



# Climate change adaptation of major infrastructure projects

## Country Report for Croatia

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

Country Report for Croatia

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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 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 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 Croatia 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:** Good practice in adaptation and resilience of infrastructure projects.

### *Country Overview*

The National Adaptation Strategy and Plan are being developed in 2017 / 2018. A working version and a draft version of the National Adaptation Strategy ([Green book](#) and [White book](#)), and of the draft of the [National Adaptation Plan](#) for 2019 – 2023 are available. The responsibility for the climate change policy in Croatia falls within the competence of the Ministry of Environment and Energy. The [Committee for inter-sectoral coordination for policies and measures for mitigation and adaptation to climate change](#) was established in September 2014 by the Croatian Government, with the task to coordinate this, monitor and evaluate climate mitigation and adaptation policies. Local authorities are involved in climate adaptation, and the [City of Zadar](#), participated in the [EU Cities Adapt](#) project, while Daruvar, Pitomača and Kloštar Podravski joined the European Commission's [Mayors Adapt](#) initiative, and the municipalities of Buzet, Labin, Pazin, Poreč, Pula and Rovinj are participating in the [LIFE SEC ADAPT project](#).

The climate adaptation [documents page](#) at the ministry of Energy and Environment includes a [Capacity Building Assessment Study](#), [Information brochure on adaptation to climate change](#), [an overview of current research](#), an [Assessment of vulnerability to climate change](#), and a page on [Climate modelling](#).

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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

Data for climate change adaptation are available from the [Database of Climate Change Indicators](#), the Croatian [Meteorological and Hydrological Service](#), the [Platform for Disaster Risk Reduction](#), and the [Croatian Bureau of Statistics](#). Impact Assessments are available, namely the [vulnerability assessment](#) until 2040 and 2070, the [SEE forum climate change vulnerability assessment](#) (2012), and the aforementioned [Assessment of vulnerability to climate change at the](#) ministry of Energy and Environment.

Methodologies that support climate adaptation are currently being developed in the [National Adaptation Strategy](#), while the Croatian State Water Company is developing a methodology applicable to the water sector. Tools that support climate adaptation include a Regional Climate Model ([RegCM](#)), the [DIVA model](#), and the eRineus heatwave warning system. Following EU requirements [Flood Maps](#) are available. Guidance for the climate adaptation are limited to the [Guidelines for the Development of Disaster Risk Assessment](#) (2014), and EU-level resources are in use for project development, consisting primarily of 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](#). The [Croatian Standards Institute \(HZN\)](#), the national standards authority, is collaborating with the European standardisation organisations and following the work of the [Adaptation to Climate Change Coordination Group \(ACC-CG\)](#). Financial resources are found to be available from the [ESI Funds](#), from the state budget, and by the private sector (including public-private partnerships - PPP).

