



Climate change adaptation of major infrastructure projects

Country report for Portugal

Prepared by:

Antonio De Rose (EY)
Filippos Anagnostopoulos (EY)
Anthony Tricot (EY)
Navdeep Sandhu (EY)
Bernardo Rodrigues Augusto (EY)
Pedro Mota (EY)
Ilse Laureysens (Arcadis)

Written by EY, ARCADIS
2018



EUROPEAN COMMISSION

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

Contact: Jonathan DENNESS, Head of Unit

Camelia-Mihaela KOVÁCS, Administrator

E-mail: REGIO-MAJOR-PROJECTS@ec.europa.eu

*European Commission
B-1049 Brussels*

Climate change adaptation of major infrastructure projects

Country report for Portugal

Europe Direct is a service to help you find answers to your questions about the European Union.

Freephone number (*):

00 800 6 7 8 9 10 11

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

LEGAL NOTICE

This document has been prepared for the European Commission however it reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

More information on the European Union is available on the Internet (<http://www.europa.eu>).

Luxembourg: Publications Office of the European Union, 2018

ISBN: 978-92-79-94485-7

doi: 10.2776/453323

© European Union, 2018

Contents

1. INTRODUCTION	6
2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK	8
3. RESOURCES	9
3.1. Data Availability	10
3.2. Methodologies	12
3.3. Tools	12
3.4. Guidance	13
3.5. Design Standards	14
3.6. System	14
3.7. Institutional Capacity	16
4. SECTOR OVERVIEW	17
4.1. Introduction	17
4.2. Transport	18
4.3. Broadband	19
4.4. Urban Development	20
4.5. Energy	20
4.6. Water	21
4.7. Waste	23
5. CASE STUDIES	24
5.1. Case studies of climate adaptation projects	24

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 Portugal 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

Action on climate change adaptation is framed by the [National Strategy for the Adaptation to Climate Change](#) (ENAAAC). The Environment Agency (APA) is in charge of national adaptation policy-making and coordination. The implementation of ENAAAC 2020 is supported by a coordination group presided by the [APA](#). The [Directorate General for the Territory \(DGT\)](#) provides information on Portugal spatial planning instruments, including objectives, strategic sectors, development and implementation and the role of different stakeholders. There are currently 26 Municipalities with local adaptation plans developed under the [ClimAdaPT.Local](#) project. [Cascais](#), [Sintra](#) and [Almada](#) have developed their own local Adaptation Strategies. [Madeira](#) also has a regional strategy for climate change, whilst [Azores](#) is developing theirs, it is expected to be finalised during 2018.

A number of resources are available in Portugal to support climate adaptation. The national [Climate Portal](#), developed by the [Portuguese Institute for Sea and Atmosphere](#) (IPMA), provides several climate indicators that quantify the occurrence and risk of

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

different atmospheric events, and information to support decision making. The [APA](#) is developing a new national adaptation platform that will provide a nationwide repository of every adaptation project in Portugal and a searchable web-database. To evaluate climate change vulnerability, the [ClimAdaPT.Local](#) projects applied the [UKCIP](#) methodology at a local level. This approach is well implemented in the Urban Development sector. At a local scale, there is evidence of climate adaptation measures already in place: The [Thermos](#) project is a methodology to evaluate economic impacts for the energy sector. The technological tools will be [replicated in Cascais](#) as one of the pilot cities. This project will allow the user to make maps based on demographic and urban characteristics, as well as local climatic patterns. There are tools to support decision-making, mainly through providing easy accessible data. The [Climate Portal](#) offers data analysis to support decision making, the [GestAqua.AdaPT](#) provides access to the tools used by the project in the development of climate and hydrological scenarios, the [Soil and Water Assessment Tool](#) has been used to calculate runoff, as well as sediments and nutrients transport to the surface water bodies, and the [CE-Qual-W2 model](#), as a hydrodynamics and water quality model, allowed the simulation of the behaviour of the two reservoirs. Guidance is available through research projects. The [adaptIS](#) project has a repository of information, resources and case studies on climate adaptation for services and industry. Several [handbooks](#) focused on climate change resilient construction are also available. [ClimAdaPT.Local](#) presents several handbooks on how to implement climate change adaptation strategies at a local level. EU resources are in use, such as the [Guide to Cost-Benefit Analysis of Investment Projects](#), the publication on [Climate Change and Major Projects](#) and the non-paper [Guidelines for Project Managers](#). According to the national organisation of standardisation, the IPQ (Instituto Português da Qualidade), there have been no national design standards specifically for climate change adaptation of infrastructure projects. The Portuguese Environment Agency Unit of Adaptation and Monitoring of the Climate Change Department produced a [poster](#) which outlines Portugal's resource capacity for climate change adaptation.

