



Climate change adaptation of major infrastructure projects

Country report for the Czech Republic

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Written by EY, ARCADIS
2018



EUROPEAN COMMISSION

Directorate-General for Regional and Urban Policy
Directorate F Closure, Major Projects and Programme Implementation III
Unit F1 – Closure and Major Projects

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Luxembourg: Publications Office of the European Union, 2018

ISBN: 978-92-79-94289-1
doi: 10.2776/256088

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Note for the readers of the printed version: the present country report links to a large number of resources via hyperlinks, which by nature are only active in the electronic version. In order to find the identified resources, an online search will usually deliver the right result; but otherwise it is also possible to make use of Annex II of the main report where all the identified resources and their hyperlinks are presented.

Disclaimer: The identified resources are non-exhaustive and present a snapshot of the readily available and accessible material during 2017. This information was collected through finite web-based desk research, and through questionnaires and interviews aimed at the relevant national competent authorities (ESIF managing authorities, research institutes, ministry officials, etc.). Further resources might be available but not accessible due to privacy restrictions, or a lack of mandate to share related material. Following the publication of the present report, more resources will continue to reach the public domain, including through Climate-ADAPT and the identified national websites.

1. INTRODUCTION

The [EU Strategy on Adaptation to Climate Change](#) of 2013 includes actions to enhance the resilience of infrastructure and mainstream climate adaptation into the European regional and cohesion policy. The [Common Provisions Regulation](#) (CPR) of 2013 states under article 8 that climate change mitigation and adaptation, and risk prevention shall be taken into consideration for investments made with the support of the European Structural and Investment Funds (ESI Funds). The regulation integrates climate change adaptation considerations into the preparation and approval of major projects¹ or other projects funded by the ESI Funds through the requirement to conduct climate change vulnerability and risk assessments. In coordination with the ESI Funds, and complimentary to them, the LIFE fund in addition assists in the realisation of the climate change adaptation objectives. Climate change analyses (such as vulnerability and risk assessments) are also sporadically found to be undertaken for infrastructure projects that are financed outside the framework of EU funds.

This report for the Czech Republic focuses on the adaptation to climate change of infrastructure projects supporting the requirement to undertake climate change vulnerability and risk assessments by presenting:

- **Legal, policy and institutional framework:** A schematic outline of national and regional policy and legal framework, and organisational structure to deal with adaptation;
- **Resources:** Offering the most important resources supporting the realisation of climate change vulnerability and risk assessments for infrastructure projects. The available resources for data, methodologies, tools, guidance, design standards, system framework and institutional capacity are contextualised and listed in this section;
- **Sector overview:** Identifying the approach, main strengths and weaknesses for each of these sectors: Transport, Broadband, Urban Development, Energy, Water and Waste; and
- **Case studies:** Current practice in adaptation and resilience of infrastructure projects.

Country Overview

The Czech Republic adopted the [Strategy on Adaptation to Climate Change in the Czech Republic](#) in 2015. The implementing [National Action Plan on Adaptation to Climate Change](#) was adopted in 2017, and will be reviewed every 4-5 years. The [State Environmental Policy](#) sets the overall framework for an effective protection of the environment and provides information on adaptation measures, mainly for water management. The Ministry of the Environment is the central state's administrative authority and supreme inspection authority in environmental affairs. It has responsibility over the development of the climate change adaptation policy of the country, and is supported by the involvement of other ministries and research institutes (Environment Centre of the Charles University, Academy of Sciences, Czech Hydrometeorological Institute).

Information on climate change adaptation is available on the [webpage dedicated to Adaptation to climate change](#) on the website of the Ministry of the Environment. Meteorological data is maintained by Czech Hydrometeorological Institute, whilst

¹ major project: an operation comprising a series of works, activities or services intended in itself to accomplish an indivisible task of a precise economic or technical nature which has clearly identified goals and for which the total eligible cost exceeds EUR 50 000 000 and in the case of operations contributing to the thematic objective under point (7) of the first paragraph of Article 9 of Regulation 1303/2013 where the total eligible cost exceeds EUR 75 000 000

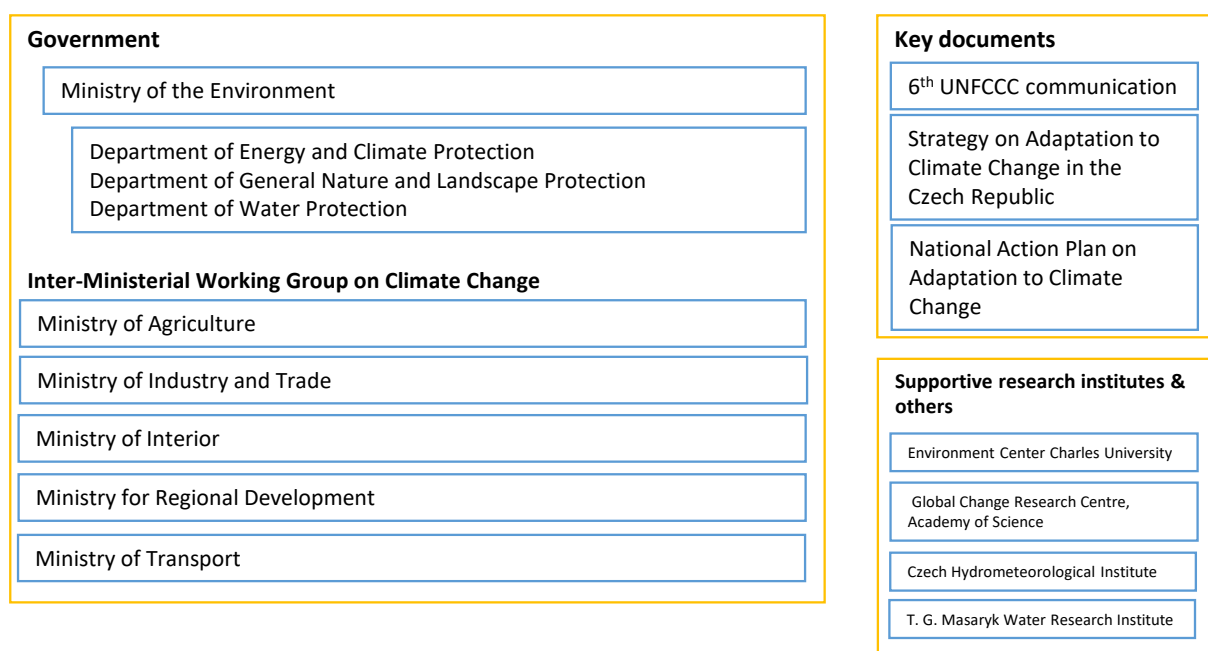
[CzechAdapt](#) provides information about the expected impacts, risks and vulnerability of potential adaptation measures. The 2017 [National Action Plan](#) is the main guidance document available and provides guidelines to achieve climate adaptation goals for individual sectors. The Ministry of Transport, as the Managing Authority for the Operational Programme for Transport, has made available online several [methodological guidance](#) documents for transport projects, where climate adaptation is included. EU resources are in use, such as the [Guide to Cost-Benefit Analysis of Investment Projects](#), the publication on [Climate Change and Major Projects](#) and the non-paper [Guidelines for Project Managers](#). There are three tools available in Czech Republic with regard to climate change adaptation; Clidata – a tool to archive climate data, Agriclim, a software to evaluate aspects and indicators of current and future climatic conditions, and a [Flood Map](#) presenting rainfall projections and erosion projections. The [Czech Office for Standards, Metrology and Testing](#), the national standards authority, is collaborating with the European standardisation bodies in the [Adaptation to Climate Change Coordination Group \(ACC-CG\)](#).

