



# **Climate change adaptation of major infrastructure projects**

Country Report for Bulgaria

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## Contents

1. INTRODUCTION .....	6
2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK .....	8
3. RESOURCES .....	9
3.1. Data Availability .....	10
3.2. Methodologies .....	10
3.3. Tools .....	11
3.4. Guidance .....	11
3.5. Design Standards .....	12
3.6. System .....	12
3.7. Institutional Capacity .....	13
4. SECTOR OVERVIEW .....	15
4.1. Introduction .....	15
4.2. Transport .....	15
4.3. Broadband .....	16
4.4. Urban Development .....	17
4.5. Energy .....	18
4.6. Water .....	19
4.7. Waste .....	20
5. CASE STUDIES .....	21
5.1. Case Studies of Climate Adaptation Projects .....	21

**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 projects<sup>1</sup> 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 complementary 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 Bulgaria 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 2014 [Climate Change Mitigation Act](#) sets out the responsibility for climate change policy, including adaptation. The Ministry of Environment and Water (MOEW) is responsible for climate change policy covering the period up to 2030 and has initiated the process to develop a National Adaptation Strategy (NAS) and a National Adaptation Plan (NAP), both expected to be finalised in 2018. The [National Expert Council on Climate Change](#) was established following the introduction of the Climate Change Mitigation Act (2014) as an advisory body to the MOEW for the purpose of supporting the minister in implementing climate change policy.

The [National Institute for Hydrology and Meteorology](#) provides weather-related statistical data, whilst the National Statistical Institute (NSI) collects data regarding the costs (in terms of damage to infrastructure and property) resulting from weather-related catastrophic events. The report [Analysis and Assessment of the Risk and Vulnerability of the Bulgarian Economy from Climate Change](#) provides details on climate models and

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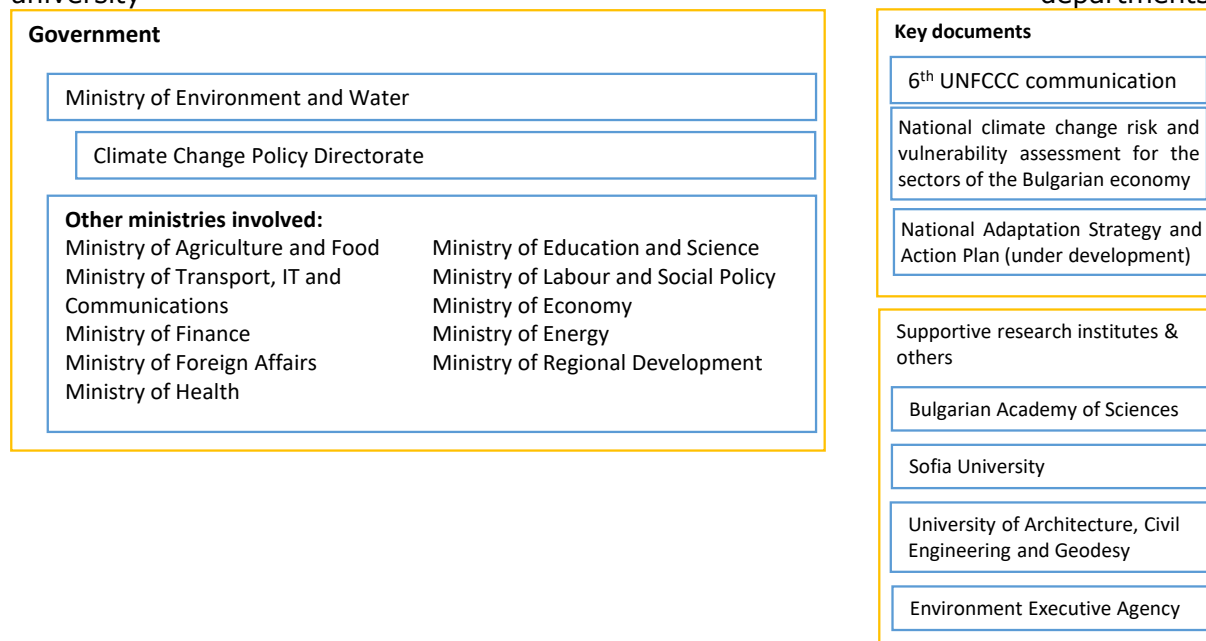
<sup>1</sup> major project: an operation comprising a series of works, activities or services intended in itself to accomplish an indivisible task of a precise economic or technical nature which has clearly identified goals and for which the total eligible cost exceeds EUR 50 000 000 and in the case 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