The main infrastructure sectors are undertaking actions for climate adaptation. [Infraestruturas de Portugal](#) (IP, SA), the public-owned company responsible for the national road and railway infrastructure systems, has been working on the theme of climate change adaptation, mainly through the usual risk management systems and procedures associated with emergency management. The Transport Group under the ENAAC 2020 is coordinated by the [IMTT Institute of Mobility and Transport](#). The [national broadband strategy](#) of 2012 mentions climate change adaptation, but mitigation remains the primary driver. For the urban development sector, [Climate.AdaPT Local](#) provides methodologies and guidance for all stakeholders. This project also provides climate factsheets for the participating municipalities. The [repository](#) of the adaptIS project presents information regarding the integration of climate change adaptation measures in the construction sector. For the energy sector, the status of implementation of the identified climate change adaptation measures by the major energy infrastructure owners and developers is unknown. It is expected to be updated within 2018 in the context of the interim report of the second phase of ENAAC. In the water sector, [extreme temperatures and a rise in precipitation](#) are of increasing concern in Lisbon, with a particular need for improved urban water cycle management. An adaptation plan for Lisbon is currently under development, and in 2015 a [Drainage Master Plan](#) was approved for the period of 2016-2030. [Flood risk management plans](#) and [flood risk maps](#) are available. In the waste sector, Portugal has transposed the EU [Directive 1999/31/EC on the landfill of waste](#) that requires landfills to be designed in such a way that pollution of the soil, groundwater or surface water is prevented. [Lipor](#) (the Intermunicipal Waste Management of Greater Porto) has developed a [Corporate Strategy](#) for the accomplishment of sustainable waste management.

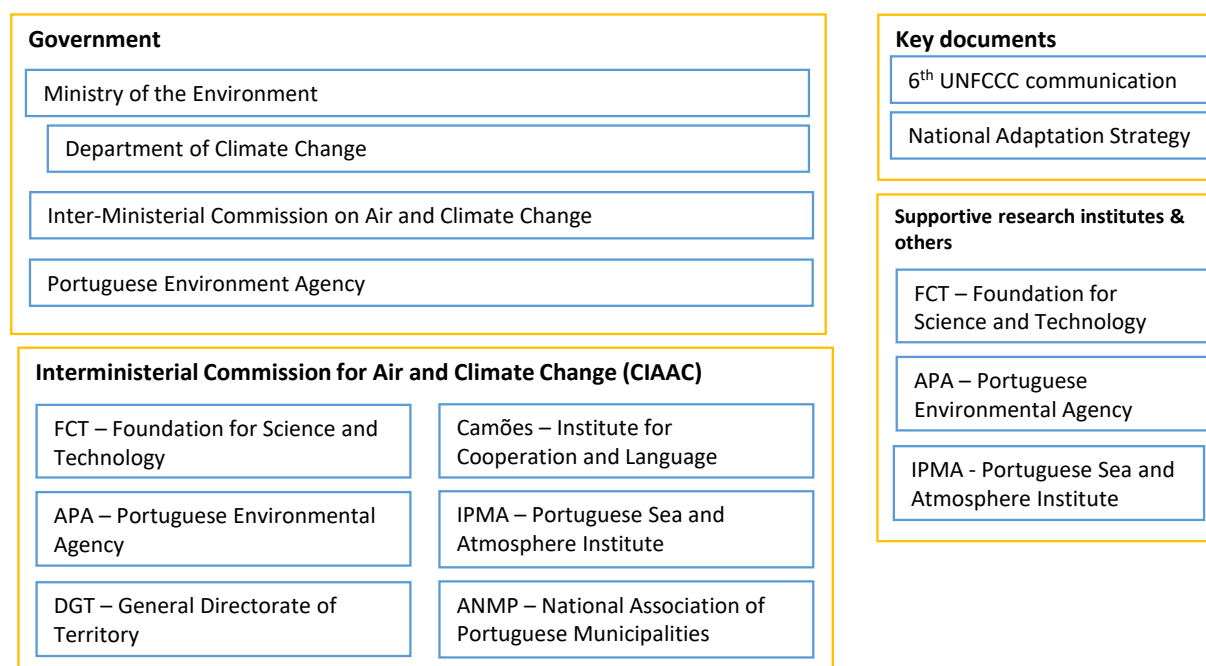
Three case studies with application of the climate change adaptation criteria are presented in the accompanying country report: on [Municipality of Cascais](#); on the project [ADAPTACLIMA](#)-EPAL providing the Empresa Portuguesa das Águas Livres ([EPAL](#)) an adaptation strategy; and the efforts for [adaptation to drought in Alentejo](#).

