



Climate change adaptation of major infrastructure projects

Country report for Hungary

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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 Hungary 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 National Climate Change Strategy (NCCS) of Hungary was amended in 2013 and a new [National Climate Change Strategy](#) (NCCS II) came into force in 2017. A National Adaptation plan is anticipated within 2018, and it will be updated every 3 years. The responsible central body for adaptation policy making and coordination is the Climate Policy Department within the Ministry of National Development. The institutions relevant for climate change adaptation are the Ministry of National Development - Ministry of State for Transport Policy, NIF Zrt. (National Infrastructure Development Corporation), MÁV Zrt. (Hungarian State Railways), Ministry of National Development – The Ministry of State for Development and Climate Policy and Key Public Services, Prime Minister’s Office – Ministry of State for European Development, and the Institute for Transport Sciences.

In terms of available resources, the most comprehensive source of information on climate change adaptation is on the website of the [National Adaptation Centre](#) (NAKFO), an independent unit of the Geological and Geophysical Institute of Hungary (MFGI). The majority of climate-related data (such as relative humidity, wind and soil data) are found via the [National Meteorological Service](#). There is also useful data on

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

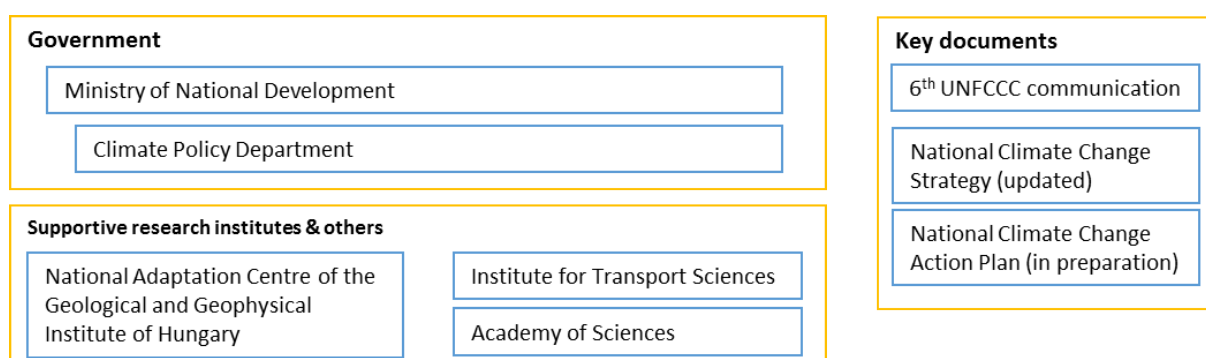
policy and climate finance climate adaptation at the [KLIMAPOLITIKA](#) website. The [Climate Risk Guide](#) developed by the Prime Minister's Office is accompanied by a [Detailed Methodological Description](#) which provides a general description for the estimation of financial costs and benefits of adaptation infrastructure investments to climate change. [Regional climate models](#) to the Carpathian Basin region are being used during the flood control assessments of the Water Management Directorates for the design of culverts, bridges, underpasses and overpasses and during railway line development. Hungary has been actively involved with its neighbouring countries of the Danube macro-region through the project SEERISK which led to the development of [Common guidelines on climate change and risk assessment in the Danube Macro-region](#). This provides guidance on how to perform a common Risk Assessment Methodology and how to take account of the social aspect of climate change in the region. Hungary is following the process for the development of European standards on climate change adaptation by the [Adaptation to Climate Change Coordination Group \(ACC-CG\)](#). There are regulations which consider the effects of the extreme weather conditions (Road and Railway Technical Specifications - RRTS) and which are starting to integrate climate change adaptation. Research institutes, such as the National Adaptation Centre of the Geological and Geophysical Institute of Hungary, the Institute for Transport Sciences and the Academy of sciences, contribute to the improvement of the institutional capacity and the knowledge capacity in Hungary. 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](#).