scenarios for Bulgaria, to assess the risk of natural disasters. The framework document ["National climate change risk and vulnerability assessment for the sectors of the Bulgarian economy"](#) allows integration of climate change risk assessments for different economic sectors and regions within a single framework. The [European Climate Adaptation Platform](#) is considered to be very useful by Bulgarian experts who value its easy access to EU-level policy documents and case studies. A tool available for climate adaptation in Bulgaria is the [Flood Risk Management Plan \(FRMP\)](#), which defines the long-term planning for flood risk reduction. The Operational Programme on [Transport and Transport Infrastructure](#) adheres to the guidelines of the ["Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient"](#) that helps developers of physical assets and infrastructure incorporate resilience to current climate variability and future climate change within their projects. More EU resources are in use, such as the [Guide to Cost-Benefit Analysis of Investment Projects](#), and the publication on [Climate Change and Major Projects](#). The [Bulgarian Institute for Standardization](#), the national standards authority, is collaborating with the European Committee for Standardisation (CEN) and the Electrotechnical Standardisation (CENELEC) that established the [Adaptation to Climate Change Coordination Group \(ACC-CG\)](#) to coordinate standardisation work in the field of adaptation to climate change. Financial resources are found to be available from the [ESI Funds](#), including 77 Million EUR under the Thematic Objective 5 on promoting climate change adaptation, risk prevention and management, from the state budget, and from the EEA and Norway Grants, out of which, 13 Million EUR are allocated for [environment protection and climate change](#).

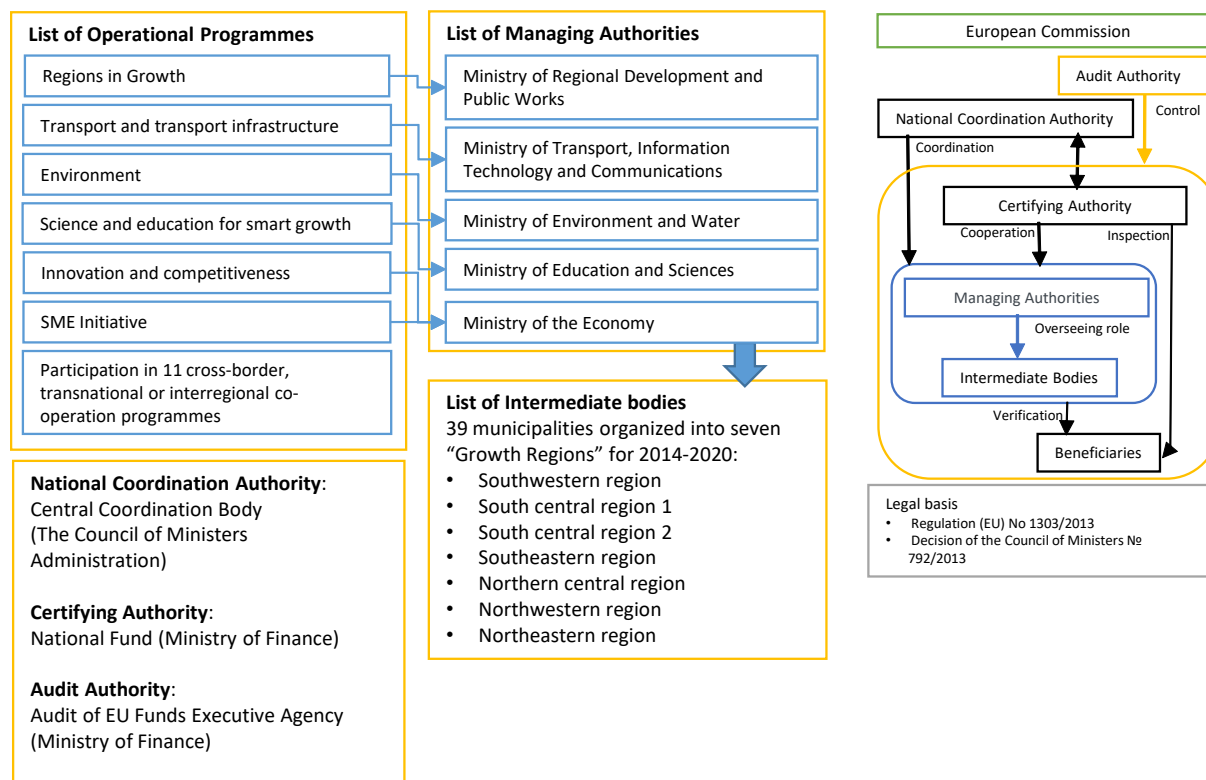
The Ministry of Transport, Information Technology and Communications uses the guiding document of JASPERS [The Basics of Climate Change Adaptation, Vulnerability and Risk Assessment](#) to consider the principles and practices of reducing risk and asset damage in the development of infrastructure projects. The framework document [Risk and Vulnerability Analysis and Assessment of the Bulgarian Economic Sectors to Climate Change](#) was finalised in early June 2014. The framework document [National Climate Change Risk and Vulnerability Assessment for the Sectors of the Bulgarian economy](#) serves as a risk and vulnerability evaluation methodology that could be used within the broadband sector. The Ministry of Environment and Water (MOEW) has developed a [National climate change risk and vulnerability assessment for the sectors of the Bulgarian economy](#). The MOEW provides both a [General Section](#) on urban planning, which describes the basic principles, and a [Specific Section](#) on urban planning which considers ecosystems and biodiversity, energy, tourism, surface waters all of which are relevant to urban development. The energy sector is not involved in the federal or regional authority climate change adaptation plans or initiatives organised by governmental bodies. In accordance with the [National Strategy for the Management and Development of the Water Sector](#), investments in the irrigation sector and in the protection of the water sector generally can be considered as measures to adapt to climate change. Topics relating to water, floods and landslides are covered under the [Operational Programme Environment 2014–2020 funded by Cohesion Funds and the Regional Development Fund](#) where investments are to be directed towards the achievement of "Promoting climate change adaptation, risk prevention and management". The Operational Programme aims to promote investment to address climate specific risks, enhancing disaster resilience and also ensuring the development of disaster management systems. Waste is covered under the Operational Programme Environment 2014–2020 funded by the Cohesion Funds and the Regional Development Fund, where investments need to contribute to the achievement of thematic objective 5 "Promoting climate change adaptation, risk prevention and management". A case study entitled [OrientGate](#) attempts to explore climate risks faced by coastal, rural and urban communities. This project examines cross-boundary cooperation in South East Europe.

