



Climate change adaptation of major infrastructure projects

Country report for Austria

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

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

1. INTRODUCTION

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

This report for Austria 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;
- **Case studies:** Current practice in adaptation and resilience of infrastructure projects.

Country Overview

Austria adopted its [National Adaptation Strategy](#) and its [National Action Plan](#) in October 2012 and the Bundesländer have either developed regional adaptation strategies, integrated adaptation and mitigation strategies, or they have integrated adaptation into existing climate mitigation strategies. The responsible institutions, organisations and groups for climate adaptation are the [Federal Ministry of Agriculture, Forestry, Environment and Water Management](#), the National Climate Protection Committee, the Interministerial Committee to Coordinate Measures to Protect Global, and the [Climate Change Centre Austria](#).

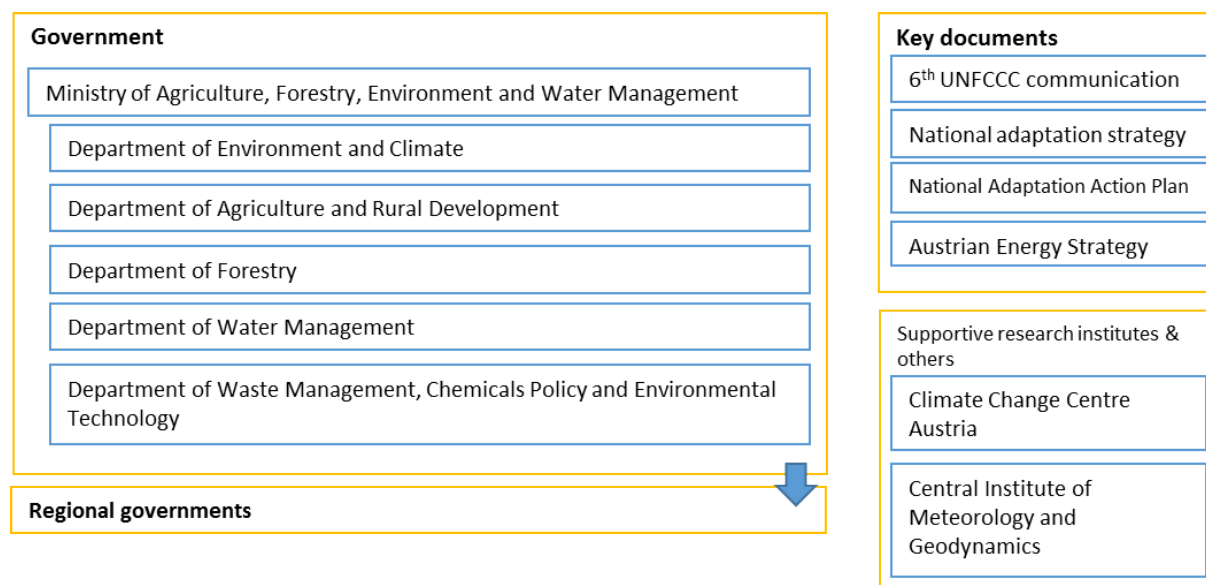
The main website for climate adaptation is [Klimawandelanpassung.at](#), while general information is available on the [webpage](#) of the Federal Ministry of Agriculture, Forestry, Environment and Water Management. Data for Climate Change Adaptation are available from Climate Change Centre Austria, from the [Central Institute for Meteorology and Geodynamics](#), and the [Centre for Natural Hazards](#). Impact Assessments are available, namely the [Austrian Assessment Report Climate Change 2014: Information and](#)

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

[materials](#), and the [Environmental Impact Assessment Satisfying Adaptation Goals Evolving from Climate Change](#). Methodologies that support climate adaptation are available from [Klimawandelanpassung](#) that contains a [Handbook on Methods and Tools for Adaptation to Climate Change - a handbook for provinces, regions and cities](#), from the [COIN](#) project, and from the project [PACINAS](#). Tools that support climate adaptation include an [evaluation tool](#) (SALDO), the demonstration of the [feasibility of climate-adapted](#) infrastructure, and [Flood Maps](#). Guidance for the climate adaptation of projects is accessible from the Institute for Meteorology ([ENVISAGE-CC](#)), from the [Strategic support for integrating climate change into project planning](#) for large projects and from the project [SPECIFIC](#). EU-level resources in use are primarily 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](#). Financial resources are found to be available from the [ESI Funds](#) and from the Climate and Energy Fund ([KLAR!](#))