2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

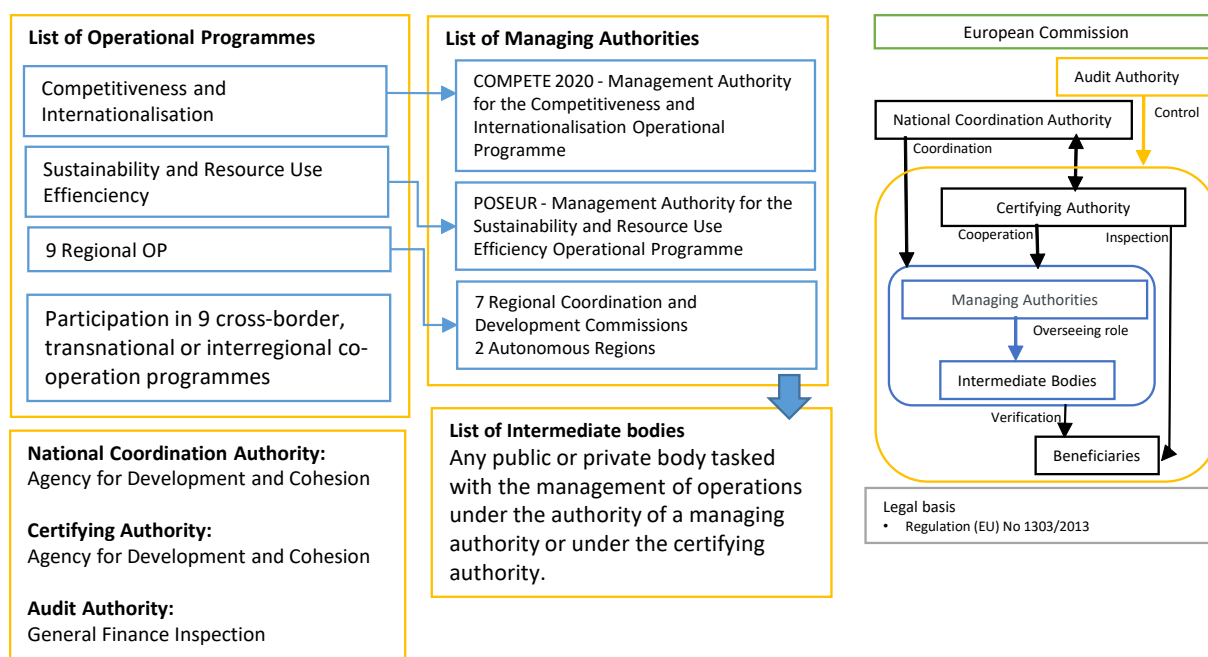
[ENAAAC](#) 2020 is Portugal's National Strategy for Adaptation to Climate Change, establishing the need for adaptation through a synthesis of the main observed changes in the climate over the 20th century and a summary of the conclusions of climate scenarios and projections for Portugal. The three main goals that guide ENAAAC 2020 are to:

- Information and knowledge about climate change;
- Implement adaptation measures;
- Promote mainstreaming of adaptation into sectoral policies

[ENAAAC](#) also identifies nine priority sectors and created nine sectoral working groups, each coordinated by the ministry or the agency responsible for the policy area. This sectoral approach brings together the actors with interest and know-how in each particular sector and thus identifies the most adequate adaptation measures. The [Strategic Framework for Climate Policy](#) (QEPiC) sets out the vision and objectives of national climate policy up to 2030, combining various instruments and measures to be implemented. [QEPiC](#), together with [ENAAAC](#) determines the values of reduction of emissions of greenhouse gases between 2020 and 2030 and creates the Inter-Ministerial Commission on Air and Climate Change (CIAAC). A national Adaptation Action Plan is currently under development. Much of the implementation of adaptation measures is taking place at regional/municipal level. Regions and municipalities are preparing action plans.