Infrastructure sectors are progressing at different speeds regarding climate adaptation. For the transport sector, the report [Climate Change and Hungary: mitigating the hazard and preparing for the impacts](#) outlines the impacts which are affecting the sector. The main resource in the transport sector that are of use to perform climate risk and vulnerability assessment is the Climate Risk Guide and the Detailed Methodological Description, available on the [website of the Széchenyi 2020 Development Programme](#). In the broadband sector, no specific initiatives are identified, but the country is planning to make use of ESI Funds for broadband development. As such, climate adaptation measures will need to be incorporated. In urban development, Hungary has taken steps towards sustainable and resilient cities that are adapted to climate change. Significant information can be found in the publication [Climate-Friendly Cities – The Handbook on the Tasks and Possibilities of European Cities in Relation to Climate Change](#). In the energy sector, the formal authority with primary responsibilities for infrastructure, disaster risk and climate data is the [National Directorate General for Disaster Management](#), and the report [Climate Change and Hungary: mitigating the hazard and preparing for the impacts](#) identifies higher frequency of extreme weather events with potential impact on energy supply. The water sector, and water management is a priority area for climate adaptation, as the annual precipitation distribution is expected to change, which is of particular importance for natural resources (water, biodiversity, forests) and agriculture. The main resources in the water sector that are of use to perform climate risk and vulnerability assessments are the Climate Risk Guide and the Detailed Methodological Description, available on the [website of the Széchenyi 2020 Development Programmes](#). For the waste sector, the primary analytical information on risk and vulnerabilities to the sector is held by the [National Waste Management Directorate](#).

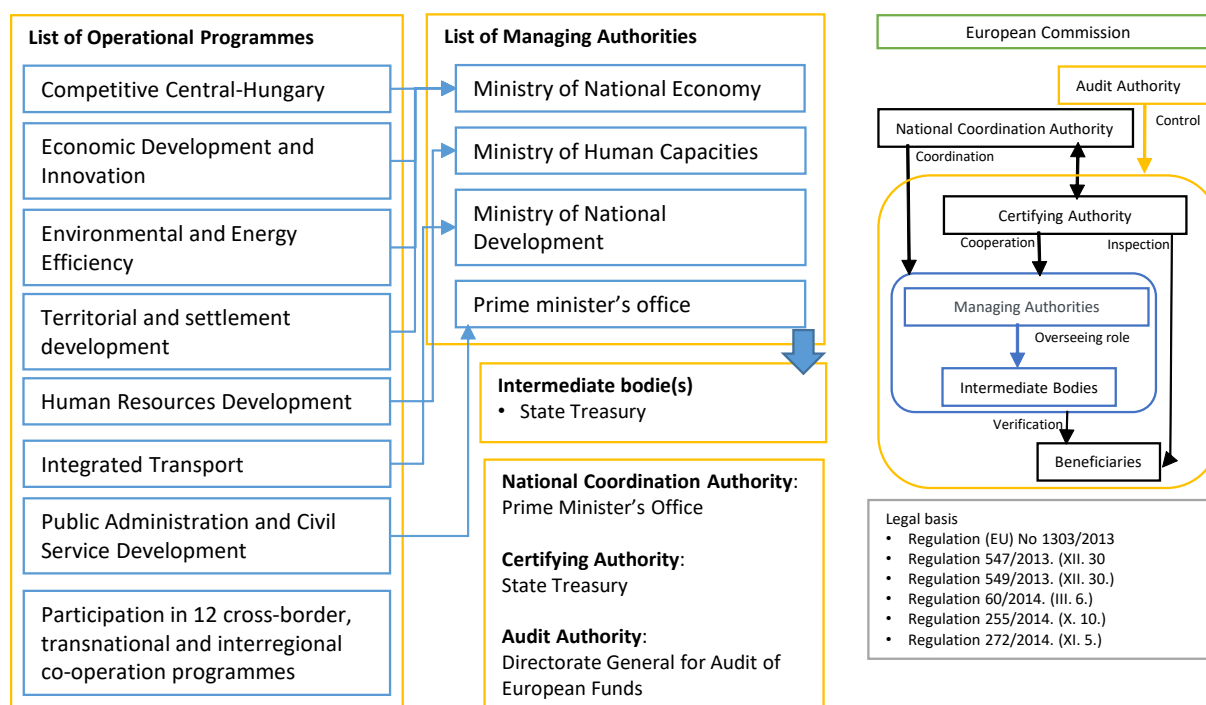
The present country report includes two case studies relevant for climate change adaptation: the [National Adaptation Geoinformatic system \(NAGiS\)](#), developed for policy-making and assistance with climate-related decision processes; and a tool for strengthening co-operation at a local level on [urban green infrastructure](#).