## 2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

The Ministry of Environment and Water (MOEW) is responsible for climate change policy. The National Adaptation Strategy and Plan are under preparation and expected to be finalised within 2018. [A draft Proposal for a National Climate Change Adaptation Strategy and Action Plan is available](#). The MOEW has established the National Coordination Council on climate change to ensure efficiency and coordination between competent institutions. Research activities are supported by the National Institute for Hydrology and Meteorology, the National Statistical Institute, the Bulgarian Academy of Sciences and university departments.



In Bulgaria, the ERDF is absorbed through several Operational Programmes managed by the relevant line ministries.





### 3. RESOURCES

This country report has reviewed the currently available resources in Bulgaria for adapting to the impacts of climate change across six key infrastructure sectors. Adaptation to climate change is integrated in the legal basis<sup>2</sup> 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
<b>Data Availability</b>	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.
<b>Methodologies</b>	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.
<b>Tools</b>	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
<b>Guidance</b>	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.
<b>Design Standards</b>	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
<b>System</b>	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
<b>Institutional capacity</b>	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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<sup>2</sup> 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. There are several sources of data available that are useful in the context of climate change adaptation. A [Broad Overview of Country Documents](#) is provided by the Ministry of Environment and Water of Bulgaria (MOEW). The information provided covers relevant documents on climate change adaptation including legislation, strategic documents and implementation of EU climate change policy.

The [National Institute for Hydrology and Meteorology](#) of the Bulgarian Academy of Sciences (NAHM-BAS) monitors climate change and publishes [weather-related statistical data](#).

The [National Statistical Institute](#) (NSI) collects data regarding the costs (in terms of damage to infrastructure and property) resulting from weather-related catastrophic events.

[Operational, Monitoring and Expert Information, Analysis and Assessments](#) are available from the [National Institute of Geophysics, Geodesy and Geography](#) which provides datasets related to seismology, earthquake engineering, geography,, current Earth's crust movements, physics of atmosphere and ionosphere, and environmental magnetism.