Sectoral Working Groups (WGs) were defined in the first phase of ENAAAC along with the socio-economic and climate scenarios used to anticipate a range of future impacts. The coordinators/chairs of the WGs are integrated in the coordination group of ENAAAC 2020.



The adaptation funding mechanisms for climate change are guaranteed by the Common Strategic Framework 2014 – 2020 (ERDF; ESF; CF; EAFRD; EFMAF) as well as programmes such as Horizon 2020, the Interreg IV-C and LIFE. The Cohesion Funds and ERDF are mainly absorbed through the two national Operational Programmes and 9 regional Operational Programmes. Specifically, the Cohesion Fund fully funds the Operational Programme POSEUR for the Thematic Objective 5 on climate adaptation.

3. RESOURCES

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

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

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

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

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

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. The national [Climate Portal](#) provides climate data and information to support decision making. It was developed by the [Portuguese Institute for Sea and Atmosphere](#) (IPMA) and provides several climate indicators that quantify the occurrence and risk of different atmospheric events; such as, air temperature or wind on the surface, or indicators that result from complex algorithms that combine model variables to create new variables to address the needs of users as indices that measure the risk of events with significant impact potential, such as, droughts, rain storms, heat and cold waves, fire risk, etc. The [web portal](#) is an open-access platform for the general public with dissemination functions for results. These data include historical data, information on climate change at regional level, and climate indicators for specific sectors in Portugal.

Apart from Climate Portal, there are two other related national databases focusing on extreme weather-related events:

- The National Authority of Civil Protection (ANPC) has a national database on disaster response and losses since 2006 and publishes this information in the yearbooks of civil protection events;
- The Portuguese Environment Agency (APA) keeps the records of the historical marks of floods and of its network of meteorological and hydrological monitoring

stations. This data is available on SNIAmb ([National System of Environmental Information](#))

The [APA](#) is developing a new national adaptation platform. This tool will provide a nationwide repository of every adaptation project in Portugal and a searchable web-database. It will be an open access platform. It intends to aggregate the currently dispersed information of every development regarding climate change adaptation and it will reference what is being done, how and where. A qualitative global indicator to evaluate the state of adaptation initiatives in Portugal is being developed. This indicator will provide an overview of the percentage level of national adaptation initiatives, as it is required by the Portuguese Management Authorities of Community Funding (e.g. POSEUR).

Portugal'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 [SIAM and SIAM II](#) studies are the basis of the climate scenario data. These comprehensive studies provide climate change scenarios and an evaluation of the predictable impacts in Portugal. They also present adaptation measures relating to the impacts detected for the various regions, taking into account the socio-economic context. The SIAM project was the most comprehensive and integrated assessment on the impacts and vulnerability associated with climate on mainland Portugal and was also the first one in southern Europe. SIAM II broadened the previous analysis to include the autonomous regions of the Azores and Madeira and for mainland Portugal, incorporating also a case study for the Sado river estuary.

[Programme AdaPT](#) is an EEA Grants programme to finance important projects for the development of adaptation in the country. The proposed project areas of the programme contribute greatly to the expected results of the programme: to increase capacity in order to assess vulnerability to climate change and to increase awareness and education on climate change. The platform [adaptIS](#) is now a reference platform that collects adaptation measures, tools and case studies. In addition, ENAAC 2020 is preparing an application to ESIF funding to develop a national adaptation portal where all the relevant information will become available to all stakeholders and general public.

Some sector-specific projects also provide climate information at a local level. Examples of these are visible in:

- The [GestAqua.AdaPT](#) project, where Eco-hydrological Scenarios and Climate Scenarios for Monte Novo and Vigia reservoirs in Alentejo Region are presented; and
- The [ClimAdaPT.Local](#) project, where climate factsheets are presented for 26 Portuguese Municipalities. This project has the goal of starting a continual process leading to the elaboration of Municipal Strategies for Adaptation to Climate Change (Estratégias Municipais de Adaptação às Alterações Climáticas) and its integration into municipal planning tools. One of the deliverables was the development of climate factsheets for each of the 26 participating municipalities. The factsheet presents a summary of the evolution of the main climate variables (temperature, sea level, precipitation, probability of extreme events).