The [transport sector](#) is highly exposed to climate change. The [Natural hazards radar](#) is an early warning detection system and the [Austrian Federal Railways](#) (ÖBB) has also implemented a nationwide [Meteorological Monitoring System](#). Broadband is addressed in the [Austrian Programme for the Protection of Critical Infrastructure](#) (APCIP). For the urban development sector the [Hazard Zone Plan](#) is a comprehensive assessment of hazards and [Planning tools](#) are used for construction and refurbishment. The energy sector is focusing mostly on climate mitigation ([Austrian Energy Strategy](#), APG [Master Plan \(2009\)](#)), and less on climate adaptation. The water sector is presenting a number of initiatives such as the [Wasserinformationssystem WIS](#), includes information on future provision safeguarding against climate change adaptation, an [early warning system](#), and the study [Klimawandel - Anpassungsstrategien für Österreichs Wasserwirtschaft](#). Austria has an updated [National Water Management Plan](#). The waste sector is a cross-section topic within the [NAP](#) - adopting approaches from both the [Waste Management Act 2002](#) and [Federal Waste Management Plan 2017](#).

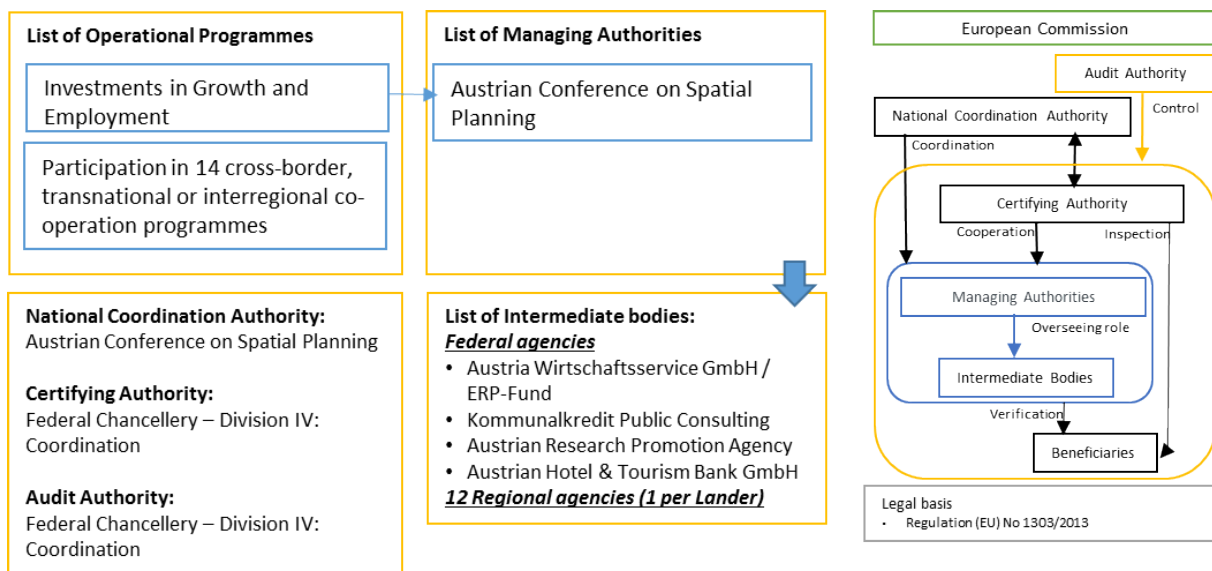
2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK



The [Federal Ministry of Agriculture, Forestry, Environment and Water Management](#) is responsible for key quality-of-life issues and for questions which are essential in creating a sustainable future. Based on the Federal principle, climate change initiatives may only be implemented in close cooperation between the Federal State Government and the Provinces. The [National Adaptation Strategy](#) (NAS) is the nationwide framework for the alignment of necessary adaptation measures. The strategy was adopted in 2012 aims to bring together relevant actors, support cooperative action and facilitate the use of synergies through cooperation whenever possible. It seeks to provide recommendations

for each of the various areas and to identify linkages for all the actors challenged with implementation. In accordance with the precautionary principle, the strategy attempts to lay a foundation for forward-looking action with regard to future climate change impacts and to foster successful implementation.

The [National Action Plan](#) (NAP) is included in the NAS, it focuses on the vulnerability of the respective areas for actions and presents 132 recommendations for adaptation in 14 areas for action. The first progress report on implementing the NAS/NAP was adopted in 2015 and is based on a sound monitoring concept. The results from the progress report show that implementation and mainstreaming of adaptation is increasing in Austria with a different level of progress in the various areas of action. The further evolution of the NAS will incorporate findings of the first progress report, as well as new scientific/practical insights, such as the vulnerability of each area for action. A first updated version of the NAS and its Action Plan was approved in November 2017. The National Climate Protection Committee is in charge of adaptation to unavoidable impacts of climate change.