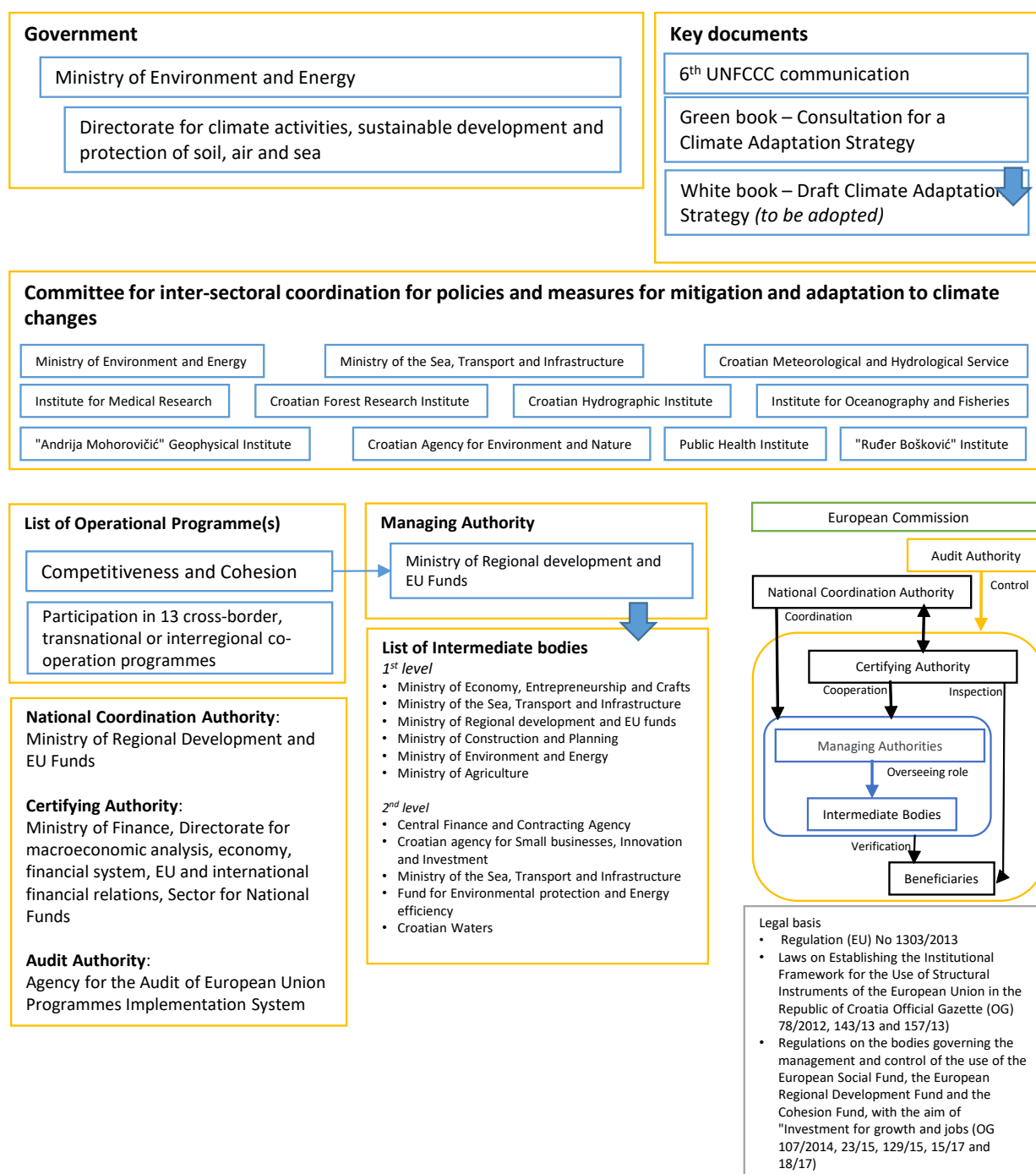
The transport sector has been sporadically included in the draft of the [National Adaptation Strategy](#), and climate adaptation is covered primarily through EU financing and, more recently, EIA requirements. The Croatian Railways Infrastructure Ltd (HŽI), for example has applied climate change vulnerability and risk assessments and have taken into consideration climate change mitigation and adaptation measures for projects financed by the ESI Funds. Broadband infrastructure resources have not been identified, but the sector is required to take climate adaptation into account for major projects. In the urban development sector steps are taken towards climate adaptation as, for example, the [City of Zagreb](#), has carried out an analysis of the anticipated climate change impacts. The energy sector is focusing mostly on climate mitigation and less on climate adaptation, and during the present study, no sector resources that include climate adaptation were identified. The water sector is presenting a number of initiatives to adapt to climate change. Due to EU Directives there are [River Basin Management Plans \(RBMP\)](#), [flood hazard and risk maps](#) and [flood risk management plans](#). The World Bank supported climate adaptation with studies on a [Water and Climate Adaptation Plan for Sava River Basin, and with the development of the hydrologic model for the Sava river basin](#). Moreover, Croatia participated in the project [Integration of Climate Variability and Change into National Strategies for Integrated Coastal Zone Management](#) funded by GEF and UNEP. The waste sector is currently adapting via EU level initiatives, such as the [Directive 1999/31/EC on the landfill of waste](#), the [Directive 2010/75/EU on industrial emissions](#) (IED) and the [BAT reference document \(BREF\) on Waste Treatments Industries](#).