The [National climate change risk and vulnerability assessment for the sectors of the Bulgarian economy](#) provides details on climate models and scenarios for Bulgaria, to assess the risk from most natural disasters. The sectors covered by the framework document are agriculture, water, urban environment, energy, transport, construction and infrastructure, ecosystems and biodiversity, human health and tourism. The Analysis and Assessment also focuses on cross-border cooperation on issues related to the impact of climate change.

As part of the [CLAVIER](#) project, which supports research on climate change and its impact on weather patterns, air pollution, extreme events and water resources, evaluations of the economic impact on agriculture, tourism, energy supply and on the public sector are conducted.

The [CECILIA](#) (Central and Eastern Europe Climate Change Impact and Vulnerability Assessment) project provides high resolution simulations covering the region and capturing complex topographical and land use features related to climate change impacts on large urban and industrial areas, including hydrology, water quality and water management.

Bulgaria'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 framework document [National Climate Change Risk and Vulnerability Assessment for the Sectors of the Bulgarian economy](#) serves as a risk and vulnerability evaluation methodology.

The [Methodology for assessing the threat and risk of floods](#), as required by Directive 2007/60/ EC, describes criteria and methods for the risk determination, classification and determination of areas with potential significant flood risk. The [Caussinus-Mestre Method](#) has been applied to climate data in Bulgaria and is generally useful for climate variability and change research.

Though not specific to Bulgaria, the [Driving-Pressure-State-Impact-Respond Methodology](#) has been used for integrating climate change risk assessments for different economic sectors and regions within a single framework.

### **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 as in risk assessments) whilst others are specific to a certain set of circumstances.

The following tools are available:

- [Division of Forecasts](#) of the Department of Hydrology publishes hydrological forecasts for water management and flood prevention
- [Flood Risk Management Plan \(FRMP\)](#) defines the long-term planning for flood risk reduction in the territory of the respective river basin districts. Areas of potential significant flood risk are determined and detailed maps prepared in an appropriate scale to visualise the potential flooding areas for presentation to stakeholders and the public
- [European Climate Adaptation Platform](#) is commonly used by Bulgarian experts who value its easy access to EU-level policy documents and case studies

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 Operational Programme [Transport and Transport Infrastructure 2014–2020](#) adheres to the guidelines of the "[Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient](#)" that helps developers of physical assets and infrastructure incorporate resilience to current climate variability and future climate change within their projects.

The MOEW have published a report from the World Bank Group, "[Financial Management of Risk of Disasters and Insurance Opportunities for Adaptation to Climate Change in Bulgaria,](#)" which provides an overview of the contribution of the insurance sector to the prevention of climate change risks and underlines some of Bulgaria's ongoing disaster risk management efforts. The European Climate Adaptation Platform [Climate-ADAPT](#) contains additional guidance documents.

### **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 [Bulgarian Institute for Standardization](#) (BDS), the national standards authority, is collaborating with the [European Standardisation Organisations](#) 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***

The 2014 [Climate Change Mitigation Act](#), adopted by Parliament in February 2014, sets out the responsibility for Climate change policy, including adaptation.

The Ministry of Environment and Water, in accordance with the Reimbursable Advisory Service Agreement signed with the International Bank for Reconstruction and Development, has initiated the process to develop a National Adaptation Strategy (NAS) and a National Adaptation Plan (NAP). The objectives of the Agreement are to support the MOEW in accessing options to address climate risks across the economy; formulating a Climate Change National Adaptation Strategy and Action Plan for the Republic of Bulgaria, which shall cover the period up to 2030; and strengthening capacity for implementation and cross-sector engagement on climate change adaptation. [A draft Proposal for a National Climate Change Adaptation Strategy and Action Plan is available.](#) The NAS and the NAP are expected to be finalised in 2018.

The framework document [National climate change risk and vulnerability assessment for the sectors of the Bulgarian economy](#) was finalised in June 2014. It serves as a basis for developing the NAS, as well as *ex-ante* conditionality for absorption of EU funds in the current programming period 2014–2020. The National Risk Assessment is undertaken in line with thematic *ex-ante* conditionality 5.1 of the Multiannual Financial Framework, according to which, national or regional risk assessments for disaster management need to be taking into account climate change adaptation. The [National Strategy for Disaster Risk Reduction](#) was adopted in 2014 – it analyses the current situation with regard to specific risks, including earthquakes, floods, landslides, forest fires, storms, snowfall and extreme temperatures. The [National Programme for Disaster Protection 2014–2018](#) includes national and regional risk assessments in national and regional plans for disaster protection.