Czech Republic's institutional support to climate change adaptation is most evident in the water, urban development, transport and energy sectors, which are addressed in the [National Adaptation Strategy](#) (2015), the [Comprehensive Impact Assessment, the Impact Assessment and the Risks Related to Climate Change in the Czech Republic](#) (2015) and the [National Action Plan for the Adaptation to Climate Change](#) (2017). The document reports expected impacts on the sectors and provides the relevant adaptation measures and their estimated costs. In the framework of the Transport Operational Programme, the Ministry of Transport has issued a report on [expert background to take into account the impacts of climate change on the preparation of transport infrastructure projects](#). UrbanAdapt, a project that aimed at developing adaptation plans in the cities Prague, Brno and Pilsen, developed a [methodology](#) to support the adaptation of cities using environment-friendly measures. A [Flood Map](#) is available on the website of the Department of Geographic Information Systems and Cartography of the Masaryk Water Research Institute. Similar [flood forecasts](#) are available on the website of the Czech Hydro-meteorological Institute. The broadband, energy and waste sectors are not involved in the national or regional authority climate change adaptation plans or initiatives organised by governmental bodies. A number of major [infrastructure projects](#) benefiting from European Structural Investment Funds, relating to climate change adaptation, are planned for the Czech Republic for the 2014 – 2020 programming period.

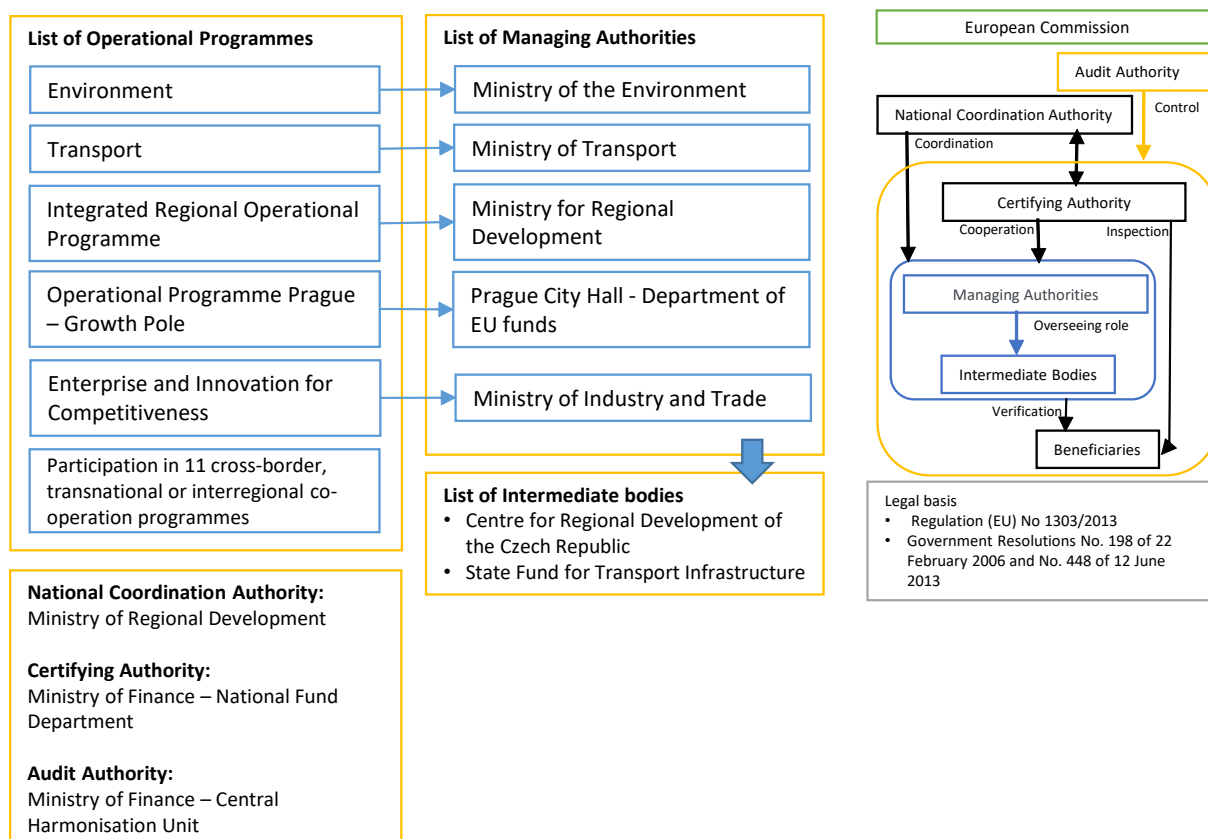
In the context of the present study, no case studies on climate change adaptation were identified for the Czech Republic.