Case studies of climate adaptation have been conducted in the resent study and are available in the respective country report for Croatia. Dubrovnik Airport, a large reconstruction investment currently being executed, includes in the planning and design phase the consideration of climate change impacts.

## **2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK**

The responsibility for the climate change policy in Croatia falls within the competence of the Ministry of Environment and Energy. The National Adaptation Strategy and Plan are being developed and the Ministry of Environment and Energy published in July of 2017 a Working version of National adaptation strategy ([Green book](#)) for consultation. The Draft

version of the National adaptation strategy ([White book](#)), and the [National Adaptation Plan for 2019 – 2023](#) (draft version) are expected to be finalised and adopted in 2018



The Government of Croatia established an [inter-sectoral and inter-ministerial committee to coordinate adaptation policy](#) in the autumn of 2014. The coordination group, based on the opinions and proposals of a technical working group, makes recommendations on the overall policy and measures for mitigation and adaptation to climate change to the Croatian government, providing support in the implementation of policies and measures to mitigate and adapt to climate change.

In Croatia ERDF is absorbed through one Operational Programme "Competitiveness and Cohesion", managed by the Ministry of Regional Development and EU funds. The Ministry of Environment and Energy (IB level 1) is the relevant Intermediate body for Priority Axis 5 (Climate Change and Risk Management) of the Operational Programme Competitiveness and Cohesion, along with the Fund for Environmental Protection and Energy Efficiency, and Croatian waters (IB level 2). These structures are further supported by line ministries, and



agencies not designated as bodies of the structure but relevant depending on the sector/OP priority i.e. so called sectoral bodies. In the case of Priority Axis 5 (part of the axis dealing with the disaster management) the primary organisation supporting relevant IBs (as well as MA) is State Protection and Rescue Directorate.

### 3. RESOURCES

This country report has reviewed the currently available resources in Croatia 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</b>	The availability of published engineering design standards (i.e. by BSI, DIN, ISO) for infrastructure projects that include sections or

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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

<b>Standards</b>	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.

### **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 [Database of Climate Change Indicators](#) hosted by the Croatian Environment Agency provides information aligned with the methodology and calculation methods of EEA and Eurostat indicators. The Croatian [Meteorological and Hydrological Service](#) publishes monthly, seasonal and annual climate information, drought monitoring data and climate maps. The [Croatian Platform for Disaster Risk Reduction](#) includes a [Disaster Risk Assessment Plan](#) and relevant documents that elaborate the risks of climate change and natural disasters in Croatia with an overview of impact on critical infrastructure.

In the context of the adoption of the climate adaptation strategy the [webpage of the ministry of Energy and Environment](#) includes documents with [an overview of current research](#), an [assessment of vulnerability to climate change](#), and [climate modelling](#).

The [Croatian Bureau of Statistics](#) (CBS) is the national statistics authority and maintains a database of statistics relating to Croatia's economy, society and environment. The exact content of these databases was not examined in the context of the present study.

The [6<sup>th</sup> National Communication to the UNFCCC](#) (2014) includes information on observed climate change (precipitation, dry and wet spells, etc.), outlines climate change scenarios and discusses the impact and adaptation to climate change by sectors (namely: water, forestry, agriculture, biodiversity, etc.). The [Assessment of Costs of Sea Level Rise in the Republic of Croatia including costs and benefits of Adaptation](#) (2008) provides results on flooding and coastal erosion as well as an estimation on housing and tourism facilities along Croatian coast. The [SEE forum issued a climate change vulnerability assessment](#) (2012) that identifies the impacts for agriculture, health, tourism, and energy by conducting vulnerability assessments for each sector.

Climate modelling was conducted to inform the National Adaptation Strategy. [Climate simulations until the end of the century have been done on 50 km and 12.5 km horizontal resolution](#), using regional climate model (RegCM) and RCP4.5 and RCP8.5 scenarios. Beside the Reports on the results of the climate modelling, complete modelling data available to interested stakeholders. Taking into account obtained climate projections until 2040 and 2070, [vulnerability assessment](#) was carried out, including economic, social and environmental impacts in the vulnerable sectors.