2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

The responsible central body for adaptation policy making and coordination is the Climate Policy Department within the Ministry of National Development. The updated Second National Climate Change Strategy for 2017-2030 (NCCS II) was presented to Parliament in 2017. NCCS II assesses climate change drivers and presents the results of national research on the potential effects of climate change in the country. The document also sets objectives for Hungary in the field of adaptation to climate change impacts. To disseminate the information on climate change, and the importance of adaptation, the [National Adaptation Centre](#) (NAKFO) was established as an organisational unit of the Geological and Geophysical Institute of Hungary (MFGI). The NAKFO helps in strategic planning in the fields of adaptation to the expected impacts of climate change. Useful data sources are available on policies related to financing climate adaptation.



The coordination of the ESIF (European Structural and Investment Funds) in Hungary is realised by the Prime Minister's Office, while the certifying authority is the State's Treasury, and the Directorate General for the Audit of European funds is the audit authority. Hungary is implementing 30 major projects in the current programming period.



3. RESOURCES

This country report has reviewed the currently available resources in Hungary 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 |
| 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 |

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

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. The most comprehensive source of information on climate change adaptation is on the website of the [National Adaptation Centre](#) (NAKFO), an independent unit of the Geological and Geophysical Institute of Hungary (MFGI). The majority of climate-related data (such as relative humidity, wind and soil data) are found via the [National Meteorological Service](#). Of high relevance are the:

- [Climate modelling activities](#)
- [Regional climate modelling](#) (2010)
- [Expected future development of climate change](#) (2010)

Data from [hydrometeorological stations](#), including rainfall, air temperature, relative humidity, wind and soil moisture, and more are available on the website of the General Directorate of Water Management.

The [Hungarian Central Statistical Office](#) (KSH) is the leading state authority on statistics, maintaining a national database of statistics. The exact content of this database was not examined in the context of the present study.

There are useful data on policy and climate finance climate adaptation at the [KLIMAPOLITIKA](#) website. The [FORESEE database](#) has been designed to allow open access to meteorological data that can be used by different modelling exercises in the fields of biogeochemistry, agronomy, hydrology and ecology. It also provides interpolated meteorological fields based on observations.

The report [Climate Change and Hungary: mitigating the hazard and preparing for the impacts](#) (2010) published as the outcome of the VAHAVA project, which was implemented by the Ministry for the Environment and Water Management and the Hungarian Academy of Sciences between 2003-2008, synthesized the existing scientific results on the climate change hazard, the assessment of its impacts in Hungary. It is a useful reference for vulnerability assessment.

Data and information environmental and other disaster potential situations are provided by the [National Directorate General for Disaster Management](#).

The [National Adaptation Geo-information System](#) (NAGiS) is a multipurpose geo-information system that can facilitate policy-making, strategy-building and decision-making processes related to the impact assessment of climate change and formulating necessary adaptation measures.

The [CARPATCLIM](#) project for regional climatological studies offers data from the [CARPATCLIM Database](#). [OrientGate](#) implements coordinated climate adaptation actions across 13 countries (mostly around South Eastern Europe) but also includes Hungary. Climate. The [CLAVIER](#) project on Climate Change and Variability: Impact on Central and Eastern Europe. Finally, [KlimaBarat](#), translated as 'Climate Friendly' presents various local government initiatives.

Research organisations use international databases, such as those of the [European Environment Agency](#), the [World Bank](#), and the project [CORDEX](#) (COordinated Experiment on Climate Change).

Hungary'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 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 [Climate Risk Guide](#) developed by the [SEERISK project](#) is accompanied by a [Detailed Methodological Description](#) for the estimation of financial costs and benefits of adaptation infrastructure investments to climate change.

Hungary has been actively involved with its neighbour countries of the Danube Region through the project SEERISK to develop a [Common Risk Assessment Methodology](#) to take into account of the impact of climate change on the region.

[Regional climate models](#) to the Carpathian Basin region are being used during the flood control assessments of the Water Management Directorates for the design of culverts, bridges, underpasses and overpasses and during railway line development.

