patent technology for purification flake graphite by ultrasonic delamination), automated mineralogy, 3D ore body modelling etc. Present long term project **RENS**, also funded by TA ČR and launched in 2020 as part of the Environment for Life programme of the Ministry of the Environment, has the main goal in studying, monitoring and evaluating the status of the rock environment, natural resources, geohazards and geological information throughout the CR and providing state authorities as well as the professional and lay public with new knowledge. Work commenced aiming to identify and evaluate thus far unstudied strategic mineral resources, to study processing technologies, and to assess the potential use of these sources in the CR. Other important project **"Acquisition of Strategic Raw Materials Deposits"** (STRASUR) is being carried out in cooperation with DIAMO, state company on the basis of implementation of Czech Government resolution No. 117/2017 on the state interest in CRM. The main goals consist from detailed description of sources CRM description, field investigations of new objects and defining the most promising objects with CRM content to future exploration. Also tests are carried out for ore processing. CGS also participated and participates in other short term projects (mainly in collaboration with GET Ltd.) focused to CRM. The project **"Study of Be, Ge, Ga and In Contents in Tailings Ponds of Ash From Coal Combustion in the Czech Republic"** (2020–2021). The case study of the Tisová tailings pond included the drilling boreholes as well as mapping of ash tailings ponds, defining and evaluating the source, design of economically/ecologically viable mining technologies, and an assessment of the most suitable technologies for recovery of Be, Ge, Ga and In. Other project "Investigation of Mineral Potential of CRM in Mineralized Waters of Czech Republic" (2021–2022) is focused to revision of the sources of mineral waters and preparing suitable objects for detailed investigation by boreholes. CGS participated in the EU project **GeoERA**, coordinated by EuroGeoSurveys. In the sub-project **"Mintell4EU"** CGS participated in updating the European Minerals Yearbook, entering data into an EU database, and creating a catalogue of important EU mining museums concerning CRM. Data are gradually integrated into the joint EU data infrastructure EGDI, managed by EuroGeoSuveys. In the **"FRAME"** sub-project CGS collaborated on the compilation of a metallogenetic map of the CRM in Europe, on a study of the so-called critical battery raw materials and raw materials from critical countries (Nb, Ta), and on studying the exploitation of abandoned mines and their dumps and tailings ponds for CRM.

Service for state geological survey represents participating in compiling of several expert reports serving as a basis for decision-making or land-use planning according to the Geological Law for the Ministry of the Environment, the Ministry of Industry and Trade, and regional and town municipalities. The most important among those reports are also the expert studies concerning the protection of mineral deposits or delimiting the mining areas, monitoring mining activities, or special studies. Important activities are with creating regional minerals strategies.

The project **"Elaboration of a Methodology for Regional Raw Materials Strategies"** (2020–2021) has been developed to help this activity. Its main output, a certified methodology, will serve as a basic working document for updating regional raw materials strategies. CGS has a long-term tradition in the study of **the environmental impacts of mining.** CGS studied (2020) spent and unburned, heavily mineralized heaps in the Žacléř area to assess the possibility of using birches for phytoextraction of heavy elements during coal mine remediation. As part of the **"Geological mapping project of the Czech Republic at 1:25,000 scale"**, environmentally significant heavy metals in soils are monitored. CGS experts collaborated in a study of the environmental impacts of mining in the mining districts of Namibia and Zambia. Contamination by mercury was investigated at the time of bush fires near the smelter in Tsumeb. Studies near the abandoned Pb smelter in Kabwe, Zambia, showed that the daily Pb intake limits according to WHO guidelines were largely exceeded. High As and Cd concentrations in stirred-up dust, contaminated by ore mining and processing, also pose a health risk, especially for children. We were also actively involved in the UNESCO/IGCP 682 **"Mine tailing revalorization"** project. Other international collaborative research activities included for example metallogenic study of the Early Cambrian Ni-Mo-PGE-Au black shales in South China, using Zn and Cu isotopes.