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**

Croatia's own methodologies and guidance are currently being developed in the [National Adaptation Strategy](#) which will provide general framework for important sectors. Croatian Waters (Hrvatske vode) the Croatian State Water Company, is developing a methodology applicable to the water sector. The Dynamic Interactive Vulnerability Assessment (DIVA) method, offers a cost assessment of climate variability and change and has been used in the context of the [ClimVar Project](#) in which Croatia was involved on the integration of climate variability and change into national strategies for the implementation of the ICZM Protocol in the Mediterranean.

### **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 Croatian Meteorological and Hydrological Service uses a Regional Climate Model ([RegCM](#)), developed by the International Centre for Theoretical Physics to provide information about climate change in Croatia. Croatia is a part of [EURO-CORDEX initiative](#) (European Coordinated Downscaling Experiment) which seeks to connect parties working on climate change. It is likely to expedite the number of simulations to understand and address climate change concerns. [Branković et al \(2013\)](#) have made use of these models to evaluate climate change on the Croatian Adriatic. The [DIVA model](#) is used in Šibenik-Knin County and is a global-macro model ideal for long coastlines. It measures the effects of rise in sea level and calculates the surfaces which may be flooded. eRineus is a heatwave warning system that is being developed by a private company in order to connect institutions of public health in Croatia. This system is currently in its beta phase and there is no official website.

The European Climate Adaptation Platform [Climate-ADAPT](#), has a dedicated tools section that is frequently updated. In addition, The Floods Directive requires Member states to prepare Flood Hazard Maps and Flood Risk Maps. Croatia has such maps, which are updated every six years and uploaded to the [Flood Hazard and Risk Maps Deliveries Database on EIONET](#).

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. [Guidelines for the Development of Disaster Risk Assessment](#) (2014) issued by the State Protection and Rescue Directorate note the following risks, which are relevant for infrastructure and intensified through climate change: open fire, floods caused by outbreaks of land water bodies, extreme temperatures, snow and ice, epidemics and pandemics. [European Commission Guidelines for Project Managers](#) to support developers of physical assets and infrastructure to ensure robustness of weather climate changes within their projects.

Ministry of Environment and Energy translated to Croatian the European Commission Non-paper guidelines for project managers, together with Guidelines on integrating climate change and biodiversity in EIA and Guidelines on integrating climate change and biodiversity in SEA.

### **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 [Croatian Standards Institute \(HZN\)](#), 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).

According to the [HZN](#), there have been no national design standards specifically for climate change adaptation of infrastructure projects. HZN is expecting the outcomes of the Adaptation to Climate Change Coordination Group set up by CEN and CENELEC, which has issued the CEN-CENELEC Guide 32 'Guide for addressing climate change adaptation in standards'.

Physical Planning Act OG 153/13, 65/17 regulates the urban development around coastal area to reduce flood risks, prevent and mitigate the adverse consequences caused by high sea level.

### **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) and more generally with resilience. A 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.

#### ***Institutional and legal framework***

The Air Protection Act (Official Gazette [130/2011](#), [47/2014](#), [61/2017](#)) prescribes the development and adoption of the National adaptation strategy for the period up to 2040 with a view to 2070 and an Action Plan. It recognises sectors exposed to climate change impacts and prescribes the obligation of undertaking adaptation measures in those identified sectors<sup>3</sup>.

The National Adaptation Strategy and Plan are being developed at the time of writing. The Ministry of Environment and Energy published in July of 2017 a Working version of National adaptation strategy ([Green book](#)). The Draft version of the National adaptation strategy ([White book](#)), together with a draft of the [National Adaptation Plan](#) for 2019 – 2023. Additional relevant documents ([Capacity Building Assessment Study](#), [Information](#)

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<sup>3</sup> hydrology and water resources; agriculture; forestry; biological diversity and natural inland ecosystems; biological diversity and marine ecosystems; coast and coastal area; tourism, and human health

[brochure - Republic of Croatia and adaptation to climate change](#) , [An overview of current research](#), [Assessment of vulnerability to climate change](#) , [Climate modelling](#)) can be found at the [documents page](#) of the dedicated climate adaptation webpage of the ministry of Energy and Environment.