The MOEW is examining the role of insurance for disaster risk reduction and, with the financial and technical support of the World Bank, it has developed the document [Financial disaster risk management and insurance options for climate change](#)

[adaptation in Bulgaria](#), which analyses the role and importance of the insurance sector for the prevention of climate risks and development of adaptation measures.

The national framework for environmental impact assessment has been revised to transpose the new EIA Directive, with aspects on climate change (greenhouse gas emissions, impacts relevant to adaptation) included.

### ***Responsible authorities***

The Ministry of Environment and Water (MOEW) is responsible for climate change policy covering the period up to 2030.

The [National Expert Council on Climate Change](#) was established upon the provision foreseen by the Climate Change Mitigation Act (2014) as an advisory body with the Minister of Environment and Water for the purpose of supporting the minister in implementing the climate change policy, as well as achieving better collaboration between the stakeholders. The Council is, however, mostly concerned with mitigation. Other institutions responsible for the climate policy implementation include the Ministry of Agriculture and Food; the Ministry of Transport, IT and Communications; the Ministry of Finance; the Ministry of Interior; the Ministry of Foreign Affairs; the Ministry of Health; the Ministry of Education and Science; the Ministry of Labour and Social Policy; the Environment Executive Agency, the Ministry of Economy; the Ministry of Energy; the Ministry of Regional Development.

To ensure efficiency and coordination between the different institutions, the MOEW established a National Coordination Council on Climate Change that gathers representatives of government ministries and agencies, at a Deputy-Minister level.

At subnational level, the [Regional Plans](#) for the period 2014–2020 include a section about the region's vulnerability to climate change, and adaptation measures at regional level.

A specific Strategy on Adaptation to Climate Change for the Municipality of Sofia has been developed under the EU funded project "[Transitioning towards Urban Resilience and Sustainability](#)" ([TURAS](#)).

### ***Management of the ESI Funds***

Bulgaria has six national operational programmes, whose managing authorities are the Ministry of Regional Development and Public Works, the Ministry of Transport, Information Technology and Communications, the Ministry of Environment and Water, the Ministry of Education and Sciences, and the Ministry of the Economy. Bulgaria is also participating in 11 cross-border, transnational or interregional co-operation programmes. The intermediary bodies between the Managing Authorities and the Beneficiaries are the 39 municipalities, organized into seven "Growth Regions" for 2014-2020. For the management of the ESI Funds, the National Coordination Authority is the Central Coordination Body, comprised of the Council of Administration Ministers; the Certifying Authority is the National Fund at the Ministry of Finance); and the Audit Authority is the Executive Agency for the Audit of EU Funds at 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***

The institutional capacity (human, technical, equipment) relevant to climate change adaptation is currently developing further, based on emerging legal and policy framework. Budgetary resources are available through the European ESI Funds, and via various development partner project and programmes, particularly of the International Bank for Reconstruction and Development.

The [Bulgarian Academy of Sciences](#) (BAS) is the leading scientific institution in the country and carries out research activities on climate change, examining fluctuations, adaptation of the individual sectors, etc. Climate change is monitored by the [National Institute of Meteorology and Hydrology](#) at the Bulgarian Academy of Science (NIMH-BAS). The [National Institute of Geophysics, Geodesy and Geography](#) at BAS provides operational, monitoring and expert information, analyses and assessments in the field of atmospheric physics.

The Ministry of Environment and Water (MOEW) is taking further actions towards the development of the NAS with the implementation of the project "Climate Change Adaptation Strategy and Action Plan" under the Operational Program "Good Governance" 2014–2020.

### ***Effective collaboration***

The MOEW has established the National Coordination Council on climate change to ensure efficiency and coordination between competent institutions. The main task of the council is to coordinate the activities related to climate adaptation strategy and to assist the MOEW with regard to integrating climate change policy into sectoral policies.

To ensure efficiency and coordination between competent institutions, the MOEW established a National Coordination Council on Climate Change, comprising representatives of government ministries and agencies, at Deputy-Minister level. Its aim is to raise awareness on climate change risks and adaptation options, to strengthen consensus on climate action and to foster climate networks for successful implementation of resilience (and mitigation) measures (including such networks as the Expert Council and Coordination Council), as well as to enhance capacity and integrate adaptation considerations in policies, programs, and investments.