ERDF is absorbed in Austria through the National Operational Programme “Investments in Growth and Employment” managed by the Austrian Conference on Spatial Planning.

3. RESOURCES

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

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

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

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

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

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

General information on climate change is available on the [dedicated webpage](#) of the Federal Ministry of Agriculture, Forestry, Environment and Water Management.

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

The national web portal "[Klimawandelanpassung.at](#)" lists relevant information and knowledge for the 14 focus sectors (see institutional framework diagram), as well as case studies and a database for research projects.

The [NAS](#) references Klimawandelanpassung's [database](#) for current and past projects. It documents adaptation activities from both research and practice. The examples in the database are intended to provide concerned actors (e.g. decision-makers in the administration, citizens) with a variety of ideas and thereby support the successful implementation of adaptation measures in their respective areas of responsibility. It also contains regional climate scenarios for Austria. These regional analyses of global climate models (GCMs) can only be performed for relatively large areas, such as the Alpine region. Data regarding temperature and precipitation are also presented in chapter 5.2. The data are currently not available on an open-source basis, though results show long-term projections to 2050, with multiple scenarios for temperature and precipitation.

In terms of physical climate change-based parameters Central Institute for Meteorology and Geodynamics ([ZAMG](#)) offers a broad range of services, from weather forecasting to climate and earthquake monitoring. The web portal host a database which also stores a large variety of environmental impact assessments, e.g. for industrial activities, highways, waste treatment facilities etc. The [HISTALP](#) database within the web portal is regularly updated and provides monthly temperature, precipitation and sunshine records for the Greater Alpine Region. The Climate Change Centre Austria holds a [database of climate scenarios for Austria \(1971 - 2100\)](#).

Specific projects implemented regionally are usually guided by the Federal province-governing entities in collaboration (see "Legal, Policy and Institutional Framework"), as the climate impact varies strongly due to the geography of the country. The [StartClim](#) web portal offers a database with different regional projects, devoted to projects for climate change adaptation measures to derive data as well as implementing specific measures. The [VIOLA](#) project (Violent Observed Local Assessment) of ZAMG makes it possible to retrieve information about weather events in Austria on a monthly basis.

There are a number of research institutions in Austria that make available information and data relating to climate adaptation, including the Climate Change Centre Austria (CCCA), StartKlim, and the Centre for Natural Hazards ([alpS GmbH](#)).

Austria'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. The Austrian Panel on Climate Change ([APCC](#)) links to the UNFCCC process and after the 5th assessment report, it published the [Austrian Assessment Report Climate Change 2014: Information and materials](#).

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. [Klimawandelanpassung](#) contains a [Handbook](#) ("Methods and Tools for Adaptation to Climate Change - a handbook for provinces, regions and cities") based on a synthesis of existing guidelines for adaptation to climate change, where over 30 manuals and guidelines were analyzed and evaluated with regard to their transferability to conditions in Austria. The [Handbook](#) presents an extensive collection of methods and tools that can assist the responsible

actors in the course of the adaptation process. The methods and tools are designed to help actors identify and overcome potential challenges both now and in the future. The handbook [Methods and Tools for Adaptation to Climate Change: A handbook for provinces, regions and cities](#) covers the essential steps of an adaptation process (Creating a Foundation for Adaptation, Identifying Risks and Finding Solutions, Implementing and Monitoring Actions) and identifies the concrete measures and tools for each phase of the adaptation process. These are provided in form of fact sheets, checklists and guidelines.

Chapter 10 of the [NAS](#) – *'The Status Quo of Adaptation in Austria – Federal State Initiatives'* explains how Austria has already dealt with the issue of adaptation to climate change for a number of years. At Federal level ("Bundesländer"), a variety of initiatives have already been enacted within each State, ranging from research projects to specific measures in individual sectors. The Austrian NAS contains a qualitative vulnerability assessment for nine sectors (i.e. water, tourism, agriculture, forestry, electricity and energy, housing and construction, health, ecosystems and biodiversity and transport/infrastructure).

The "[Environmental Impact Assessment Satisfying Adaptation Goals Evolving from Climate Change](#)" (Envisage-CC) evaluates the impacts of climate change to major infrastructure projects. Environmental Impact Assessments (EIA) are required legislation in Austria for major infrastructure projects, as outlined by the [UVP-G 2000](#) (Environmental Impact Assessment Law 2000). The project assesses how to incorporate the consequences of climate change, and to a certain extent, climate change adaptation measures into large projects e.g. through 'climate proofing'. The project was conducted with key stakeholders in Austrian infrastructure ([ASFINAG](#), [ÖBB](#), [APG](#) etc.), as well as the Urban Development Department within the City of Vienna.