The National Adaptation Strategy (NAS) and the Adaptation plan is being developed within a [project funded through the EU Transition facility](#). The project started in May 2016 and it is expected that the Strategy will be finalised and adopted in 2018, following the regular procedure – adoption by the Government and placing into the adoption procedure in the Parliament.

The NAS focus is on several sectors<sup>3</sup> of action, identified as most vulnerable to climate change impacts. It includes information on expected climate change, expected impact in different sectors, it proposes a set of measures for each sector and gives estimation of financial resources and possible funding sources. Further information, including legislation, strategic documents and EU Strategy on Adaptation to Climate, are found in the [climate adaptation page of the Ministry of Environment and Energy](#).

The Air Protection Act also requires that counties, the city of Zagreb and other cities adopt a programme for air and ozone layer protection and climate change mitigation and adaptation. Certain activities are underway at the city level, as 11 cities and municipalities are signatories to the Covenant of Mayors for Climate and Energy with adaptation commitments. Additionally, the City of Zagreb carried out an analysis of the anticipated climate change effects. A set of 47 measures was defined with the goal to improve Zagreb's resilience to climate change. They include measures for protection against heat waves (buildings and green infrastructure), water management, adaptation of transport infrastructure, improvement of energy infrastructure and landslides.

The [Water Act](#) (OG 153/09, 130/11, 56/13 and 14/14) prescribes the obligation to consider climate change within the process of development of flood risk management plans and the River basin management plan

In 2015, the Government adopted a Decision on the [Disaster Risk Assessment for the Republic of Croatia](#) . The development of Risk Assessment was coordinated by the [State Protection and Rescue Administration \(DUZS\)](#), whereby the DHMZ was an active partner in the preparation of multiple-selected risks (drought, flood, open-type fire, extreme temperature) and snow and ice risk coordinator. 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.

Amendments to the regulation on Environmental Impact Assessment were adopted to transpose the revised EIA Directive in January 2017. Climate change adaptation considerations have been included.

Activities to promote adaptation to climate change are defined within the framework of the [Operational Programme - Competitiveness and cohesion](#) for the EU financial period 2014 – 2020 (thematic objective Promoting climate change adaptation, risk prevention and management).

### ***Responsible authorities***

The responsibility for the climate change policy in Croatia falls within the competence of the Ministry of Environment and Energy.

Local authorities are involved in climate adaptation. The [City of Zadar](#), was one of 21 cities across Europe that was selected for participation in the [European Commission project "EU Cities Adapt"](#) (January 2012 – June 2013), during which Vision of climate change readiness and draft Action plan for adaptation to climate change were developed. Three cities (Darugar, Pitomača, and Kloštar Podravski) joined the European Commission's

[Mayors Adapt](#) initiative. Six Croatian municipalities (Buzet, Labin, Pazin, Poreč, Pula and Rovinj) that are participating in the [LIFE SEC ADAPT project](#) together with municipalities from Italy, Spain and Greece, signed the new Covenant of Mayors for Climate and Energy. As a part of the preparation of the Plan on the social, economic and environmental aspects of the life and development of the [City of Zagreb](#), an analysis of the anticipated climate change effects was carried out.

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

Croatia has set up the Operational programme on Competitiveness and Cohesion, whose Managing Authority is the Ministry of regional Development and EU Funds. Croatia is also participating in 13 cross-border, transnational or interregional co-operation programmes.

The Ministry of Environment and Energy (IB level 1) is the relevant Intermediate body for Priority Axis 5 (Climate Change and Risk Management) of the Operational Programme Competitiveness and Cohesion, along with the Fund for Environmental Protection and Energy Efficiency, and Croatian waters (IB level 2). These structures are further supported by line ministries, and agencies not designated as bodies of the structure but relevant depending on the sector/OP priority i.e. so called sectoral bodies. In the case of Priority Axis 5 (part of the axis dealing with the disaster management) the primary organisation supporting relevant IBs (as well as MA) is State Protection and Rescue Directorate.