2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

The Ministry of the Environment is the central state administrative authority and supreme inspection authority in environmental affairs. It has responsibility over the development of the climate change adaptation policy of the country. With the involvement of the other ministries and research institutes (Environment Centre of the Charles University, Academy of Sciences, Czech Hydrometeorological Institute, T.G. Masaryk Water Research Institute), it developed the [National Strategy on Adaptation to Climate Change in the Czech Republic](#) (2015) and the implementing [National Action Plan on Adaptation to Climate Change](#) (2017). Relevant ministries are also responsible for their respective implementation tasks, as defined in the NAS as well as NAP.



ERDF is mainly absorbed through four thematic Operational Programmes, managed by the relevant line ministries and one Operational Programme focused on Prague, managed by the City of Prague. The main infrastructure investments are made through the Operational Programme for Transport, managed by the Ministry of Transport. The Ministry of Environment, EU Funds Dept., is the Managing Authority of the Operational Program Environment 2014 - 2020. The Unit of EU Projects Implementation in close cooperation with the intermediate body the State Environmental Fund is responsible for communication of major projects with JASEPRS and the European Commission. Through the other OP, various investments are made for development of the water supply and sewerage systems, and the development of the energy supply infrastructure.



3. RESOURCES

This country report has reviewed the currently available resources in the Czech Republic for adapting to the impacts of climate change across six key infrastructure sectors. Adaptation to climate change is integrated in the legal basis² for ESIF-funded projects, through the processes of vulnerability and risk assessments which are, broadly:

1. Vulnerability – evaluating the sensitivity and exposure of infrastructure to climate change
2. Risk – estimating the likelihood and impact of relevant climate hazards
3. Adaptation - consideration of adaptation options and integration into the project planning

The legal requirements for major projects also foresee climate change mitigation. This study however is focused on climate change adaptation and does not cover mitigation aspects.

Information on the requirements for climate change adaptation is available in the 2016 publication [Climate Change and Major Projects](#), and details on the methodology of climate resilience analysis is provided in the 2017 JASPERS publication [The Basics of Climate Change Adaptation, Vulnerability and Risk Assessment](#). Further resources are being identified in the present publication and its references. Effective vulnerability and risk assessments for the adaptation of major projects to climate change require the resources explained in the following table:

Resources	Explanation
Data Availability	The availability, accessibility and applicability of data on climate projections and impacts, on past and historic events, on geophysical parameters, on long-term scenarios, on economic, environmental and social impacts, etc.
Methodologies	The existence of quantitative or qualitative methodologies (a system of processes, a set of principles and rules) for integrating climate change adaptation in the development of infrastructure projects.
Tools	The availability of tools for planning, evaluation, impact estimation (i.e. software, maps, computer simulations, long term climate forecasts etc.) to assist with the adaptation of infrastructure to climate impacts
Guidance	The provision of guidance on how to use methodologies (i.e. for conducting climate change vulnerability and risk assessments) or develop the required infrastructure project documentation relating to climate adaptation.
Design Standards	The availability of published engineering design standards (i.e. by BSI, DIN, ISO) for infrastructure projects that include sections or appropriate provisions to ensure resilience to climate change impacts
System	The institutional and legal framework that the formal authorities work with to deliver their primary responsibilities for climate adaptation, infrastructure, and management of European Structural and Investment Funds

² Regulation (EU) No 1303/2013, Commission Delegated Regulation (EU) No 480/2014, Commission Implementing Regulation (EU) No 1011/2014, No 215/2014, 2015/207; and the Directives 2001/42/EC, 2011/92/EU and 2014/52/EU

Institutional capacity	The human and technical capacity of institutions to carry out their functions. It depends on being adequately resourced, on having the appropriate expertise, and on collaborating effectively and enforcing laws and regulations
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3.1. Data Availability

Quantitative data are essential to understand the relevant risks and the requirements for any corresponding climate change adaptation in key sectors. General Information on climate change adaptation is available on the [webpage dedicated to Adaption to climate change](#) on the website of the Ministry of the Environment. The key document framing the country's efforts, the [National Adaptation Strategy](#) (NAS) provides data on climate change and appropriate adaptation measures. A "[Comprehensive study on impacts, vulnerability and risks sources connected to climate change in the Czech Republic](#)" (2015), published by the Ministry of the Environment, provides several assessments of long-term climate risk under a range of scenarios and vulnerability assessments by sector.

The [State Environmental Policy](#) sets the overall framework for an effective protection of the environment in the Czech Republic until 2020. The document provides, *inter alia*, information on adaptation measures in water management and overall improvement of climate adaptation to climate change in the country. In accordance with its principles several Impact assessments were produced, including:

- An [assessment](#) of the effect of climate change on the water budget;
- An [update of existing estimates](#) of the impacts of climate change in the water, agriculture and forestry sectors.

The Policy of Protection from Impacts of Drought and Water Scarcity was adopted by the Government in July 2017. The analytical part of the document describes the main observed adverse trends in climate and hydrological conditions in last three decades including several maps of vulnerability to drought and water scarcity. The strategic section of the document defines vision and strategic goals, which include improving the knowledge of current and future risk of drought and water scarcity, preparedness based on operational plans and measures, awareness rising, ensuring balance between available water resources and water demand across all sectors and restoring the natural water regime of the landscape.

The [Czech Hydrometeorological Institute](#) (CHMI) provides information on actual weather conditions, hydrological and meteorological situations and alerts to extreme hydrological and meteorological situations. It also maintains a database of climate change observations, scenarios and exposures, air pollution and record of GHG emissions. [Flood forecasts](#) are available on the website of the CHMI.

The [Czech Statistical Office](#) (CZSO) is the national statistics authority and maintains a database of statistics relating to the Czech Republic's economy, society and environment. The exact content of this database was not examined in the context of the present study.

Regarding climate extremes, the warning system has been further improved on the basis of the innovated Integrated Warning Service System in the Czech Republic. This system includes forecast warning information on 26 dangerous phenomena and each phenomenon is awarded a danger level (low, medium, extreme). A large number of stations with operative presentation of measured data and forecasts have been placed on the website of the reporting and forecasting flood service.