4. Areas for cooperation and Institutional support for cooperation with Czech companies

- There are various possibilities of cooperation with the institutions already mentioned above as well as with other governmental and non-governmental organisations (e.g. universities, research centres). Cooperation with companies and businesses can be facilitated with relevant associations and confederations listed below.

- The Czech Republic can offer its experience, especially in the following areas:
  - waste management
  - water protection and wastewater treatment
  - remediation of ecological burdens
  - improvement of air quality
  - nature and landscape protection
  - conservation and sustainable use of biodiversity
  - promotion of energy efficiency

- The Ministry of the Environment is ready to share environmental information and best practices including implementation of legislation and improvement of awareness on environmental (policy) issues.

- The Ministry of the Environment actively participates and supports the development and dissemination of clean environmental technologies.

CzechTrade

Website: http://www.czechtradeoffices.com/

The agency is an official contact partner for foreign companies which are looking for qualified Czech-based product suppliers, services providers, or investors. CzechTrade operates worldwide via more than 50 foreign representatives.

Official database of Czech exporters: http://exporters.czechtrade.cz/en/

BusinessInfo

Website: https://www.businessinfo.cz/psc/

The official Czech portal for business and exports is sponsored by the Ministry of Industry and Trade of the Czech Republic and is operated by CzechTrade, the agency responsible for promoting exports. It is an official Czech portal for business professionals searching for information, assistance, or trade contacts in the Czech Republic. One of the main tasks of the portal is to help foreign businesses to navigate the Czech business environment.

CzechInvest

Website: https://www.czechinvest.org/en?force

Business and Investment Development Agency CzechInvest is an agency of the Ministry of Industry and Trade. The agency contributes to attracting foreign investment and developing domestic companies through its services and development programmes. CzechInvest also promotes the Czech Republic abroad and acts as an intermediary between the EU and small and medium-sized enterprises in implementing structural funds in the Czech Republic.

Czech Export Bank

Website: http://www.ceb.cz/en/

It is a specialised, directly and indirectly, state-owned banking institution. It forms one of the pillars of the government's pro-export policy system. Its mission is to support Czech exports and the renown of the Czech Republic as a well-established international exporter and thus promote the overall competitiveness of Czech products throughout the world.

Czech Chamber of Commerce

Website: http://www.komoracz.eu/

It is an entity representing the entrepreneurial public and became an integral part of the economic life in the Czech Republic. It protects the interests of its members – small, medium, and large enterprises associated in a network of regional chambers and trade associations.

Association of Small and Medium-Sized Enterprises and Crafts of the Czech Republic

Website: https://amsp.cz/?lang=en

On an open apolitical platform it associates small and medium-sized enterprises, as well as tradespeople and their organisations from the entire republic. It represents the interests of more than 260.000 entrepreneurial subjects and keeps its important position within European structures.

Confederation of Industry of the Czech Republic

Website: http://www.spcr.cz/en

It is a voluntary, non-political and non-governmental body which is acting as the most important employers´ organizations in the Czech Republic. It serves as an umbrella for 32 associations (so called collective members) together with 150 direct members. The total number of members is reaching 11.000.

International Chamber of Commerce Czech Republic

Website: http://www.icc-cr.cz/en

The main aim of ICC Czech Republic is to assist Czech companies and other businesses to integrate into world events through this prestigious world organization. Within the framework of its activities, ICC Czech Republic creates opinions and statements on issues sent by ICC Headquarters for examination. At the same time, this agenda is influenced so as it compliance complies with the interests of ICC Czech Republic members.

▼ Building of the Ministry of the Environment of the Czech Republic.