A [climate change vulnerability assessment](#) was carried out for tourism and critical infrastructure. The methodology generally follows the [IPCC vulnerability method](#) and as generally described [KRITÉR](#) project.

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. The [Climate Risk Guide](#) developed by the Prime Minister's Office describes the steps taken to make the projects climate-responsive and gives project managers a toolbox of eight modules. In order to minimise additional workloads and costs resulting from the climate-proofing of projects, the toolbox can be integrated into the overall process of project design and implementation.

The [NAGiS system](#) holds adaptation indicators in connection with vulnerability of public health, vulnerability of arable farming, vulnerability of residential buildings by storms, vulnerability assessment of flash floods, general floods, supply of the drinking water, excess water, droughts, natural values, tourism and forests, the system lists indicators in these topics and themes.

Hungary has been actively involved with its neighbour countries of the Danube macro-region through the project SEERISK which led to the development of [hazard, impact and risk maps](#) for the region. Similarly, the [CARPATCLIM](#) project for regional climatological studies offers an interactive [atlas](#) as the basis for climate assessment and further applied climatological studies as well as for drought monitoring in the LCR in the frame of the European Drought Observatory.

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 Prime Minister's Office, acting as the National Coordination Authority for the different Operational Programmes implemented in the country for the programming period 2014-2020, published in 2017 a [Climate Risk Guide](#) which describes the steps to be taken by project developers in order to increase their projects' climate resilience and thus be compliant with Regulation (EU) 1303/2013. The guide is accompanied by a detailed methodology.

The [Climate Risk Guide](#) developed in the SEERISK project provides details on incorporating climate change into existing project design and implementation processes, specifically for climate change adaptation. In this context it has delivered the [guideline on climate change adaptation and risk assessment in the Danube macro-region](#).

Hungary has been actively involved with its neighbour countries of the Danube Region through the project SEERISK which led to the development of [Common guidelines on climate change and risk assessment in the Danube Macro-region](#) which provides guidance on how to perform a common Risk Assessment Methodology and how to take account of the social aspect of climate change in the region.

The Governmental Decree No. 314/2005 (XII.25.) regarding the [procedures of environmental impact assessment and the single procedure of authorization of utilization of the environment](#) outlines the activities that must be authorized by the environmental protection authority and where an environmental impact assessment needs to be performed before the commencement of those activities. The subsequently amended legislation (Government Decree 139/2017. (VI.9)) requires the preparation of Climate Risk Analysis and Risk Management Plans. This national legislation is the transposition of Directive 2014/52 / EU amending Directive 2011/92 / EU on the assessment of the effects of certain public and private projects on the environment.

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 Hungarian Standards Institution ([MSZT](#)) 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).

3.6. 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

Hungary has the following policies in place for climate adaptation:

- [National Climate Change Strategy 2014-2025](#) (NCCS II) with a view to 2050
The Parliamentary Resolution on NCCS II foresees that the Government will adopt a National Action Plan (NAP) six months after the adoption of the NCCS II. The NAP will be updated every 3 years
- [Strategic Fundamentals of Hungarian Climate Policy: Vision and Objectives](#) (part of the Parliamentary Resolution on the NCCS II)
- [Climate Response](#) in which more than 140 local government leaders and other local stakeholders have been trained on local climate protection activities and opportunities in four regions: Southern and Central Transdanubia, Northern Great Plain, and the eastern half of the Central-Hungarian region)
- Development of a [National Adaptive Geospatial System](#), a multifunctional geospatial system that promotes legislation, strategy building, decision making and the founding of the necessary measures to adapt to the impacts of climate change in Hungary.

Currently there is no system in place for monitoring the mainstreaming of adaptation into specific sectoral policies, nor for the assessment of adaptation actions that are being implemented.

Governmental Decree 314/2005 and the Governmental Decree 2/2005 respectively translated the EIA Directive and the SEA Directive into national law. Governmental Decree 139/2017 on the [Environmental Impact Assessment and the Integrated Environmental Authorisation](#) provides that, in the early stage of project development, effects of climate change have to be analysed and evaluated so as to take subsequent actions and measures to adapt thereto, as per the provisions of the revised EIA Directive.