The main model used for climate change scenarios to date in the Czech Republic is ALADIN-CLIMATE/CZ regional climate model. The basis for the estimates of impacts is a

specific project allowing the integration of the regional climate model (RCM) ALADIN-CLIMATE/CZ with A1B emission scenario for 1961 – 2100 with horizontal resolution of 25 km, completed in 2011. These projections (they do not cover key uncertainties due to climate models or socioeconomic scenarios) have been used to screen the environmental impacts of climate change in specific sectors (water management, agriculture and forestry sectors) and to inform the initial identification of potential adaptation options.

The [Comprehensive Study on Impacts](#) has a section with an overview of the latest development in this field, mentioning several recent projects involved in modelling climate change in the Czech Republic, and/ or projects developing systems to monitor and share data.

[CzechGlobe](#), the Global Change Research Institute of the Czech Academy of Sciences (GCRI) carries out research on issues related to climate change adaptation.

[CzechAdapt](#), a system for the exchange of information on climate change in the Czech Republic, provides relevant information about the expected impacts, risks, vulnerability and potential adaptation measures for the Czech Republic based on the best available methods, e.g. GCM CMIP5 models and regional models. It offers an interactive map showcasing regional climate change impacts and provides models for the future. The region models used in CzechAdapt come from another project, [EUROCORDEX](#) – a coordinated downscaling programme

Similarly, the project [Podpora výměny informací o dopadech změny klimatu a adaptačních opatření na národní a regionální úrovni](#) (Support of information exchanging about impact of the climate change and adaptation on national and regional level) serves as a platform to exchange information on climate change impacts and relevant adaptation measures at the national and regional level. Several documents provide data on climate changes at different levels, incl. vulnerability indicators of the regions of the Czech Republic to climate change.

The [Integrated System for Drought Monitoring](#) provides regional data on relative soil condition, drought intensity, relative soil saturation and overall impact on the crop yield. Further information on drought is also found on the [website](#) of the VODA-SUCHO Interdepartmental Commission. [Drought forecasts](#) are available on the website of the Institute of Global Change Research.

Specific information on floods is found on the [Flood Information System website](#). The [website](#) of the Strategy on the Nature Close Protection Measures Against the Negative Impacts of Floods and Erosion Phenomena in the Czech Republic also provides relevant information.

Information on the adaptation of urban areas to climate change can be found on the website of the project [Urban Adaptation on Climate Change](#) as well as on the website of the project [UrbanAdapt](#).

The Czech Republic's [Sixth National Communication](#) to the United Nations Framework Convention on Climate Change (UNFCCC) also provides long-term climate change assessments across a range of sectors, with scenarios on risk and vulnerability assessments by sector.

Updates for a wide range of national adaptation actions, can be found in the [National adaptation actions deliveries database on EIONET](#), and on the [Climate-ADAPT](#) website.

3.2. Methodologies

Methodologies for integrating climate change adaptation into the development of infrastructure projects rely on the basic rules of risk assessment.

The Ministry of Transport, as the Managing Authority for the Operational Programme for Transport, has made available online several [methodological guidance documents](#) for transport projects, where climate adaptation is included. The Ministry is also currently completing a sectoral methodology for assessing the economic efficiency of transport projects (expected to be effective in 2018).

Further methodologies were developed and applied in different projects on climate adaptation:

- A [catalogue of measures](#) to adapt to water infiltration and retention
- A [methodology](#) to support adaptation to climate change in rural areas

3.3. Tools

Tools are highly valuable for facilitating climate adaptation studies and planning for infrastructure. They can be public or private, numerical or descriptive, and be provided in many mediums, such as software, text documents, maps, and so on. Some tools are generic (such in risk assessments) whilst others are specific to a certain set of circumstances.

[Clidata](#) is a tool intended to archive climate data. This computer-based programme provides access to past data from a number of measuring stations thus offering supporting in establishing climate change scenarios.

[Agriclim](#) is a software used to evaluate aspects and indicators of current and future climatic conditions, according to selected scenarios, taking into account maximum and minimum air temperatures, daily sum of solar radiation and precipitations, mean daily wind speed, mean daily air humidity. The software models the results in 500 x 500 m grids covering the country.

As part of the project "[Podpora výměny informací o dopadech změny klimatu a adaptačních opatření na národní a regionální úrovni](#)" (Support of information exchanging about impact of the climate change and adaptation on national and regional level), a [list of vulnerability indicators](#) was drawn up to support the identification of climate change impacts on regions, populations or economic sectors based a selection of climate changes.

A [Flood Map](#) is available on the website of the Department of Geographic Information Systems and Cartography of the Masaryk Water Research Institute. An interactive [Map](#) presenting rainfall projections is available on the website of the CHMI. An interactive [Map](#) presenting erosion projections is available on the website of the Research Institute for Soil Improvement and Soil Protection.

EIONET provides [Flood Maps](#) which are publically available, mapping areas of potential significant flood risk. EIONET also contains Flood Risk Management Plans.

For a continual update of available tools, the reader is referred to the European Climate Adaptation Platform [Climate-ADAPT](#), which has a dedicated tools section.

3.4. Guidance

Guidance is an essential requirement to ensure consistency in applying methodologies and tools.

The NAS and the [National Action Plan](#) are the main guidance documents available, which provide strategy and direction for how adaptation should be considered in different sectors. The NAS includes the basic principles and specification of adaptation measures

and list of adaptation measures. More details can be found in NAP, including the description of an integrated approach to adaptation to climate change, the concept of vulnerability to climate change (trajectory of climate change impact based on the exposure, sensitivity, and adaptation capacity), system of indicators, etc.

The [Guide to cost-benefit analysis of investment projects](#) provides practical guidelines for the evaluation of major projects. The guide clarifies the common principles and rules for the practical application of the cost-benefit analysis across sectors and considers climate change within this context.

The Ministry of Transport has developed a [guidance document](#) to support project developers in filling the Environmental assessment section (section F8) of the Application Form. The guide suggests where to find data sources, the key documents to refer to, how to perform a climate risk and vulnerability assessment; and how to choose the appropriate adaptation measures.