ENVIRONMENTAL PROTECTION IN THE CZECH REPUBLIC
EXPERIENCE AND KNOW-HOW

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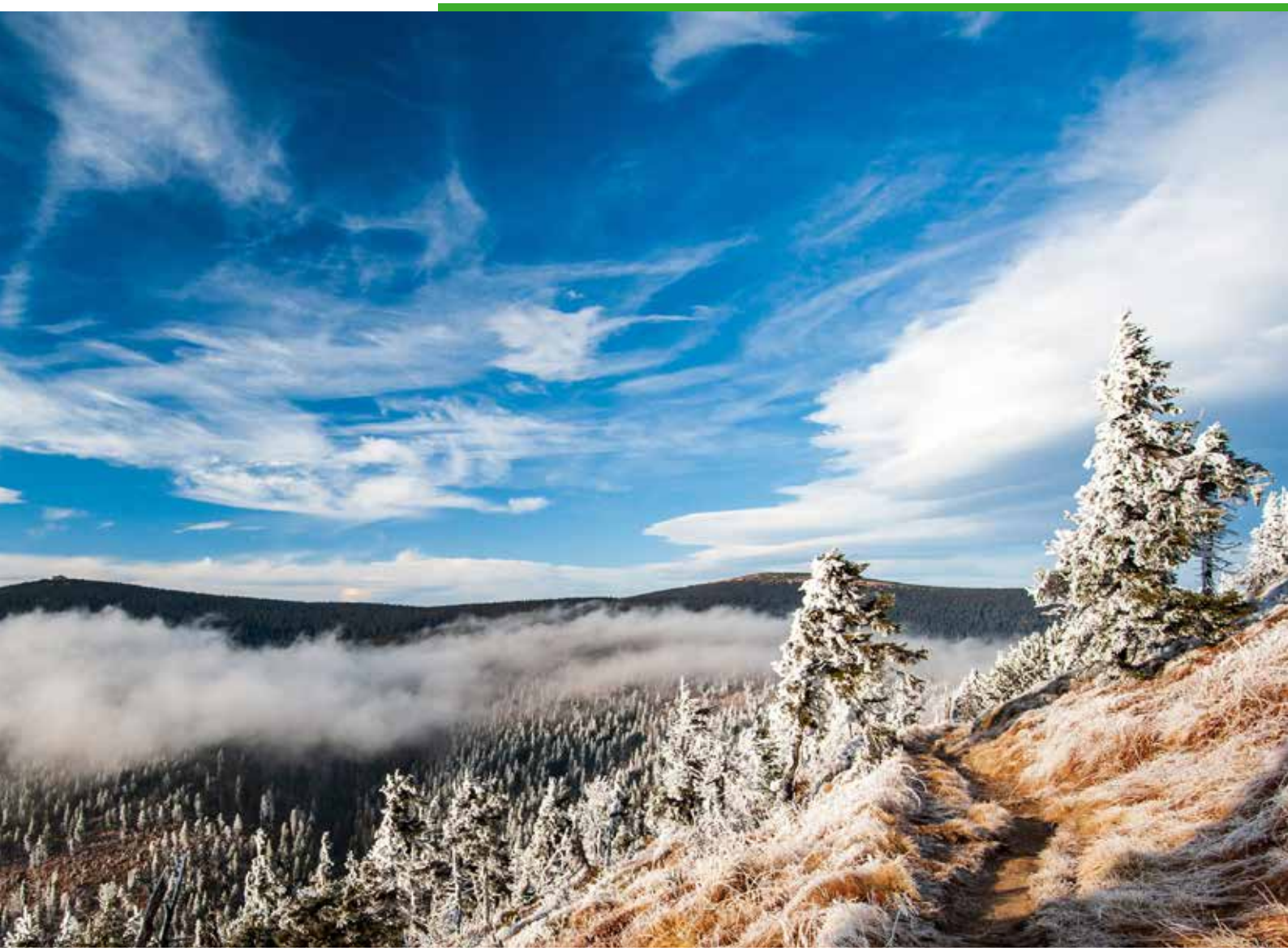
▼ The Jeseníky mountains in winter.



Ministry of the Environment
of the Czech Republic

2022