Bulgaria has taken action to secure funding for the development of the NAS under Operational Programme "Good governance" 2014-2020

### ***Financial resources***

The [ESI Funds are enabling the development of major projects](#) in the 2014 – 2020 programming period for Bulgaria. Concerning major projects, by early 2018, there have been 15.5 Million EUR approved for Network Infrastructures in Transport and Energy; 10.2 Million EUR for Low-Carbon Economy; and 8 Million EUR in Environment Protection & Resource Efficiency. The [dataset will be updated regularly](#) to reflect changes in the programme lists and major project notifications.

According to the [ESIF-viewer](#), Bulgaria is planning investments of 7.4 Billion EUR. Projects under the Thematic Objective 5 on promoting climate change adaptation, risk prevention and management will be receiving 77 Million EUR, with an additional 1 449 Million EUR approved for Network Infrastructures in Transport and Energy (thematic objective 7); and 1503 Million EUR in Environment Protection & Resource Efficiency (Thematic Objective 6).

A Memorandum of Understanding on the Implementation of the Financial Mechanism of the European Economic Area was signed between Bulgaria and Iceland, Liechtenstein and Norway (EEA and Norway Grants). The [total allocation for 2014 – 2021 is 210.1 Million EUR](#), out of which, 13 Million EUR are allocated for [environment protection and climate change](#).



## 4. SECTOR OVERVIEW

### 4.1. Introduction

Since 2014, the requirements for major projects to obtain ESIF funding<sup>3</sup> demand that project applications integrate climate change considerations<sup>4</sup>, 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](#)

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*.<sup>5</sup>

### 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 sea-level rise and 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 in Bulgaria. Bulgaria's transport system has been designed, built and operated in accordance with the geographic and climate conditions typical of the country and its constituent regions. The variety of weather patterns in the different parts of the country has made the transport system relatively flexible taking into account both the usual multi-annual weather conditions and the extreme local meteorological phenomena that directly or indirectly affect the functioning of the transport system.

Road and railway transport have a leading role in this system. The assessment of the potential vulnerability of the two types of transport was based on the results of the [PESETA II project](#), which provides an objective view of the potential impact of climate

<sup>3</sup> [http://ec.europa.eu/regional\\_policy/archive/projects/major\\_projects/index\\_en.cfm](http://ec.europa.eu/regional_policy/archive/projects/major_projects/index_en.cfm)

<sup>4</sup> 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>

<sup>5</sup> 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.

change in the different parts of the European continent, including the vulnerability and cost of adaptation to the transport sector.

### ***Transport infrastructure***

The Ministry of Transport, Information Technology and Communications uses the guiding document of JASPERS [The Basics of Climate Change Adaptation, Vulnerability and Risk Assessment](#) to consider the principles and practices of reducing risk and asset damage in the development of infrastructure projects.

The framework document [Risk and Vulnerability Analysis and Assessment of the Bulgarian Economic Sectors to Climate Change](#) was finalized in early June 2014. The sector is addressed based on a system of indicators assessing vulnerability to future climate change for the period 2016-2035. The following documents are also relevant:

- [ORDINANCE No 1 as of 26 May 2000](#) on the design of roads
- [ORDINANCE No 2 as of 29 June 2004](#) for planning and designing of the transport systems of the urbanised territories
- Technical requirements for the railway infrastructure

The resilience of the transport system is to ensure that the design and construction standards take into account the local climate in the different parts of the country.

The [Operational Programme on Transport and Transport Infrastructure 2014–2020](#) (OPTTI) is the main programming document on which Bulgaria receives EU funding for the transport infrastructure development. The following programmes have some climate change adaptation perspective:

- Struma Motorway – Lot 3.1, Lot 3.3 and Zheleznitsa Tunnel
- Construction of “Kalotina – Sofia” Motorway - Lot 1 “Western Arc of the Sofia Ring Road (SRR)”, Phase 2
- Sofia Metro Extension Project: Line 3, Stage I – Section “Vladimir Vazov Blvd. – Centre – Zhitnitsa Str.”
- Modernization of Railway line Sofia-Plovdiv: Section Elin Pelin-Kostenetz

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.