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 responsible central body for adaptation policy making and coordination is the Climate Policy Department within the Ministry of National Development. Furthermore, the Mining and Geological Survey of Hungary acts as an institution providing background research. As part of the Geological and Geophysical Institute of Hungary, a [National Adaptation Centre](#) (NAFKO) was established. The centre is responsible for the development of the climate change strategies, the national adaptation strategies and the climate change action plans.

Other institutions of relevance for climate change adaptation are the Ministry of State for Transport Policy (within the Ministry of National Development), National Infrastructure Development Corporation (NIF Zrt.), Hungarian State Railways (MÁV Zrt.), Ministry of State for Development and Climate Policy and Key Public Services (within the Ministry of National Development), Ministry of State for European Development (Prime Minister's Office), and the Institute for Transport Sciences.

The [Reflex Environmental Protection Association](#) and [European Climate Alliance](#) along with environmental organisations and local governments, established the Hungarian Climate Protection Association in 2009. The objective of the alliance is to take effective initiatives with the community and social organisations concerned with the climate change problem.

At the regional and local level, a number of cities are being active on climate change adaptation. There are eight signatories in Hungary for the adaptation actions of the [Covenant of Mayors of Climate & Energy](#).

Management of the ESI Funds

ESI Funds in Hungary are absorbed through the Széchenyi 2020 Plan which includes seven national operational programmes managed by the Ministry for National Economy, the Ministry of National Development, the Ministry of Human Capacities, or the Prime Minister's office. Hungary is also participating in 12 cross-border, transnational and interregional co-operation programmes. Comprising the control system of the ESI Funds, the National Coordination Authority is the Prime Minister's Office, the Certifying Authority is the State Treasury, and the Audit Authority is the Directorate General for Audit of European Funds.

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

Research institutes, such as the National Adaptation Centre of the Geological and Geophysical Institute of Hungary, the Institute for Transport Sciences and the Academy of sciences, contribute to the improvement of the institutional capacity and the knowledge capacity in Hungary. The institutional capacity (human, technical, equipment) relevant to climate change adaptation is currently developing further.

Effective collaboration

Managing Authorities are examining adaptation to climate change and generally cooperate effectively with stakeholders since this is a legal requirement. The [Hungarian Climate Protection Association](#) and the [European Climate Alliance](#) take effective initiatives with the community and social organisations concerned with the climate change problem.

Financial resources

Budgetary resources are available through the European ESI Funds (Széchenyi 2020 Plan), the Swiss Contribution and EEA and Norway Grants.

The [ESI Funds are enabling the development of major projects](#) in the 2014 – 2020 programming period for Hungary. Concerning major projects, by early 2018, there have been 86 Million EUR approved for Network Infrastructures in Transport and Energy; 3 Million EUR for Research and Innovation; 6 Million EUR in Environment Protection & Resource Efficiency; and 6 Million EUR for Climate Change Adaptation & Risk Prevention. The [dataset will be updated regularly](#) to reflect changes in the programme lists and major project notifications.

According to the [ESIF-viewer](#), Hungary is planning investments of 27.7 Billion EUR. Projects under the Thematic Objective 5 on promoting climate change adaptation, risk prevention and management will be receiving 891 Million EUR, with an additional 3 372 Million EUR approved for Network Infrastructures in Transport and Energy (Thematic Objective 7); 2 290 Million EUR in Environment Protection & Resource Efficiency (Thematic Objective 6); and 397 Million EUR for Information and Communication Technologies (Thematic Objective 2). The shares within these Thematic Objectives that may relate to climate adaptation are unknown.

The European Commission and Switzerland signed a bilateral agreement on 27 February 2006 on the [Swiss Contribution](#) established by the Swiss government. In accordance with the Agreement, Hungary received a funding of more than 130 Million Swiss Francs under the programme, and supported 39 projects until 2017. The Swiss Contribution grants funding in the following four priority areas: 1) Security, stability, reform; 2) Environmental protection and infrastructure; 3) Support of the private sector; 4) Human resource and social development.

The [EEA and Norway Grants](#) have contributed 153.3 Million EUR between 2009 and 2014 in three key areas of support, namely 1) Strengthening civil society, 2) Increasing competitiveness of green enterprises, and 3) Adapting to climate change. For adaption to climate change, the partner had been the Norwegian Directorate for Civil Protection, which contributed 7 Million EUR, or 4.5% of the total. The total allocation for the period 2014 – 2021 is increased to 214.6 Million EUR, while the [key support areas in the latest programming period](#) have also increased to five, one of which is on Environment, Energy, Climate Change and Low Carbon Economy that includes a sub-programme on Climate Change Mitigation and Adaptation.