The [National Institute of Statistics](#) (INE) is the national statistics authority and maintains a database of statistics relating to the economy, society and environment. The exact content of this database was not examined in the context of the present study.

Additional information may be found in the 2016 [Reporting on national adaptation actions](#), submitted in the context of the Monitoring Mechanism Regulation. 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.

To evaluate climate change vulnerability, the [ClimAdaPT.Local](#) projects applied the [UKCIP](#) methodology at a local level. This approach is well implemented in the Urban Development sector.

At a local scale, there is evidence of climate adaptation measures already in place: The [Thermos](#) project (which stands for Thermal Energy Resource Modelling and Optimisation System) provides methodologies, data, and tools to enable public authorities and other stakeholders to undertake sophisticated thermal energy system planning far more rapidly and cheaply than they can today. The project will be [replicated in Cascais](#) as one of the pilot cities. This project will allow the user to make maps based on demographic, urban characteristics, construction typology, as well as local climatic patterns.

The [Coastal National Working Group](#) created in 2014 as a follow up to the [National Strategy for Integrated Coastal Zone Management \(ENGIZC\)](#), published a report listing a set of recommendations for the integrated management of the coastal areas of Portugal in the short (2020), medium (2050) and long-term. The report analyses strategies in the areas where the risk of erosion is high due to severe flooding.

In the absence of any suitable national methodologies, the reader is referred to the EU-level official methodologies from the [European Commission](#) and [JASPERS](#), which are adequate for infrastructure projects.

The [Portuguese Environment Agency \(APA\)](#) provides information through its website and via the publication of leaflets explaining the opportunities for funding and updates on implementation. A methodological approach has been developed to have a common indicator for all sectors and governance levels to measure progress on implementation of adaptation measures under plans or programmes.

3.3. Tools

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

[Portuguese Environment Agency \(APA\)](#) is Portugal's primary web portal for environmental topics, situated within the Portuguese Ministry of the Environment. Its mission is to propose, develop and monitor, on an integrated and participated manner, the public policies for the environment and sustainable development, in close cooperation with other sectoral policies and public and private entities. The web portal provides information regarding climate change adaptation at a National level, including reporting to the EU and UNFCCC, as well as international links.

There are tools to support decision-making, mainly through providing easy accessible data. As mentioned earlier, the [Climate Portal](#) is a very useful tool. The Portal allows users to access weather data, see the evolution of climatological processes resulting from

numerical modelling applied to climate parameters for selected areas and/or time intervals, provides data through a map service, and performs data download operations and maps geo-climatic units according to the user profile. It constitutes a very useful tool for supporting planning and decision-making in the short, medium and long-term. The Portal is used to determine the vulnerabilities and can be used to help authorities, such as the [Portuguese National Authority for Civil Protection](#) (ANPC), in disaster risk management.

Some of the sectoral Ada.PT programmes also provide tools related to the correspondent sector needs:

- The [AdaptForChange](#) project provides a Web GIS (Geographic Information System) for visualising the potential of natural regeneration by native forests;
- [GestAqua.AdaPT](#) provides access to the tools used by the project in the development of climate and hydrological scenarios. The [Soil and Water Assessment Tool](#) was used to calculate runoff, as well as sediments and nutrients transport to the surface water bodies. The [CE-Qual-W2 model](#), a hydrodynamics and water quality model, allowed the simulation of the behaviour of the two reservoirs, adding the qualitative component to the evaluation of water availability; and
- The [adaptIS](#) programme provides an extensive set of tools with the intention to help the identification of vulnerabilities and definition of potential interventions to adopt measures of adaptation to the climate change in respect to buildings and surrounding areas. These tools are related essentially, with structural and infrastructural stability, energetic efficiency and thermal comfort conditions of buildings, hydraulic efficiency, systems of water reuse and drainage.

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.

Some of the AdaPT projects have developed their own guidelines to support the dissemination of content:

- [adaptIS](#) project has a repository of information, resources and case studies on climate adaptation for services and industry. It consists on a multi-sectoral platform to raise awareness among the business community of the need to assess risks and vulnerabilities associated with extreme weather events and consequent adoption of adaptation measures. Several [handbooks](#) focused on climate change resilient construction are also available;
- [AdaPT AC:T](#) aims to develop a method to assess touristic projects' vulnerability to climate change and support the development of adaptation plans. Several [guidelines](#) for implementing adaptation strategies in the tourism sector are available online;
- [AdaptForChange](#) presents good practices for reforestation in drylands and good practice for soil and water conservation also in drylands; and

- [ClimAdaPT.Local](#) presents several handbooks on how to implement climate change adaptation strategies at a local level. This guidance is specifically relevant to the Urban Development sector.