### ***Airport infrastructure***

There are five public airports in the country: in Sofia (state owned), Varna and Burgas (in concession to the private sector), Plovdiv and Gorna Oryahovitsa (owned by the Ministry of Defence).

No materials or information on climate adaptation targeting airport infrastructure specifically was retrieved from interviews or desk study. However, more general documents 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.

Bulgaria has the second-fastest broadband in the world after South Korea and the largest ICT sector in southeastern Europe, which generates 10% of the nation's GDP. The telecommunication sector will not remain unaffected by rising temperatures. The data centers and cable networks are heat-sensitive. Extreme weather conditions might lead to Internet outage and interruption of institutional systems. Currently, responsibility over networks' resilience lies with Internet providers in Bulgaria. As the grid is still partly using overhead distribution lines, it is directly exposed to current weather conditions. No official adaptation measures to climate change are present. However, it is a general best practice for operators to use flood mapping information from environmental agencies to safeguard new planned data centers from flooding. For civil works (including 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 do not take climate change into account. CEN-CENELEC is currently working on adapting a number of EN standards to climate change. See the Final Report of the present study (European Commission, 2018) for more information in the section on *Available resources at the EU level*.<sup>6</sup>

The framework document [National Climate Change Risk and Vulnerability Assessment for the Sectors of the Bulgarian economy](#) serves as a risk and vulnerability evaluation methodology that could be used within the sector. A specific broadband sector framework has yet to be developed though the following design document has some relevance: [ORDINANCE No 35 as of 30.11.2012](#) on the rules and norms for design, construction and commissioning of cable electronic communications networks and the respective infrastructure.

Bulgaria has committed to invest €25.5 million in broadband deployment into the 2014-2020 programme through the European Structural and Investment Funds (EU Funding for Broadband). A further project is the High-speed ICT infrastructure aiming at high quality broadband connectivity in Bulgaria and enhancement the EU Digital Single Market, though this has little relevance to climate change adaptation.

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

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<sup>6</sup> 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.

pilot projects, and can initiate dedicated infrastructure projects to improve their resilience to climate change.

The sector will be more frequently subject to periods of high temperatures in the future, particularly in the big cities due to the technical and functional specificity of the buildings, the lack of thermal insulation, and poor energy efficiency. In consequence, the cities will become "urban heat islands". The cities generate significant greenhouse gases worldwide, hence the production of additional warmth. The high density of buildings and high amount of asphalt streets in Bulgaria, in addition to growing population, increases these effects.

The framework document [Risk and Vulnerability Analysis and Assessment of the Bulgarian Economic Sectors to Climate Change](#) was finalized in early June 2014. The sector is addressed based on a system of indicators assessing vulnerability to future climate change for the period 2016-2035.

A possible measure will be to expand the green areas which, in [Varna](#), are currently insufficient. This could lead to stabilisation of the temperature range, could help the prevention of floods and retain rainfall, and reduce the carbon dioxide emissions. Currently, there is little in place or anticipated in the immediate future concerning adaptation to climate change in the urban development sector in Bulgaria.

The following methodologies are generally useful to the sector:

- The framework document [National Climate Change Risk and Vulnerability Assessment for the Sectors of the Bulgarian economy](#) serves as a risk and vulnerability evaluation methodology
- There is a [General Section](#) which describes the general principles and a [Specific Section](#) which considers ecosystems and biodiversity, energy, tourism, surface waters all of which are relevant to urban development

MOEW, Water Sector refers to [Methodology for assessing the threat and risk of floods, as required by Directive 2007/60/ EC](#) regarding criteria and methods for the risk determination and classification and determination of areas with potential significant flood risk

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 impact 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 a large impact on different sectors due to the increasing dependency on (electric) power provision for all kind of operational systems, such as water supply (pumping installations, etc.), the food system (transport, cooling, etc.), transport (electrified vehicles, dynamic traffic information).

The sector has two main objectives: (i) to reduce industry emissions of greenhouse gases (GHGs) and (ii) to adapt to changes that have occurred or are inevitable. Currently, there is little in place or anticipated in the immediate future concerning adaptation to climate change. The framework document [National Climate Change Risk and Vulnerability Assessment for the Sectors of the Bulgarian economy](#) serves as a risk and vulnerability evaluation methodology. There is a [General Section](#) which describes the general principles and a [Specific Section](#) which considers, among other sectors, 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 an impact 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. 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.