The Cost of Inaction ([COIN](#)) project developed economic methods for assessing climate change impacts, and identified the conditions which caused costs to arise within individual areas and fields of activity.

Public adaptation takes place at all levels of government. Ministries, state departments and municipalities are required to provide support after flood events or to set the framework conditions in advance so that the possible effects of climate change are minimised. Building on project [COIN](#), in which the costs of climate change for Austria were determined, project [PACINAS](#) deals with which costs and benefits are connected with public climate change adaptation. Case studies at the city, state and federal levels serve to estimate both the existing adjustment deficit and future adjustment costs. The focus is on adaptation costs due to extreme events such as flooding, gravitational processes and heat as well as selected other climate-sensitive areas (public infrastructure, etc.).

The [PATCH:ES](#) project analyses private adaptation in Austria – its extent, main actors and drivers and potential effects to relief public budgets, but also identifies instances of ineffective adaptation policy, adverse external effects and contradictions to federal policies. It reveals the dynamics and trade-offs for private adaptation within three test case studies (agriculture, tourism, and private households) and derives recommendations for good governance, synchronizing private adaptation with governmental efforts.

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 media, 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 [NAS](#) contains a set of a criteria that enables the evaluation of the National

Adaptation Strategy. An [evaluation tool \(SALDO\)](#) has been developed for the estimation and assessment of the status of climate change adaptation. These cover the defined areas for action (on the basis of international experience). SALDO is an [Excel-based tool](#), which enables a comprehensive assessment of a wide range of adaptation measures, using multi-criteria analysis. This criteria catalogue will also contribute to further clarify the objectives of each respective recommendation. An overview of tools by sector is also [available](#). Planning tools for mobility and transport-related case studies also include the demonstration of the [feasibility of climate-adapted](#) infrastructure.

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 [Ministry for Agriculture, Forestry, Environment and Water Management](#) (prepared in cooperation with [Umweltbundesamt](#), [BMLFUW](#) and [Klima - und Energiefonds](#)), lists which measures can be taken in different areas to remain viable under changing climatic conditions. It creates a nationwide framework for action, from which specific measures in different areas can be derived. The strategy is implemented in close cooperation between the Federal Government and the Länder.

The Institute for Meteorology, as part of the research project [ENVISAGE-CC](#) (ENViromental Impact Assessment Satisfying Adaptation Goals Evolving from Climate Change), published the guidance document "[Strategic support for integrating climate change into project planning](#)" for large projects. As a follow-up to this work, the project [SPECIFIC](#) (SPECific Climate change ForesIGHT in projeCt design) offers guidance on rail, highway and power grid projects.

In order to support politicians and experts in the public administration of provinces, regions and cities, as well as actors in regional management in developing adaptation strategies,

A [handbook](#), developed in the context of the project FAMOUS (Factory of Adaptation Measures operated at different Scales) provides guidance for the strategic and proactive examination of climate change impacts. Its aim is to support politicians and experts in the public administration of provinces, regions and cities, as well as actors in regional management in developing adaptation strategies.

An overarching guidance (published in 2014) is a [communication](#) strategy that focuses on practically oriented, target group-specific and action-motivating recommendations for effectively communicating climate change and adaptation

Climate change adaptation will be addressed in the upcoming amendment of the Environmental Impact Assessment Law in Austria in 2018. The guidance documents for conducting Environmental Impact Assessment Reports are currently being revised.

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.

[Austrian Standards](#), 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 [National Adaptation Strategy](#) (NAS) was adopted on 23 October 2012 by the Council of Ministers and taken into consideration by the Provincial Governors' Conference on 16 May 2013. It is a nationwide framework for the alignment of necessary adaptation measures. The strategy aims to bring together relevant actors, support cooperative action and facilitate the use of synergies through cooperation whenever possible. The Austrian Adaptation Strategy is divided into two parts: a Strategic Framework (or "context") and an Action Plan.

The [National Action Plan](#) (NAP), adopted as part of the NAS focuses on the vulnerability of the respective areas for actions and presents 132 recommendations for adaptation in 14 areas for action. Monitoring, evaluation and reporting is planned on a five-year-cycle.

The Bundesländer have either developed regional adaptation strategies [Oberösterreich (2013), Steiermark (2015), Vorarlberg (2016), Salzburg (2017)], integrated adaptation and mitigation strategies [Tirol (2015)], or they have integrated adaptation into existing climate mitigation strategies [Niederösterreich (2011), Wien (2009)].