3.5. Design Standards

Design standards are critically important for all infrastructure projects to ensure stability and optimal functioning under the strain of natural phenomena. For civil works (including bridges, buildings, masts and towers for the mobile access networks), EN standards are available to address natural forces such as wind and snowfall, e.g. EN1991-1-4 (Eurocode 1) and EN1993 (Eurocode 3) for structures in steel. However, these standards might be outdated and not account for the impacts of climate change.

The [Comprehensive Study on Impacts, Vulnerability and Risks Sources Connected to Climate Change in the Czech Republic](#) (2015) provides an overview of the existing design standards (Czech State Standards).

The [Czech Office for Standards, Metrology and Testing](#) (UNMZ), the national standards authority, is collaborating with the [European Standardization Organizations](#) in the context of the EU Regulation No 1025/2012 on European standardisation. The European Committee for Standardisation (CEN) and Electrotechnical Standardisation (CENELEC) established the [Adaptation to Climate Change Coordination Group \(ACC-CG\)](#) to coordinate standardisation work in the field of adaptation to climate change in support of the implementation of the EU Strategy on Adaptation to Climate Change. More information is available in the section on *Available resources at the EU level* in the Final Report of the present study (European Commission, 2018)³.

3.6. System

The institutional system for adapting to climate change requires a legal framework (laws and implementing regulations) and strategies and policies (with implementing action plans). The system is usually conflated with disaster management (and its various components, preparedness, reduction etc.) and more generally with resilience.

Institutional and legal framework

The [Ministry of the Environment](#), with the involvement of the other ministries and research institutes, developed the [National Strategy on Adaptation to Climate Change](#) (NAS) (2015) and the implementing [National Action Plan on Adaptation to Climate Change](#) (NAP) (2017). The NAS will be reviewed and updated in 2020. From then onwards, the Strategy will be reviewed once in every ten years. The NAP will be

³ European Commission (2018) Climate change adaptation of major infrastructure projects. A stock-taking of available resources to assist the development of climate resilient infrastructure. Final report.

evaluated in 2019 and this evaluation will form the basis for the revision of the NAS. From then onwards, the NAP will be reviewed every 4-5 years, depending on the reporting obligations of the Czech Republic within the framework of its international commitments.

The City of Prague adopted its own regional adaptation strategy. Currently, six other municipal strategies have been adopted, in the form of binding and non-binding documents. In total, these one regional and six local adaptation strategies cover 18% of the Czech population.

The protection and adaptation of critical infrastructure in the Czech Republic is covered by the [Complex Strategy of the Czech Republic to solve the Critical Infrastructure problem](#) (2010). The basic principle of addressing critical infrastructure issues is to ensure the functioning of key and strategic infrastructures in order to ensure the protection of the population.

The national frameworks for Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) have been revised to include certain adaptation requirements to transpose the new EIA Directive: the amendment transposing the new EIA Directive requires the assessment of impacts of the project related to climate change (the impact of the project on climate, vulnerability of the project to climate change exposures and risk of major accidents and/or disasters caused by climate change), including the assessment of impacts relevant to adaptation.

The Czech Republic has developed a comprehensive multi-hazard system based on an integrated early warning system connected with a special rescue and response system. The system was tested on occurring weather extremes (floods in the last 15 years). However, potential risk scenarios do not take into account climate change projections.

Strategy of Environmental Safety 2016-2020, with an outlook to 2030, which implements the Sendai Framework for Disaster Risk Reduction 2015-2030, includes measures for disaster risk reduction for disasters caused by climate change, mainly extreme meteorological events.

A multi-sectoral National platform on disaster risk reduction (DRR) to coordinate actions and activities related disaster risk reduction (Sendai Framework DRR) to climate change was established in February 2015. The flood protection is the focus area of this integration and both the NAS and NAP, include DRR measures such as risk-management measures for floods.

The National Risk Assessment is undertaken in line with thematic ex-ante conditionality 5.1, according to which, national or regional risk assessments for disaster management need to be taking into account climate change adaptation.

Responsible authorities

The [Ministry of the Environment](#) is the central state administrative authority and supreme inspection authority in environmental affairs. Its website provides basic information on climate change adaptation and information on climate policy of the Czech Republic, Environmental Impact Assessment (EIA) process and funding schemes.

Relevant ministries are responsible for their respective implementation tasks defined in the NAS as well as NAP. The Department of General Nature and Landscape Protection was responsible for the preparation of the NAS and the Department of Energy and Climate Protection was actively involved in the preparatory phase, including consultations with the CHMI. Implementation tasks are distributed within relevant ministries with respect to their responsibilities in particular topics.

An Inter-Ministerial Working Group on Climate Change was established in January 2015. This group cooperates, consults and works further on the basis of the NAS and was involved in preparation process of the NAP. An adaptation platform was established in

January 2016 within the framework of the Inter-Ministerial Working Group to prepare the NAP.

Management of the ESI Funds

The Czech Republic has five Operational programmes and a corresponding number of Managing Authorities. The Environment OP is managed by the Ministry of the Environment; the Transport OP is Managed by the Ministry of Transport; the Integrated Regional Operational Programme is managed by the Ministry of Regional Development; the Operational Programme Prague – Growth Pole is managed by the Prague City Hall - Department of EU funds; and the Enterprise and Innovation for Competitiveness OP is managed by the Ministry of Industry and Trade. Additionally, the Czech Republic is participating in 11 cross-border, transnational or interregional co-operation programmes. The most prominent Intermediary bodies are the Centre for Regional Development of the Czech Republic, and the State Fund for Transport Infrastructure. In the control system of the ESI Funds, the National Coordination Authority is the Ministry of Regional Development; the Certifying Authority is the National Fund Department within the Ministry of Finance; and the Audit Authority is the Central Harmonisation Unit within the Ministry of Finance.

3.7. Institutional Capacity

The institutional challenge for climate change adaptation is that climate policy is a cross-cutting issue, and requires co-operation across a large number of institutions. To be effective in delivering climate change adaptation a minimum level of capacity is needed on leadership, technical and human resources, effective collaboration, and financial support.