Bulgarian water resources are expected to change in terms of quantity and quality with the gradual increase of atmosphere temperature. Increasing temperatures combined with growing consumption (population and industry) are anticipated to lead to an increased scarcity of the resource. This increasing scarcity could be mitigated though by tackling water leakages (60%), primarily due to the outdated water infrastructure. Achieving the necessary improvements will require a substantial amount of investment in the renewal of the infrastructure and in the expansion of water purification and wastewater treatment plants.

The Ministry of Environment and Water (MOEW) has to develop detailed strategic action plans with measures for countering increased risks due to lower rainfall levels, less snow, less river water sourced from snowmelt and higher winter temperatures. In accordance with the [National Strategy for the Management and Development of the Water Sector](#), investments in the irrigation sector and in the protection of the water sector generally can be considered as measures to adapt to climate change. Topics relating to water, floods and landslides are covered under the [Operational Programme Environment 2014 – 2020 funded by Cohesion Funds and the Regional Development Fund](#) where investments are to be directed towards the achievement of “Promoting climate change adaptation, risk prevention and management”. The Vratsa Integrated Water Project - Phase 2 has some climate change adaptation perspective.

In the context of adaptation to climate change, Bulgaria is aiming to establish a [National Real Time Water Management System](#) to ensure better forecasting and early warning, and to implement measures related to flood risk prevention and management solutions, aiming at strengthening river banks (using ecosystem-based solutions), as well as adopting measures for landslide risk prevention and management.

Two useful documents which consider the sector and its need to respond to climate change are:

- [Adaptation of the Bulgarian Water Sector to Climate Change Extremes](#)
- MOEW (2012) [National Strategy for the Management and Development of the Water Sector in Bulgaria. Annex 1, analysis of water use and future needs for water \(In Bulgarian\)](#)

The following tools are also available:

- [Division of Forecasts](#) of the Department of Hydrology publishes hydrological forecasts for water management and flood prevention
- [Flood Risk Management Plan \(FRMP\)](#) defines the long-term planning for flood risk reduction in the territory of the respective river basin districts. Areas of potential significant flood risk are determined and detailed maps prepared in an appropriate scale to visualise the potential flooding areas for presentation to stakeholders and the public

A project for [risk management and flood protection in the cross-border regions of Calarasi and Polski Trambesh in Romania and Bulgaria, respectively](#), will implement a [Flood Forecasting and Early Warning System in Polski Trambesh Municipality](#) and improve the joint risk management in this cross-border region.

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, reuse 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.

Waste is covered under Operational Programme Environment 2014–2020 funded by the Cohesion Fund and the Regional Development Fund, where investments are to be directed, among others, towards the achievement of thematic objective 5 “Promoting climate change adaptation, risk prevention and management”.

The [Executive Environment Agency](#) issued a report in 2011 on the “[Waste management and impact of waste generated on the environment](#)”, which gives targets for waste reduction and recycling. Currently, a [National Waste Management Plan 2014–2020](#) sets targets for recycling levels and treatment of waste. These documents do not address, however, the impact of climate change on the sector, nor do they mention adaptation.

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 (for example, the impact of higher temperature on biofilter performance, aerobic decomposition, etc.). Climate change, however, 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

OrientGate	
Project description	The OrientGate project will foster concerted and coordinated climate adaptation actions across the SEE region. The project will explore climate risks faced by coastal, rural and urban communities; contribute to a better understanding of the impact of climate variability and change on water regimes, forests and agro-ecosystems; and analyse specific adaptation needs in the hydroelectricity, agro-alimentary and tourism sectors.
Photograph	n/a
Budget	EUR 4 777 800
Climate Change Vulnerability and Risks	<p>The principal scope of the project is to convey the up-to-date climate knowledge to policy makers who may best benefit from it, that is urban planners, nature protection authorities, regional and local development agencies, territorial and public works authorities. The principal project results include six pilot studies of specific climate adaptation exercises, a data platform connected to the EU Clearinghouse on Climate Adaptation, capacity enhancing seminars and workshops, working partnership among the hydro-meteorological offices of the SEE countries.</p> <p>No specific climate change vulnerability and risks analyses.</p>
Climate change adaptation measures	No specific climate change adaptation measures
Good practice	Provides basis for an appropriate level of transboundary cooperation
Further information	<a href="http://www.southeast-europe.net/hu/">http://www.southeast-europe.net/hu/</a>



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