The [Austrian Programme for Critical Infrastructure Protection](#) includes a plan initially enacted in 2008, and further developed based on results from 2014; based on the [European Programme for Critical Infrastructure Protection](#) (EPCIP). The plan includes a strategy and measure in order to ensure the security of supply of all infrastructural sector, including food, transport, telecommunication, energy, financial services, social and health services etc. The Austrian Programme for Critical Infrastructure Protection is implemented on a regional level (Federal States). The following presentation ("[Schutz kritischer Infrastrukturen APCIP](#)") provides an example of measures taken in the State of Carinthia.

The European EIA Directive has been transposed in the Austrian legislation with the UVP directive ([Umweltverträglichkeitsprüfung](#)). Climate change adaptation will be integrated in the upcoming amendment of the Environmental Impact Assessment Law in 2018. The guidance documents for conducting Environmental Impact Assessment Reports are currently being revised.

Responsible authorities

The [Federal Ministry of Agriculture, Forestry, Environment and Water Management](#) has the overall responsibility for adaptation policy-making; whereas the [Federal Principle](#) provides for the sharing of tasks; legislative, executive and financial - between the nine Austrian Provinces and the Federal Government. The National Climate Protection Committee is in charge of adaptation to unavoidable impacts of climate change.

The Kyoto Forum (consisting of representatives of the Ministry and the federal states and originally established for mitigation issues) provided strong support for the development of the NAS. In addition, the existing Interministerial Committee to Coordinate Measures to Protect Global Climate (IMC Climate Change) was kept regularly updated on the status of work towards the NAS. On behalf of the Ministry and in close cooperation with the Kyoto Forum, the Environment Agency Austria (EAA) fulfilled an important role as a semi-public support unit regarding several strands of activities throughout the entire NAS process.

Management of the ESI Funds

Austria is participating in 14 cross-border, transnational or interregional co-operation programmes, and has one national Operational Programme on Investments in Growth and Employment, which is managed by the Austrian Conference on Spatial Planning. The intermediate bodies are comprised of 12 Regional agencies (one per Lander), and on the federal level by the Austria Wirtschaftsservice GmbH / ERP-Fund, the Kommunalkredit Public Consulting, the Austrian Research Promotion Agency, and the Austrian Hotel & Tourism Bank GmbH. Furthermore, the National Coordination Authority is the Austrian Conference on Spatial Planning, while the Certifying Authority and the Audit Authority is Division IV on Coordination of the Federal Chancellery.

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

Adaptation actions in various thematic fields and sectors are fostered in applied research projects, financed by the ACRP (Austrian Climate Research Programme) of the [Climate and Energy Fund](#) and [StartClim](#), where stakeholder involvement is a key element. Through the support of research activities, the federal government seeks to strengthen the scientific data bases of its climate change adaptation strategy in order to ensure its successful implementation and also support monitoring and evaluation.

The Ministry of Agriculture, Forestry, Environment and Water Management in cooperation with the Climate and Energy Fund has initiated and provided financial support for dedicated workshops in provinces in order to build capacity for adaptation, discuss implementation means and highlight research results relevant for the respective province as a basis for deciding on concrete adaptation measures.

Effective collaboration

For successful implementation of the NAS, the cooperation between all actors concerned is essential. Existing committees such as the National Climate Protection Committee are important fora to ensure continuous exchange and sustain close contact between the Ministry and the provinces. In addition, the Ministry of Agriculture, Forestry, Environment and Water Management in cooperation with the Climate and Energy Fund initiated and

provided financial support for dedicated workshops in provinces in order to build capacity for adaptation, discuss implementation means and highlight research results relevant for the respective province as a basis for deciding on concrete adaptation measures.

For vertical coordination and implementation, existing committees such as the Kyoto-Forum and the National Climate Protection Committee are important for a continuing regular exchange and close contact between the Ministry and the provinces.

The Ministry of Agriculture, Forestry, Environment and Water Management as well as the Ministry of Science, Research and Economy are in close collaboration and provide financial support to the association. Many policy relevant research projects are being undertaken by consortia or single institutions who are full members of the CCCA.

The [Climate Change Centre Austria](#) (CCCA) is a contact point for research, politics, media and the public. It serves to promote a sustainable climate dialogue in Austria. The goal is to create a national climate dialogue in Austria. Alongside the main office (administrative support) exists the CCCA-Service Centre (knowledge hub) and the CCCA-Datacenter which provides access to data, models etc. concerning climate change adaptation.

The [PACINAS project](#) deals with potential (planned) public adaptation and associated costs, benefits, and challenges with respect to implementing the National Adaptation Strategy (NAS) in Austria. It complements the Austrian-funded project COsts of INAction ([COIN](#)), which assessed climate change impacts for the sectors considered in Austria's NAS up to 2050.