Currently several "How to" [Handbooks](#) are also available on the [ClimAdaPT.Local](#) project website, such as how to "*Evaluate the Economic Impact of Adaptation Options*".

On the policy planning side, climate change adaptation is now included within the EU-wide Environmental Impact Assessment (EIA) directive and the Strategic Environmental Assessment (SEA).

The first "local Climate change adaptation strategic plans of Sintra and Cascais, two multi-sectoral studies aimed at characterizing impacts and opportunities at the municipal level in an integrated way, published socio-economic and climate scenarios for those municipalities in 2009 and 2010. Despite these projects not being very recent, they remain as references on local scenario analysis and impacts of climate change in Portugal, and are still consistently used to support adaptation projects.

[Portugal2020](#) also lists 339 past projects funded and approved by the EU, with the objective related to the prevention of overall climate risk, from meteorological radars to emergency mobile networks, to hydraulic projects for flood protection.

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

3.6. 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](#) (ENAA 2020) provides the framework for relevant studies, programmes and the sector-responsible ministries. It also provides and sets the strategy parameters to respond the challenges and concerns that Portugal faces regarding climate change. Evaluations of the [original strategy](#) have been foreseen in the Resolution of the council of Ministers n.º 24/2010 for 2016, 2018 and 2020.

Within the context of Strategic Environmental Assessments (SEA) Climate Change is considered at the screening stage and is frequently identified as a Critical Factor for Decision-Making (CFD) in the scoping phase.

The integration of climate change is being considered in the transposition process of the Environmental Impact Assessment (EIA) Directive 2014/52/EU.

Portugal is promoting the integration and monitoring of climate adaptation (mainstreaming) in the most relevant public and sectoral policies and in the main instruments of territorial planning at national, regional and local level. At a regional level, some municipalities have been proactive regarding local climate change adaptation policy:

- [Cascais](#), [Sintra](#) and [Almada](#) developed their own local Adaptation Strategies in 2010, 2009 and 2012 respectively, before the start of the [ClimAdaPT.Local](#) project in 2015;
- [Madeira](#) also has a regional strategy for climate change, whilst [Azores](#) is developing theirs, it is expected to be finalised during 2018;
- There are currently 26 Municipalities (including Funchal (Madeira) and Vila Franca do Campo (Azores)) with local adaptation plans developed under the [ClimAdaPT.Local](#) project.

Additional information may be found in the 2016 [Reporting on national adaptation actions](#), submitted in the context of the Monitoring Mechanism Regulation.

Responsible authorities

In Portugal the Environment Agency (APA) is in charge of national adaptation policy-making and coordination. The implementation of ENAAC 2020 is supported by a coordination group presided by the [APA](#), and composed of the coordinators of the thematic areas and the sectoral working groups, as well as the representatives of the Autonomous Regions of Azores and Madeira and of the [National Association of Portuguese Municipalities](#). In this way, the coordination group brings together the central administration bodies which in turn engage their specific stakeholders. This coordination group is advised by a scientific panel composed of scientists of recognized experience in different areas related to, among others, climate change, environment, risk management or public policies.

A presentation by the [Directorate General for Spatial Planning and Urban Development of Portugal \(DGOTDU\)](#) to the FACTs 9th Inter-regional Event (Régua, Estarreja, Porto on November 9th to 11th, 2011) provides information on Portugal, including objectives, strategic sectors, development and implementation and the role of different stakeholders.

Portugal has set up an Interministerial Commission for Air and Climate Change (CIAAC), which ensures the political follow-up of the sectoral councils and the regional governments of the Azores and Madeira. Six cross-cutting thematic areas have been identified: i) research; ii) financing; iii) international cooperation; iv) communication / dissemination; v) spatial planning; and vi) water resources. The work to be developed under these thematic areas is essentially undertaken by the nine priority sectors that constitute the basic units of work of ENAAC 2020, under the coordination of APA and other relevant bodies of each thematic area.