The other 1<sup>st</sup> Level Intermediary Bodies are the Ministry of Economy, Entrepreneurship and Crafts; the Ministry of the Sea, Transport and Infrastructure; the Ministry of Regional development and EU funds; the Ministry of Environment and Energy; the Ministry of Construction and Planning and the Ministry of Agriculture. The second level Intermediary bodies are the Central Finance and Contracting Agency; the Croatian agency for Small businesses, Innovation and Investment; the Ministry of the Sea, Transport and Infrastructure; the Fund for Environmental protection and Energy efficiency; the Croatian Waters.

Project developers for EU-funded projects submit project applications directly to the managing authority, the Ministry of Regional Development and EU Funds, or to the intermediary bodies in the Ministry of Environment and Energy (for the water and waste management projects), and the Ministry of Sea, Transport and infrastructure (for the transport projects).

In the ESIF system, the National Coordination Authority is the Ministry of Regional Development and EU Funds, the Certifying Authority is the Directorate for macroeconomic analysis, economy, financial system, EU and international financial relations at the Sector for National Funds at the Ministry of Finance. Finally, the Audit Authority is the Agency for the Audit of European Union Programmes Implementation System.

### ***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 2017 [Assessment of the need to strengthen capacities for adaptation to climate change](#) is examining the required capacities and offers an overview of the existing one institutional framework and the experts working in the competent bodies on policies related to the impact of climate change at the national and local level. The study identifies deficiencies, barriers to technology transfer, vulnerability determination and application of adjustment measures, and involved stakeholders. It proposes a strengthened capacity and



organizational solutions at national and local level to improve co-operation between different levels of management (vertical coordination) and co-operation between bodies of different competences and experts at the national level (horizontal coordination).

The Ministry of Environment and Energy was partner in the project [CroAdapt2](#), which supported activities for awareness raising at local and regional level, in the context of the forthcoming development of climate change adaptation strategy. The Project resulted in the [Informative brochure](#), [Guidelines for Croatian regional and local decision makers](#), and an update of the [website of the Ministry of Environment and Energy](#). In the context of the development of the NAS, a series of 10 workshops for experts in different sectors is being carried out (regarding climate modelling, using the results of modelling and scenarios for impact and vulnerability assessment, assessing measures, etc.). A series of seven [workshops](#) is aimed to civil servants at national and local level.

### ***Effective collaboration***

The [Committee for inter-sectoral coordination for policies and measures for mitigation and adaptation to climate change](#) was established in September 2014 by the Croatian Government, with the task to coordinate this complex policy, monitor and evaluate implementation and planning of policies and measures for mitigation and adaptation to climate change, provide opinions on planning and strategic documents, etc. It consists of two groups: coordination (minister and assistant ministers) and technical group (representatives from ministries, scientific institutions, academia and other dealing with climate change and adaptation issues).

The [CroAdapt](#) Project provided advisory and technical support to the Croatian Ministry of Environmental and Nature Protection (now Ministry of Environment and Energy) in intensifying the national dialogue on climate adaptation. Project results include policy recommendations for development of adaptation strategy and action plan, [regional adaptation guidelines for policy-makers](#) and a [brochure on climate adaptation designed for the general public](#).

The Managing Authority for the OP Competitiveness and Cohesion, covering CF and ERDF, suggests that, in broad sense, the competent public institutions are understaffed. In the context of project preparation within OPCC framework it cannot be concluded that this poses any threat or weakness. What is of greater significance, referring to project preparation within OPCC framework, is the lack of experience in assessing climate change impact and adaptation measures on the specific projects since this is a relatively new issue.

Amendments to the regulation on environmental impact assessment were adopted to transpose the EIA Directive in January 2017. Climate change adaptation considerations have been included.

### ***Financial resources***

The implementation of long term climate change measures will be funded from the state budget, the European Structural and Investment Funds (ESI Funds) and by the private sector (including public-private partnerships - PPP).

The [ESI Funds are enabling the development of major projects](#) in the 2014 – 2020 programming period for Croatia. Concerning major projects, by early 2018, there have been 12 Million EUR approved for Network Infrastructures in Transport and Energy; 33 Million EUR in Environment Protection & Resource Efficiency; 6 Million EUR for Research and Innovation; 3 Million EUR for Information and Communication technologies. The [dataset will be updated regularly](#) to reflect changes in the programme lists and major project notifications.