Technical and human resources

Interviewed personnel from the managing authorities stated that considering the limited resources, the responsible Czech institutions have sufficient and qualified staff. The institutional capacity (human, technical, equipment) relevant to climate change adaptation is currently developing further, based on the recent adoption of the NAP (2017). Budgetary resources are available mainly through the European ESI Funds, and EEA Grants.

The institutional support of the Czech Republic to climate change adaptation is most evident in the water, urban development, transport and energy sectors, which are addressed in [National Adaptation Strategy](#) (2015), [the Comprehensive Study on Impacts, Vulnerability and Risks Sources Connected to Climate Change in the Czech Republic](#) (2015) and the [National Action Plan on Adaptation to Climate Change](#) (2017). The document reports expected impacts of climate change on each sector and provides the relevant adaptation measures and their estimated costs.

There is a [State program for Environmental Education and Awareness Raising](#) for the years 2016-2025, which contains specific targets and measures focused on education and dissemination of information regarding climate change mitigation and adaptation. It is aimed at state administration bodies, regions, municipalities and towns, while it is also including high schools, ecological councils, non-profit organizations, educational and research institutions, museums, zoos, botanical gardens, and libraries.

A system of indicators for assessment of vulnerability and adaptation to climate change has been introduced in the National Action Plan on Adaptation to Climate Change (2017) and currently is being implemented.

Effective collaboration

An Inter-Ministerial Working Group on Climate Change was established in January 2015. This group cooperates, consults and works further on the basis of the NAS and was involved in preparation process of the NAP. An adaptation platform was established in January 2016 within the framework of the Inter-Ministerial Working Group to prepare the NAP.

The ministries cooperate at government level, while adaptation efforts are discussed at the [Government Council for Sustainable Development](#). The Council initiates, conceives, coordinates, monitors, evaluates and supports strategic dimensions in state management. It proposes measures to reconcile long-term objectives and targets with medium- and short-term objectives and programs in line with the principles of sustainable development. The Steering Committee is comprised by representatives from the Ministry of Industry and Trade, Ministry for Regional Development, Czech-Moravian Confederation of Trade Unions, Czech Business Council for Sustainable Development, Society for Sustainable Life, the Ministry of the Environment, and the Ministry of Labor and Social Affairs. Another 30 institutions are members of the Government Council for Sustainable Development.

Financial resources

The [ESI Funds are enabling the development of major projects](#) in the 2014 – 2020 programming period. Concerning major projects, by early 2018, there have been 108 Million EUR approved for Network Infrastructures in Transport and Energy; 5.1 Million EUR in Environment Protection & Resource Efficiency; 4 Million EUR for Research and Innovation. The [data set will be updated regularly](#) to reflect changes in the programme lists and major project notifications. According to the [ESIF-viewer](#), the Czech Republic is planning investments of 21.9 Billion EUR. Projects under the Thematic Objective 5 on promoting climate change adaptation, risk prevention and management will be receiving 32 Million EUR, with an additional 4 558 Million EUR approved for Network Infrastructures in Transport and Energy (Thematic Objective 7); 935 Million EUR in Environment Protection & Resource Efficiency (Thematic Objective 6); and 744 Million EUR for Information and Communication Technologies (Thematic Objective 2).

The Czech Republic has received support from the EEA grants in two financing periods [2004 – 2009](#) and [2009 – 2014](#) with a focus on two main topics: systems for information exchange on climate change adaptation (dissemination, awareness raising campaigns, education), and strategies and measures for adapting to a changing climate (strategies, action plans and concrete measures).

4. SECTOR OVERVIEW

4.1. Introduction

Since 2014, the requirements for major projects to obtain ESIF funding⁴ demand that project applications integrate climate change considerations⁵, such as a vulnerability and risk analysis and adaptation option appraisal. At EU-level, material is available to assist in fulfilling these requirements. Key websites and documents are:

- The [Climate-ADAPT](#) website containing many links to data and a [map viewer](#)
- EUROPEAN COMMISSION Directorate-General for Regional and Urban policy: The [Guide to Cost-benefit analysis of Investment projects](#) (also referred to as the 'CBA guide')

⁴ http://ec.europa.eu/regional_policy/archive/projects/major_projects/index_en.cfm

⁵ For a compilation of the climate change requirements for major projects in 2014-2020, see: <http://www.jaspersnetwork.org/plugins/servlet/documentRepository/displayDocumentDetails?documentId=401>

- EUROPEAN COMMISSION DIRECTORATE-GENERAL CLIMATE ACTION: [Non-paper of Guidelines for Project Managers: Making vulnerable investments climate resilient](#)
- JASPERS Guidance note: [The Basics of Climate Change Adaptation, Vulnerability and Risk Assessment](#)
- JASPERS Guidance note: [An overview of the most important sources for integrating climate change in \(major\) projects](#)

Additional relevant material can be found in the Final Report of the present study (European Commission, 2018) in the section *Available resources at the EU level* and in *Annex I*.⁶

4.2. Transport

Investments in the transport sector are very diverse, covering roads (including bridges and tunnels), inland waterways, rail, ports / airports, and public transport infrastructure. Any disruption caused in this sector can affect many other sectors (economic and societal) directly. Potential threats are linked with extreme weather events, such as extended heatwaves, flooding, heavy rainfall or storm, and landslides amongst others. They are a potential threat to both infrastructure and operation of the transport system.

[The Comprehensive Study on Impacts, Vulnerability and Risks Sources Connected to Climate Change in the Czech Republic](#) presents the expected impacts of climate change which will affect urban development, their costs and the costs of the relevant adaptation measures. Based on the identified impacts the [National Action Plan](#) presents the increased vulnerability of the sector to climate change.

The [National Adaptation Strategy](#) presents several adaptation measures for the sector, such as taking into account the consequences of climate change when designing buildings and transport structures; research on new materials; ensuring sustainable temperature in public transport; and facilitating effective communication.

Effective monitoring of climate data may be done on the basis of the information provided by the [Czech Hydrometeorological Institute](#).

Road infrastructure

Under the Operational programme for Transport, 14 major projects are planned to be implemented. These include, for instance) the development of [motorway D1 between Přerov - Lipník nad Bečvou](#), the continuation of the development of [motorway D35 between Opatovice-Časy-Ostrov](#), the continuation of the development of the [road connection between Nebory - Oldřichovice – Bystřice](#) (75 Million EUR).