Financial resources

According to the [ESIF-viewer](#), Austria is planning investments of 1.26 Billion EUR. Out of these, 31 Million EUR are approved for Network Infrastructures in Transport and Energy (Thematic Objective 7) and 100 Million EUR are approved in Environment Protection & Resource Efficiency (Thematic Objective 6). The shares within these Thematic Objectives that may relate to climate adaptation are unknown.

The Climate and Energy Fund ([KLAR!](#)) supports regions with climate change adaptation measures by supporting ideas, concepts and projects in the areas of research and development, mobility, market penetration and raising awareness. The Fund has sponsored more than 110,000 projects since 2007.

4. SECTOR OVERVIEW

4.1. Introduction

Since 2014 the requirements for major projects to obtain ESIF funding³ demand that project applications integrate climate change considerations⁴, such as a vulnerability and risk analysis and adaptation option appraisal. At EU-level, material is available to assist in fulfilling these requirements. Key websites and documents are:

- The [Climate-ADAPT](#) website containing many links to data and a [map viewer](#)

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

⁴ For a compilation of the climate change requirements for major projects in 2014-2020, see: <http://www.jaspersnetwork.org/plugins/servlet/documentRepository/displayDocumentDetails?documentId=401>

- 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*.⁵

4.2. Transport

Investments in the transport sector are very diverse, covering roads (including bridges and tunnels), inland waterways, rail, ports / airports, and public transport infrastructure. Any disruption caused in this sector can affect many other sectors (economic and societal) directly. Potential threats are 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.

Vulnerability is expected to be high for [transportation infrastructure](#) in some regions. Increase in the amount of snow at elevations above 1800m, potentially accompanied by a higher risk of avalanches, and thawing of permafrost, resulting in rock-fall and landslides, may affect infrastructure. Heavy precipitation locally can result in drainage system overloads and the flooding of underpasses as well as in increasing risk of landslides and mud flows; erosion and washouts can threaten the stability of railroad embankments and road beds. Increased heat stress can result in damage to materials and structures, as well as the deformation of pavement and rail infrastructure. Planning tools for mobility and case studies include the demonstration of the [feasibility of climate-adapted infrastructure](#).

Road infrastructure

Information and early warning systems for transport infrastructure in extreme weather events are in place. The [Natural hazards radar](#) is an early warning detection system for avalanches, mudslides, rock fall, slipping, etc. aiming to achieve a timely warning for interference and [emergency](#) measures.

The project [SPECIFIC](#) (SPECific Climate change Foresight in project design) offers guidance on rail and highway projects.

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

Railway infrastructure

⁵ European Commission (2018) Climate change adaptation of major infrastructure projects. A stock-taking of available resources to assist the development of climate resilient infrastructure. Final report.

The [Austrian Federal Railways](#) (ÖBB) has also implemented a nationwide [Meteorological Monitoring System](#) in order to face the challenges of climate change and more frequent extreme weather events.

For additional relevant information, see the section above on Road infrastructure.

Airport infrastructure

With regard to airport infrastructure in Austria, no specific information was retrieved on helping (airport) authorities to take climate change into account. But more general materials are available which apply to all types of projects, including airport infrastructure. See section 4.1 for more information.

4.3. Broadband

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

Broadband is not regarded as a stand-alone sector in Austria; it is a sub-section of infrastructure and is addressed in the [Austrian Programme for the Protection of Critical Infrastructure](#) (APCIP). The implementation of APCIP with regard to climate change adaptation is connected to the National disaster management institution [Staatlicher Krisen- und Katastrophenschutzmanagement](#) (SKKM) which is responsible for disaster prevention, preparedness and assistance.

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 (incl. masts and towers for the mobile access networks), EN standards are available to address wind and snowfall, e.g. EN1991-1-4 (Eurocode 1) and EN1993 (Eurocode 3) for structures in steel. But these standards don't take climate change into account. CEN-CENELEC is currently working on adapting a number of EN standards to climate change. See Final Report of the present study (European Commission, 2018) for more information in the section on *Available resources at the EU level*.⁶

With regard to EU funding of Austria'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 Austria is approximately €26 Million.

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

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

4.4. Urban Development

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

Legislation for spatial planning in Austria is made in cooperation of State, Federal States and local communities on the [Österreichische Raumordnungskonferenz](#) (ÖROK) Platform, providing increased interconnection between (spatial) zoning and hazard zone planning:

- The [Hazard Zone Plan](#) is a comprehensive assessment of hazards and is intended to serve as a basis for spatial planning, construction and security. An example of Federal state planning exists in [Salzburg](#);
- Hazard zone planning for climate change adaptation is highlighted in Austria's [Strategy for Adaptation to Climate Change](#). The Styrian regional planning programme for the flood-safe development of residential areas includes mandatory regulations with clearly defined legal consequences for zoning and construction in flood plains and hazardous areas;
- ÖROK [Recommendation No. 52](#) on the preventive handling of natural hazards in spatial planning recommends the designation and binding of flood areas and danger zones into planning and building law as well as their safeguarding by stipulating their use – or prohibition of their use - in the regional planning.