4. SECTOR OVERVIEW

4.1. Introduction

Since 2014, the requirements for major projects to obtain ESIF funding³ demand that project applications integrate climate change considerations⁴, 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')
- 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](#)

³ http://ec.europa.eu/regional_policy/archive/projects/major_projects/index_en.cfm

⁴ 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>

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*.⁵

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 extreme weather events, such as extended heatwaves, flooding, heavy rainfall or storm, and landslides amongst others. Extreme weather events are a potential threat to both infrastructure and operation of the transport system.

Road infrastructure

The report [Climate Change and Hungary: mitigating the hazard and preparing for the impacts](#) (2010) outlines the following impacts for the transport sector:

- Milder winter with increased precipitation levels, but with less frost damages to the infrastructure;
- Drier, warmer summer incurring more damages due to heat;
- Decreased flood in spring;
- Increased damages of road, rail and other transport equipment caused by storms.

For the transport sector, the National Climate Change Strategy suggests the following adaptation measures:

- Ensure sufficient sun protection of the infrastructure (tree planting, grassing of tracks);
- Adapt station buildings to extreme weather conditions, and realise the protection of underground tunnels against floods and inundation (raising of flood-prone sections);
- Roads should have asphalt mixture more resistant to heat waves, pavements covered with paving stones, shade, and water-permeable surfaces.

In the ESIF programming period 2014 – 2020, the Integrated Operational Programme for Transport (IKOP) foresees the implementation of 21 major projects. Funds will be allocated to the development and modernisation of the Hungarian motorway infrastructure (projects will be performed on sections of the M0, M1, M2, M30, M35, M4, M6 and M86) as part of the TEN-T network. Renovation, electrification and modernisation projects of existing railway tracks are also planned, together with the reconstruction of railway stations (such as Székesfehérvár and Szombathely stations). Transport infrastructure is funded by the ERDF and the Cohesion Fund.

According to Government Decree 139/2017. (VI.9) on the [Environmental Impact Assessment and the Integrated Environmental Authorisation](#), a climate risk analysis and a risk management plan is to be performed for infrastructure projects.

The Climate Risk Guide and the Detailed Methodological Description, available on the [website of the Széchenyi 2020 Development Programmes](#), can be of use when performing climate risk and vulnerability assessments in the transport sector.

⁵ 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.

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

The main International Airport in Hungary is the Liszt Ferenc International Airport in Budapest. Other (international) commercial airports are situated in Debrecen, Győr-Pér, Pécs-Pogány, Sármellék and Szeged. No specific strategy on making Hungarian airports climate resilient was retrieved from desk study or interviews. But more general materials are available which apply to all types of projects, including airport infrastructure. See section 4.1 for more information.

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 report [Climate Change and Hungary: mitigating the hazard and preparing for the impacts](#) (2010) does not address the broadband sector. Climate adaptation is neither mentioned in the [National Infocommunication Strategy 2014-2020](#).

The authority with primary responsibilities in the broadband sector for infrastructure, disaster risk and climate data is the [National Directorate General for Disaster Management](#).

The ESI Funds for the 2014-2020 programme aims to support investments in the Next Generation Access high-speed broadband networks up to €241 million. Part of the broadband budget will be spent via various financial instruments. For the 2014-2020 period, financial resources from the [Economic Development and Innovation Operational Programme](#) will support the expansion of ICT networks and the expansion of high speed connections ([Performing tasks related to the preparation and implementation of broadband developments](#)).

According to Government Decree 139/2017. (VI.9) on the [Environmental Impact Assessment and the Integrated Environmental Authorisation](#), a climate risk analysis and a risk management plan is to be performed for infrastructure projects.

The main resources in the broadband sector that are of use to perform climate risk and vulnerability assessments are the Climate Risk Guide and the Detailed Methodological Description, available on the [website of the Széchenyi 2020 Development Programmes](#).