According to the [ESIF-viewer](#), Croatia is planning investments of 8.6 Billion EUR. Projects under the Thematic Objective 5 on promoting climate change adaptation, risk prevention

and management will be receiving 262 Million EUR, with an additional 1322 Million EUR approved for Network Infrastructures in Transport and Energy (Thematic Objective 7); 2056 Million EUR in Environment Protection & Resource Efficiency (Thematic Objective 6); and 308 Million EUR for Information and Communication Technologies (Thematic Objective 2). The shares within these Thematic Objectives that may relate to climate adaptation are unknown.

Financial resources received from the auctioning of emission allowances for the period from 2014 to 2016 are paid into the Environmental Protection and Energy Efficiency Fund. A part of collected funds was allocated for applied research and development related to climate change adaptation in line with the [Programme for stimulating research and development activities in the area of climate change for the period 2015 – 2016](#).

The implementation of long term climate change measures will be funded from the state budget, the European Structural and Investment Funds (ESI Funds) and by the private sector (including public-private partnership - PPP).

#### **4. SECTOR OVERVIEW**

Since 2014, the requirements for major projects to obtain ESIF funding<sup>4</sup> demand that project applications integrate climate change considerations<sup>5</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>6</sup>

##### **4.1. 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

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<sup>4</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>5</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>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.



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 Croatia.

### ***Road infrastructure***

The Ministry of Environment and Energy has prepared a draft of the [National Adaptation Strategy for the period up to 2040](#) with a view to 2070, however, the transport sector has been only sporadically included.

The topic of climate change adaptation (and mitigation) in the transport sector has been covered primarily through EU financing and, more recently, EIA requirements. Any Major Project application for EU funding in the financing period 2014-2020 requires climate change adaptation and mitigation, and disaster resilience to be addressed.

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

### ***Railway infrastructure***

According to the Croatian Railways Infrastructure Ltd (HŽI ), the following projects which are planned to be financed through EU funds, have applied climate change vulnerability and risk assessments and have taken into consideration climate change mitigation and adaptation measures:

- Upgrade and Construction of Second Track on Railway Line Section Križevci – Koprivnica – state border
- Reconstruction and Electrification of Zaprešić - Zabok Railway Section
- Upgrade and electrification of railway M601 Vinkovci-Vukovar

No railway specific guides or documents on climate adaptation have been retrieved from desk study or interviews. But more general materials are available which apply to all types of projects, including railway infrastructure. See section 4.1 for more information.

### ***Airport infrastructure***

The Republic of Croatia has seven international airports (Zagreb, Split, Dubrovnik, Zadar, Osijek, Rijeka and Pula) and three national airports (Brač, Mali Lošinj and Osijek) for commercial air transport. For Dubrovnik Airport, a large investment project for reconstruction and development is currently being executed. In the planning and design phase, climate change effects have been considered. See section 5 Case studies for more information.

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

## ***4.2. 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.

With regard to EU funding of Croatia's broadband infrastructure, there is comprehensive guidance provided in '[European Funding for Broadband 2014 – 2020](#)'. This report states that European Structural and Investment Funds are the largest EU public funding source that supports broadband investment. The report also states that the 2014 - 2020 total budget for broadband deployment in Croatia is approximately €203 Million.

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*.<sup>7</sup>

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

### **4.3. 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.

As a part of the preparation of the Plan on the social, economic and environmental aspects of the life and development of the [City of Zagreb](#), an analysis of the anticipated climate change effects was carried out. After a thorough intersectoral analysis, which involved a large number of experts from different areas, a set of 47 measures was defined, with the goal to improve Zagreb's resilience to climate change. They include measures for protection against heat waves, measures for response to heat waves (buildings and green infrastructure), and water management measures, measures for adaptation of transport infrastructure, measures for improvement of energy infrastructure and measures for mitigation of climate change effects on landslides.

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

### **4.4. Energy**

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

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<sup>7</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.

During the present study, no known sector resources that include climate adaptation were identified, or suggested by the interviewed national authorities. But more general materials are available which apply to all types of projects, including energy infrastructure. See section 4.1 for more information

#### **4.5. 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 obliged 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.