CLISP (climate change adaptation and spatial planning in the alpine space) – includes an [assessment](#) of the “climate change fitness” of planning instruments and processes.

[Planning tools](#) used within construction and refurbishment for climate change adaptation are available. Examples of available tools include the EU-Project “[GRaBS](#)” (Green and Blue Space Adaptation for Urban Areas and Eco Towns).

The project PACTCH:ES (Private Adaptation Threats and Chances: Enhancing Synergies with the Austrian NAS implementation) explains the adaptive action that households take in response to urban heat waves and to more frequent and severe floods events.

There has been a collective climatological improvement of urban areas, in particular consideration of micro / meso-climatic conditions in urban and open space planning and a reduction of the heat island effect. These are included in the [UVP-G 2000](#) (Environmental impact assessment law 2000) and the [Strategy UHI prevention](#) in Vienna.

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

4.5. Energy

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

The project [SPECIFIC](#) (SPECific Climate change Foresight in projeCt design) offers guidance on power grid projects.

Austria has undergone an optimisation of their energy infrastructure network to avoid foreseeable bottlenecks and overcapacities in the future due climate change:

- [Technical and organisational regulations](#) are in place for operators and users of networks via e-control;
- The [Austrian Energy Strategy](#) and the APG [Master Plan \(2009\)](#) "Transmission Network 2009-2020" provide a basis for medium and long-term network planning.
- [District cooling](#) in Vienna; the portal provides a list of locations who have adopted district cooling.
- [Energiesparhaus](#) is a platform for information and good practice on sustainable housing, including thermal comfort guides.
- [Sommertauglich BAUEN](#) provides information on protection from overheating in summer, with an [initiative](#) on Federal State level (upper Austria).
- Thermal comfort in the form of thermal restoration of building stock is funded by the State and by the Federal States; e.g. [Vienna](#), [Upper Austria](#) and [Lower Austria](#).

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.

The national water information system ([Wasserinformationssystem WIS](#)) includes information on future provision safeguarding against climate change adaptation. Federal States also have their own water information system: e.g. [Upper Austria](#) and [Tyrol](#).

Austria's Sixth National Communication to the UN Framework Convention on Climate Change ([UNFCCC](#)) comments on vulnerability with respect to water resources and water management exhibited strong regional variability.

The Central Institute of Meteorology and Geodynamics have produced an [early warning system](#), and also engage in regional climate modelling. The result is high-resolution data sets for the highly articulated terrain of Austria and its surroundings.

The [natural hazard](#) web portal contains detailed mapping of floods, erosion and stone impact, avalanches and a map of significant historical events. It also contains links to hazard processes and factsheets for projects of torrent and avalanche control. The study ("[Klimawandel - Anpassungsstrategien für Österreichs Wasserwirtschaft](#)") details adaptation strategies within the water sector, from flood risk to rising sea temperatures.

The updated [National Water Management Plan](#) has been available since July 2017. The basis of the National Water Management Plan is a comprehensive analysis of groundwater, surface water (such as rivers and lakes), and associated land ecosystems and wetlands. The effects of significant pollution and anthropogenic impacts on surface waters and groundwater are estimated. This also includes an estimation of the impact of climate change on the Austrian water sector. Rainwater may be temporarily retained in storage media and collected for subsequent use, such as for irrigation purposes, toilet flushes, or the washing machine. This relieves the drainage system during heavy rain, reduces drinking water consumption and lessens the pressure on the abstraction of groundwater.

Austria has also developed a flood protection, spatial development plan [Schutzwasserwirtschaftlicher Raumentwicklungsplan](#) (SREP); a separate instrument for the coordination of space requirements between water management and spatial planning has been developed.

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

4.7. Waste

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

Waste is a cross-section topic within the [NAP](#) - adopting approaches from both the [Waste Management Act](#) 2002 and [Federal Waste Management Plan](#) 2017. The Federal Waste Management Plan considers the relevance of the waste sector in climate change throughout its contribution to greenhouse gas emissions (e.g. landfilling, combustion, biological treatment, etc.). There is no consideration on climate adaptation in the plan.