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 civil works (e.g. 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*.⁶

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 report [Climate Change and Hungary: mitigating the hazard and preparing for the impacts](#) (2010) outlines the following impacts relevant to urban development:

- Increased solar exposure incurring higher heat impacts and a broader spread between peak cold / warm temperatures.
- Increased wind loads due to higher frequency of extreme wind events, affecting stability of buildings.
- Change in precipitation patterns and groundwater conditions affecting buildings' foundations.
- Increased frequency of heat island effect.

The authorities with primary responsibilities in the urban development sector for infrastructure, disaster risk and climate data include: [National Directorate General for Disaster Management of the Ministry of the Interior](#), [Hungarian Energy and Utilities Regulatory Office](#), [National Transport Authority](#), and [General Directorate of Water Management](#).

According to Government Decree 139/2017. (VI.9) on the [Environmental Impact Assessment and the Integrated Environmental Authorisation](#), a climate risk analysis and a risk management plan is to be performed for infrastructure projects.

Vulnerability scenarios are therefore established during the initial preparatory phase of projects in order to address relevant risk adaptation measures: enlarging drainage systems, modernising power supplies, etc.

Hungary has taken steps towards sustainable and resilient cities that are adapted to climate change. Significant information can be found in the publication [Climate-Friendly Cities – The Handbook on the Tasks and Possibilities of European Cities in Relation to Climate Change](#).

The Climate Risk Guide and the Detailed Methodological Description, available on the [website of the Széchenyi 2020 Development Programmes](#), can be of use when performing climate risk and vulnerability assessments of urban development projects.

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.

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. 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 (such as pumping installations), the food system (transport, cooling), transport (electrified vehicles, dynamic traffic information), etc.

The report [Climate Change and Hungary: mitigating the hazard and preparing for the impacts](#) (2010) identifies higher frequency of extreme weather events with potential impact on energy supply.

The [National Directorate General for Disaster Management](#) is the responsible authority for infrastructure, disaster risk and climate data in the energy sector.

During the ESIF Funds 2014 – 2020 programming period, the Environmental and Energy Efficiency Operational Programme is aiming to support investments in the Energy sector by contributing to the financing of projects under different calls. One major project is planned and will consist of the development of the interconnections between the district heating systems of three districts of Budapest (Csepel, Kispest and Kelenföld).

According to Government Decree 139/2017. (VI.9) on the [Environmental Impact Assessment and the Integrated Environmental Authorisation](#), a climate risk analysis and a risk management plan is to be performed for infrastructure projects.

The main resources in the energy sector that are of use to perform climate risk and vulnerability assessments are the Climate Risk Guide and the Detailed Methodological Description, available on the [website of the Széchenyi 2020 Development Programmes](#).

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 an impact on both water quantity and quality. Following the EU Floods Directive 2007/60/EC, Member States prepare Flood Hazard Maps and Flood Risk Maps, which include the history of floods and climate scenarios. Hungary has realised such maps, which are updated every 6 years and uploaded to the [flood hazard and risk maps deliveries database on EIONET](#), as well as the relevant and [flood risk management plans](#). 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.

In Hungary, water management is a priority area for climate adaptation, as the annual precipitation distribution is expected to change, which is of particular importance for natural resources (water, biodiversity, forests) and agriculture. In the field of water management, there are significant resources from national and EU sources for adaptation projects (flood protection and drainage, water retention water management, urban storm water management and drainage).

During the ESI Funds 2014 – 2020 programming period, the Environmental and Energy Efficiency Operational Programme is aiming to support investments in the Water sector by contributing to the financing of projects under different calls. Four major projects are to be implemented, three of which in line with the Vasarhelyi Plan's Further Development (VTT) to develop flood protection infrastructure along the Upper Tisza river, improve flood management in the Lower Tisza region and develop water reservoirs for the river. These projects will directly contribute to the reduction of the impact of climate change.

- [Planning for water management and climate change impacts, IT and monitoring](#)
- [Improving the Infrastructure of Sustainable Water Management](#)
- [Transformation and development of drinking water supply networks](#)
- Rehabilitation of the estuarine section of Mosoni-Danube

A major project is included in the list of projects of EEEOP to develop the long-term treatment, disposal and use of sewage sludge in the municipality of Budapest,

- [Development of sub-systems for pre-treatment, recovery and disposal of municipal waste](#)

The authorities with responsibilities in the water sector for infrastructure, disaster risk and climate data include: [National Directorate General for Disaster Management](#), [Hungarian Energy and Utilities Regulatory Office](#), and [General Directorate of Water Management](#).