In the framework of the Transport OP, the Ministry of Transport has issued a report on [Expert technical basis for considering the impacts of climate change during the preparation of transport infrastructure related projects](#). The Ministry has also developed a [guidance document](#) to support project developers in filling section F8 of the Application Form. The Ministry of Transport has also made available online several [methodological guidance documents](#) for transport projects, where climate adaptation is included. Applicants for grants from the Ministry of Transport or from the Railway Infrastructure Administration are also making use of the 2017 [JASPER's methodology on the Basics of Climate Change Adaptation, Vulnerability and Risk Assessment](#).

⁶ European Commission (2018) Climate change adaptation of major infrastructure projects. A stock-taking of available resources to assist the development of climate resilient infrastructure. Final report.

In general, the EU [Guide to cost-benefit analysis of investment projects](#), translated by the Ministry of Transport, is a useful guidance document. It takes into account the requirement of the European Commission to draw up practical guidelines for the evaluation of major projects. The main objective of the guide is therefore to clarify the common principles and rules for the practical application of the cost-benefit analysis across sectors, including the transport sector.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

Railway infrastructure

See section above on Road infrastructure. No railway specific guides or documents on climate adaptation have been retrieved from desk study or interviews.

Airport infrastructure

Czech Republic has six airports with international passenger and freight transport (Prague Airport, Brno Airport, Ostrava Airport, Karlovy Vary Airport and Pardubice Airport). In 2016, the Ministry of Transport published a [State Action Plan](#) to reduce CO₂ emissions from civil aviation, but currently no specific actions are planned to make airports more climate resilient.

See section 4.1 for some general documents that can help in taking climate considerations into account. They apply to all types of projects, including airport infrastructure.

4.3. Broadband

The International Telecommunication Union has issued the recommendation L.1502 "[Adapting information and communication technology infrastructure to the effects of climate change](#)" for the purpose of identifying climate threats and their impact. L.1502 supports Resilience by design in identified risky areas, and proposes changes to equipment installation standards to ensure protection from more frequent extreme weather phenomena and their impacts. The European broadband sector standardisation bodies have not prepared vulnerability assessment and risk management framework for dealing with climate change in broadband projects.

The Ministry of Industry and Trade is the entity governing the attribution of EU funds for broadband projects. The [National Adaptation Strategy](#) does not address the sector. The vulnerability of the broadband network to floods can however be assessed based on the information provided by the [flood risk and hazard maps](#). It is a general best practice for operators to use flood mapping information from environmental agencies to safeguard new planned data centres from flooding.

For the programming period 2014-2020, the Operational Programme for Enterprise and Innovation for Competitiveness is planned to contribute with 521 € millions to the development of broadband projects.

In general, the [Guide to cost-benefit analysis of investment projects](#), prepared by the Ministry of Transport is a useful guidance. The document takes into account the requirement from the European Commission to draw up practical guidelines for the evaluation of major projects. The main objective of the guide is therefore to clarify the common principles and rules for the practical application of the cost-benefit analysis across sectors, including the broadband sector.

For civil works (incl. masts and towers for the mobile access networks), EN standards are available to address wind and snowfall, e.g. EN1991-1-4 (Eurocode 1) and EN1993

(Eurocode 3) for structures in steel. But these standards don't take climate change into account. CEN-CENELEC is currently working on adapting a number of EN standards to climate change. See Final Report of the present study (European Commission, 2018) for more information in the section on *Available resources at the EU level*.⁷

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

4.4. Urban Development

Investments in the urban development sector include site developments (industrial and other), urban planning, local infrastructure, building projects (such as hospitals, schools), and much more diverse projects. Cities have a unique position to analyse and respond to local impacts and vulnerabilities, such as heat island effects, which depend on the specific layout of a city, its green spaces, and numerous other factors. Cities can actively support the uptake of climate change adaptation in infrastructure projects through, for instance pilot projects, and can initiate dedicated infrastructure projects to improve their resilience to climate change.

[The Comprehensive Study on Impacts, Vulnerability and Risks Sources Connected to Climate Change in the Czech Republic](#) presents the expected exposures to climate change which will affect urban development, their costs and the costs of the relevant adaptation measures. Based on it, the [National Action Plan](#) presents the increased vulnerability of the sector to climate change.

The [National Adaptation Strategy](#) presents several adaptation measures for the sector:

- Measures aiming to minimize surface water runoff, which contain an entire set of partial measures such as maintenance of reservoirs and restoration of artificial yet close-to-nature water features in settlements etc.
- Measures focusing on reduction of pollution in runoff with objective of minimizing potential contact of the runoff with pollution sources
- Measures aiming functional and ecologically stable system of urban vegetation
- Measures in the urban development sector, construction sector, and architecture with the objective of supporting technologies using renewable energy sources in cooling and air conditioning of buildings, implementation of low-energy passive standards and technologies in public buildings, re-use and revitalizations of brownfields
- Construction solutions implementing shading of buildings, installation of external shutters and awnings, implementation of "green" and "white" roofs and pavements, replacement of black tarmac with pale surfaces etc.

Effective monitoring of climate data may be done on the basis of the information provided by the [Czech Hydrometeorological Institute](#).

UrbanAdapt, a project that aimed at developing adaptation plans in the cities of Prague, Brno and Pilsen and ran between 2015 – 2016, developed a [methodology](#) to support the adaptation of cities using environment-friendly measures.

⁷ European Commission (2018) Climate change adaptation of major infrastructure projects. A stock-taking of available resources to assist the development of climate resilient infrastructure. Final report.

A similar [methodology](#) was developed as part of the project “Adaptation of Residential Areas to Climate Changes – Practical Solutions and Experience Sharing” with the aim of supporting the adaptation of urban area to climate change.

Under the OP - Environment, several projects have been approved with the aim of adapting to the effects of climate change on the frequency of wildfires and increase the safety of urban developments.