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 climate adaptation projects

Cost relevance of adaptation in cities	
Project description	Graz, Linz, Baden and Judenburg were investigated as case studies for an initial assessment of adaptation costs in cities. Publicly accessible budgetary data (www.offenerhaushalt.at) was used for Graz, Linz and Baden, and the budgetary data for Judenburg as well as budget details from the other cities were collected directly on site. Expenses for damage recovery were identified for time periods after extreme weather events. In addition, interviews were conducted in all four cities with various representatives from the local government.
Photograph	n/a
Budget	Not available
Climate Change Vulnerability and Risks	<p>Interviews were conducted in all four cities with various representatives from the local government, some responsible for environmental, climate and energy issues, and others responsible for municipal building management, road infrastructure, for water and wastewater management, for green space management and planning, further for urban planning, for disaster and risk management as well as for financial and budget management:</p> <ul style="list-style-type: none"> • Spatial planning is seen as particularly important in areas with a low potential for settlement expansion and where there is a high level of competition for land. • Water management is a key area that has already been impacted by climate change. Measures include the erection of dams, newly constructed, reinforced or improved with new technical means. • In Graz, additional costs are also accrued through the alternative or additional irrigation of urban trees, as well as from a greater volume of green space planning effort. • A distinction between pure damage repair and further adaptation measures is usually not carried out in the cities. The cities focus mainly on damage elimination after extreme events, with pre-emptive adaptation measures being implemented only occasionally. <p>Interviewed city officials, in all four of the cities surveyed, expect a further increase in the number of heat days, longer heat and drought periods, but also an increase in severe rainfall events and a correspondingly rising risk of flooding.</p>
Climate change adaptation measures	<ul style="list-style-type: none"> • Urban green space concept with incremental implementation (networking of green areas, balancing existing deficits in green areas); • Construction of flood protection measures or flood

	<p>retention basins;</p> <ul style="list-style-type: none"> • Restoration of road infrastructure; • Awareness raising of the population for self-sufficiency; and <p>Establishment of heat warning systems (cooperation with the country and health authorities).</p>
Good practice	<p>Quantitative and qualitative information was collected on damage caused and costs for damage repair, and partly for adaptation measures (e.g. on flood protection, on public green space improvement, replanting trees or plant nursing management) were collected. Additional information on long-term adaptation relevant expenditures was obtained for these cities as well.</p> <p>Especially in the fields of spatial planning, land use and building management (incl. thermal refurbishment), maintenance of (local) roads, water and sewage management (E.g. renovation and adaptation of the channel network) and (to a lesser extent) lawn care and open green maintenance are cities required to deal with the already noticeable effects of climate change.</p>
Further information	CCCA - PACINAS Factsheet 3

Iterative Climate Risk Management

Project description	This project set out to test the concept of iterative climate risk management based on a detailed analysis of current and future flood risk in Austria, with a special focus on the fiscal effects of flood risk. This concept links climate change adaptation and disaster risk management within a process-oriented decision support framework. Additionally, based on the empirical and modeling results, as well as the insights gained from dialogue with key stakeholders, a further goal was to establish a generic framework applicable to other decision contexts.
Photograph	n/a
Budget	Not available
Climate Change Vulnerability and Risks	By continually reviewing and integrating new scientific knowledge on climate change (e.g. emerging early trends and changes in variability that exacerbate existing risks or create new risks), decisions are adjusted over time with scientific and empirical evidence. Hence, disaster risk management in Austria is evolving to include early adaptation to climate change, addressing current variability (and the existing adaptation deficit) while mainstreaming climate change in decision processes.
Climate change adaptation measures	<ul style="list-style-type: none"> • Spatial planning is seen as particularly important in areas with a low potential for settlement expansion and where there is a high level of competition for land.

	<ul style="list-style-type: none"> • Water management is a key area that has already been impacted by climate change. Measures include the erection of dams, newly constructed, reinforced or improved with new technical means. • In Graz, additional costs are also accrued through the alternative or additional irrigation of urban trees, as well as from a greater volume of green space planning effort. • A distinction between pure damage repair and further adaptation measures is usually not carried out in the cities. The cities focus mainly on damage elimination after extreme events, with pre-emptive adaptation measures being implemented only occasionally. • Interviewed city officials, in all four of the cities surveyed, expect a further increase in the number of heat days, longer heat and drought periods, but also an increase in severe rainfall events and a correspondingly rising risk of flooding.
Good practice	<p>The following methods and tools were employed:</p> <ul style="list-style-type: none"> • A broad stakeholder dialogue with Austrian disaster risk management as well as climate change adaptation experts and practitioners; • Comprehensive budget analyses with a focus on the Austrian disaster fund; <p>State of the art economic flood risk modelling with IIASA's CATastrophe SIMulation (CATSIM) framework.</p>
Further information	CCCA - PACINAS Factsheet 2

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