In the Croatia water sector, the data used relies on several data sources: the National Water Management Plan (2016-2021), Croatian Waters, the Croatian Central Bureau of Statistics (Statistical Yearbooks) and EUROSTAT.

The Floods Directive requires Member states to prepare Flood Hazard Maps and Flood Risk Maps. Croatia has produced such maps, which are updated every six years and uploaded to the [flood hazard and risk maps deliveries database on EIONET](#). Croatia is participating in transboundary water management in International Sava River Basin Commission which started process of drafting Adaptation Strategy for this Basin. The World Bank prepared some documents in 2015 relevant for climate adaptation. These include:

- [Water and Climate Adaptation Plan for Sava River Basin](#)
- [Development of the hydrologic model for the Sava river basin](#)

Croatia participated in the project "[Integration of Climate Variability and Change into National Strategies for Integrated Coastal Zone Management](#)" funded by the Global Environment Fund (GEF) and the United Nations Environment Programme (UNEP), which was implemented in the Mediterranean countries. Croatia (along with Tunisia) was selected as a pilot area for two activities:

- (1) The estimate of the possible costs of climate variability and change for the entire Croatian Adriatic coast, using the globally recognized [DIVA methodology](#) (Dynamic Integrated Vulnerability Assessment).
- (2) Development of the Integrated coastal zone management plan (ICZM) with a special emphasis on climate variability and change, using the "[Climagine participatory method](#)". In April 2016, [Integrated coastal zone management plan for the Šibenik-Knin county](#) was adopted, as the first plan of this kind in Croatia.

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

#### **4.6. Waste**

Project investments in the waste sector are related to separate collection infrastructure, re-use and recycling infrastructure, energy recovery facilities and closure of landfills.

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

During the present study, no known sector resources that include climate adaptation were identified, or suggested by the interviewed national authorities. Nevertheless, waste infrastructure needs to comply with environmental legislation, such as the Landfill Directive and the Industrial Emissions Directive.

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

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

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

## 5. CASE STUDIES

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

Dubrovnik Airport	
Project description	The Dubrovnik Airport Development Project is a project to meet future air traffic demands in the Dubrovnik region and to improve the safety, technical and operational standards and efficiency of the airport. The project includes construction and upgrading of the airside facilities comprising the runway, taxiways, aprons, strip, fuel farm, ground handling facilities, reconstruction and development of the passenger terminal complex, airport rescue and firefighting facilities, administration facilities, water supply, waste water and waste management facilities, energy supply facilities as well as development of the landslide facilities comprising access roads and car/bus parking.
Photograph	N/A
Budget	EUR 225.3m
Climate Change	A) Increase in average temperature levels and temperature extremes can cause the degradation of the take-off

Vulnerability and Risks	<p>runway</p> <p>B) Higher frequency of high volumes of rain can damage the runway infrastructure, and cause peak capacity at the rainwater draining system</p> <p>C) Increase in extreme thunderstorms can cause damage to the terminal building, to navigation equipment and signalization</p>
Climate change adaptation measures	<p>A) Increase in average temperature levels and temperature extremes and degradation of take-off runway: the study didn't show temperature to have an impact on the runway, so no actions were taken in regards to that.</p> <p>B) Higher frequency of high quantities of rain</p> <ol style="list-style-type: none"> <li>1. Damage of the take-off runway and other infrastructure: materials should be used that can cope with high quantities of rain without getting damaged.</li> <li>2. Difficulty for the rainwater draining system to sustain higher quantities of rain: a new draining solution is needed which will store water and then slowly let it into the environment. This should allow for the facilities to be unaffected by the high rain quantities.</li> </ol> <p>C) Increase in extreme thunderstorms</p> <ol style="list-style-type: none"> <li>1. Damage to the terminal building, navigation equipment and signalization: Dubrovnik Airport is made to withhold winds of up to 200 km/h. The calculation of bearing capacity needs to be adapted.</li> </ol>
Good practice	<p>This project contains a well-executed environmental impact study, risk and vulnerabilities assessments as well as proposed adaptation measures.</p>
Further information	

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