In general, the [Guide to cost-benefit analysis of investment projects](#), prepared by the Ministry of Transport is a useful guidance. The document takes into account the requirement from the European Commission to draw up practical guidelines for the evaluation of major projects. The main objective of the guide is therefore to clarify the common principles and rules for the practical application of the cost-benefit analysis across sectors, including urban development.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

4.5. Energy

Project investments in the energy sector are related to power generation infrastructure, energy distribution networks and energy storage (e.g. through hydropower). Potential impacts of climate change on energy infrastructure may include increased damage to power generation plants or problems with energy provision, leading to black-outs or other disruptions. Disruptions in the energy sector can have large impacts on different sectors due to the increasing dependency on (electric) power provision for all kind of operational systems such as water supply (pumping installations, ...), the food system (transport, cooling, ...) and transport (electrified vehicles, dynamic traffic information, ...).

[The Comprehensive Study on Impacts, Vulnerability and Risks Sources Connected to Climate Change in the Czech Republic](#) presents the expected impacts of climate change which will affect the energy sector, their costs and the costs of the relevant adaptation measures. Based on it, the [National Action Plan](#) presents the increased vulnerability of the sector to climate change. The [National Adaptation Strategy](#) presents several adaptation measures for the sector divided by the electricity sector, the gas sector, the oil sector the heating sector and the renewable sector.

Effective monitoring of climate data may be done on the basis of the information provided by the [Czech Hydrometeorological Institute](#).

Under the Operational Programme Enterprise and Innovation for Competitiveness, two major projects are planned for the energy sector: the expansion, reconstruction and transformation of Kočín substation and the construction of a 400 KV overhead transmission power line between Přeštice – Vítkov to improve the electricity supply system.

In general, the [Guide to cost-benefit analysis of investment projects](#), prepared by the Ministry of Transport is a useful guidance. The document takes into account the requirement from the European Commission to draw up practical guidelines for the evaluation of major projects. The main objective of the guide is therefore to clarify the common principles and rules for the practical application of the cost-benefit analysis across sectors, including the energy sector.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

4.6. Water

Investments in the water sector are linked to efficient water supply (including reduction of leakage), wastewater treatment and water reuse as well as the implementation of [River Basin Management Plans \(RBMP\)](#) to ensure integrated water management at the river basin scale. Important threats are linked to water quantity (droughts and floods) as well as quality (water pollution). Climate change can have several impacts on both water quantity and quality. Following the EU Floods Directive 2007/60/EC, Member States are obligated to perform flood risk assessment and to elaborate [flood hazard and risk maps](#) and [flood risk management plans](#). Flood risk maps include the history of floods and climate scenarios. For the Czech Republic, these are publically available on the [Flood Information System](#) website. Member States also need to take climate change into consideration when developing RBMP. A [Guidance document on adaptation to climate change in water management](#) is available to ensure that the RBMP are climate-proofed. [Evaluations of the RBMP and FRMP](#) are also available on the EC website.

[The Comprehensive Study on Impacts, Vulnerability and Risks Sources Connected to Climate Change in the Czech Republic](#) presents the expected impacts of climate change which will affect urban development, their costs and the costs of the relevant adaptation measures. Based on it, the [National Action Plan](#) presents the increased vulnerability of the sector to climate change. The [National Adaptation Strategy](#) presents several adaptation measures for the sector:

- Improve the stability of the resources
- Improve the wastewater retreatment and the overall management of the resources
- Prepare Flood Maps and Flood Risk Management Plan
- Ensure and maintain sufficient water resources for drink water supply in case of long-lasting drought
- Increase the interconnections between different water distribution network

Further to the Flood Information System, effective monitoring of climate data may be done on the basis of the information provided by the [Czech Hydrometeorological Institute \(CHMI\)](#). A [Flood Map](#) is also available on the website of the Department of Geographic Information Systems and Cartography of the Masaryk Water Research Institute. Similar [flood forecasts](#) are available on the website of the CHMI. [Rainfall projections](#) are available on the website of the CHMI. [Drought forecasts](#) are available on the website of the Institute of Global Change Research.

Under the Operational Programme for the Environment, almost 200 projects have been approved to improve flood protection and rainwater management. With the aim of adapting to the effects climate change along the Desna River, a project has been submitted to decrease the flood vulnerability of the cities of Rapotín, Vikýřovice and Petrov and, if approved, will receive 13 € millions of EU funding.

In general, the [Guide to cost-benefit analysis of investment projects](#), prepared by the Ministry of Transport is a useful guidance. The document takes into account the requirement from the European Commission to draw up practical guidelines for the evaluation of major projects. The main objective of the guide is therefore to clarify the common principles and rules for the practical application of the cost-benefit analysis across sectors, including the water sector.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

4.7. Waste

Project investments in the waste sector are related to separate collection infrastructure, re-use and recycling infrastructure, energy recovery facilities and closure of landfills. Potential impacts of climate change on waste infrastructure may include increased rates of waste decomposition, odour and dust due to increased temperatures, flooding of landfills and waste treatment facilities, and reduced water availability for wet processes in waste treatment facilities. Also the impact on transport infrastructure should be considered, as transport is a critical component of waste management (collection, transport to and from waste treatment facilities). The impact on transportation is discussed in the section on transport above.

During the present study, no known sector resources that include climate adaptation were identified, or suggested by the interviewed national authorities. Nevertheless, waste management plants and landfills are subject to (EU) environmental legislation, such as the Landfill Directive and the IED.

For landfills, [Directive 1999/31/EC on the landfill of waste](#) requires that landfills are situated and designed in such a way that pollution of the soil, groundwater or surface water is prevented. This requirement is translated into national design standards for the construction of landfills that include the consideration of temperature, precipitation extremes and flooding where relevant.

Large waste treatment plant are subject to [Directive 2010/75/EU on industrial emissions](#) (IED), which requires as a general principle that necessary measures should be taken to prevent accidents which may have environmental consequences, and to limit those consequences. This requires that a structured management plan should be available that includes and mitigates hazards such as extreme weather conditions (e.g. flooding, very high winds). In the [BAT reference document \(BREF\) on Waste Treatments Industries](#), some information is provided on the impact of certain climatic conditions (e.g. the impact of higher temperature on biofilter performance, aerobic decomposition, etc.). Although climate change is not specifically addressed.

See section 4.1 for more information on other documents that can help in taking climate considerations into account.

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