According to Government Decree 139/2017. (VI.9) on the [Environmental Impact Assessment and the Integrated Environmental Authorisation](#), a climate risk analysis and a risk management plan is to be performed for infrastructure projects.

The main resources in the water sector that are of use to perform climate risk and vulnerability assessments are the Climate Risk Guide and the Detailed Methodological Description, available on the [website of the Széchenyi 2020 Development Programmes](#).

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 ESI Funds 2014 – 2020 programming period, the Environmental and Energy Efficiency Operational Programme is aiming to support investments in the Waste sector by contributing to the financing of projects under different calls. Two major projects are

included in the list of projects of EEEOP to develop waste management infrastructure in the Central Danube Region:

- [Development of municipal waste collection, transport and pre-treatment systems;](#)
- [Disposal of biodegradable waste from landfills.](#)

According to Government Decree 139/2017. (VI.9) on the [Environmental Impact Assessment and the Integrated Environmental Authorisation](#), a climate risk analysis and a risk management plan is to be performed for infrastructure projects.

The main resources in the waste sector that are of use to perform climate risk and vulnerability assessments are the Climate Risk Guide and the Detailed Methodological Description, available on the [website of the Széchenyi 2020 Development Programme](#).

The primary analytical information on risk and vulnerabilities to the sector is held by the [National Waste Management Directorate](#). The formal authority with primary responsibilities in the waste sector for infrastructure, disaster risk and climate data is the [National Directorate General for Disaster Management](#).

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 transposed 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.

5. CASE STUDIES

5.1. Case studies of climate adaptation projects

Establishing a National Adaptation Geoinformatic system (NAGiS)

| | |
|---------------------|---|
| Project description | The National Adaptation Geo-information System (NAGiS) project is a multi-purpose geo-information system that can facilitate the policy-making, strategy-building and decision-making processes related to the impact assessment of climate change and formulating the required adaptation measures in Hungary. NAGiS may directly support the implementation, supervision and evaluation of the second National Climate Change Strategy, and the implementation and evaluation of the Environment and Energy Operational Programme |
| Photograph | n/a |

| | |
|--|---|
| Budget | €1.6 million |
| Climate Change Vulnerability and Risks | N/A |
| Climate change adaptation measures | <p>The three main parts of the NAGiS are:</p> <ul style="list-style-type: none"> • Map-visualization system (with a resolution of 10×10 km, containing hundreds of layers which show the way different aspects of climate change can affect certain areas of the country); • Database (GeoDat) containing the calculation results based on modelling (exposure, sensitivity, expected impact, adaptive capacity and vulnerability) • Meta-database facilitating navigation through different kinds of information (a sort of "data-map" about what to find and where). |
| Good practice | <p>The most important project outputs are scalable and replicable:</p> <ul style="list-style-type: none"> • Indicators on water regime groundwater level • Three comprehensive databases developed • An effective website • Operational manual of NAGiS |
| Further information | http://nater.mfgi.hu/en |

5.2. Case studies of infrastructure projects which have addressed climate change adaptation

Urban green infrastructure development, preservation, restoring, expanding and management – tool for optimising the experience of living through people, parks and common programmes

| | |
|---------------------|---|
| Project description | <p>Strengthening cooperation at local level in border region concerning:</p> <ul style="list-style-type: none"> • Environmental protection in urban settlements; • Revitalization of cities parks and forest and spreading green infrastructure in cities; • Sanitation of degraded area in cities • Creating measures for environment protection of urban natural environment and preparation of reports and guides; • Cooperation with citizens and awareness-raising; and • Digital cadastre establishment |
|---------------------|---|

| | |
|--|--|
| Photograph | n/a |
| Budget | €2.1 million |
| Climate Change Vulnerability and Risks | No specific vulnerabilities or risks were assessed |
| Climate change adaptation measures | Various soft measures that assist in general adaptations such as the establishing of three nature trail; and improved waste management |
| Good practice | Lays down some basic measures for future adaptive capacity building |
| Further information | http://www.si-hu.eu/start_en/ |

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