Management of the ESI Funds

Portugal has 16 national Operational programmes, comprising of the Competitiveness and Internationalisation OP, Sustainability and Resource Use Efficiency OP, amongst the 6 thematic OP, plus 9 more regional OPs, while the country also participates in 9 cross-border, transnational or interregional co-operation programmes. Each thematic OP has its

own Management Authority. The Management Authorities for the highlighted OPs are Compete2020 and the POSEUR, each corresponding to the first two of the above-mentioned OPs, while the Regional OPs are covered by 7 Regional Coordination and Development Commissions and 2 Autonomous Regions. Intermediary bodies are tasked with further responsibilities. Regarding the control of the ESI Funds, the Agency for Development and Cohesion acts both as the National Coordination Authority and the certifying Authority, while the Audit Authority is with the General Finance Inspection.

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.

A good overview of the capacity of Portugal is found in the 2016 [Reporting on national adaptation actions](#), submitted in the context of the Monitoring Mechanism Regulation.

An [academic review](#)³ of Portugal's policy and research on climate change organises these into three domains: climate science and assessment, policy development, and public engagement. The study discusses the research gap and policy opportunity in these domains, which can be explored to improve and address existing issues related to climate change adaptation. One of the major gaps identified was the lack of monitoring networks that would supply systematic information for climate change studies, since fundamental data is missing in various areas.

Technical and human resources

The Portuguese Environment Agency Unit of Adaptation and Monitoring of the Climate Change Department produced a [poster](#) which outlines Portugal's resource capacity for climate change adaptation. The poster comments on 'Supporting the start-up of Adaptation actions' through:

- Evaluating the current capacity to adapt, and prioritising the implementation of options and adaptation measures that moderate future negative impacts and/or help to take advantage of opportunities arising from climate change;
- Capacity building of municipal officers, through the development of local adaptation action plans and mainstreaming climate change into municipal plans;
- Focus on access to information, public education and education at school level. Aiming at citizen's awareness and intervention capacity, demanding public authorities and enterprises at all levels to minimise risk exposure and increase response capacity to climate change; and
- Focus on public authorities, notably at local and sectoral levels. Aiming the creation of a community of actors, relevant across sectors, with enough awareness, information, tools and capacity to include adaptation to climate change in the processes with which they are involved.

The INTERREG IVC project F:acts! – Forms for Adapting to Climate Change through Territorial Strategies, is directed to exchange good practices, and transfer knowledge about climate change adaptation (Directorate General of Spatial Planning-DGT participation).

³ [WIREs Climate Change 2013](#)

Effective collaboration

The implementation of ENAAC 2020, as part of the Portuguese Strategic Framework for Climate Policy (QEPIC) is supported by the Interministerial Commission for Air and Climate Change (CIAAC) which oversees the implementations of sectoral measures and ensures policy guidance on climate change and air, promoting the articulation and integration of climate change policies in sectorial plans, programs and actions. The ENAAC 2020 coordination group is presided by the Portuguese Environment Agency – APA, and composed of the coordinators of the thematic areas and of the sectoral working groups, as well as the representatives of the Autonomous Regions of Azores and Madeira and of the National Association of Portuguese Municipalities. In this way, the coordination group brings together the central administration bodies which in turn engage their specific stakeholders.

Financial resources

The adaptation funding mechanisms for climate change are guaranteed by the Common Strategic Framework 2014 – 2020 (ERDF; ESF; CF; EAFRD; EFMAF) as well as programmes such as Horizon 2020, the Interreg IV-C and LIFE. The [ESI Funds are enabling the development of major projects](#) in the 2014 – 2020 programming period for Portugal. Concerning major projects, by early 2018, there have been 64 Million of eligible costs approved towards Research and Innovation. The [data set will be updated regularly](#) to reflect changes in the programme lists and major project notifications.

Under the EEA Grants 2009-2014, an adaptation programme is being implemented with a total budget of 3,52 Million EUR (3 Million EUR from EEA and 529,412 EUR from the Portuguese Carbon Fund – FPC). Some more National funds (FA – Environmental Fund, FEE – Energy Efficiency Fund) are also supporting climate adaptation. Under POSEUR's Axis II, which is focused on climate adaptation, Portugal is investing 144 Million EUR towards capacity building, planning, and support tools; and another 200 Million EUR for coastal protection.

4. SECTOR OVERVIEW

4.1. Introduction

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

- The [Climate-ADAPT](#) website containing many links to data and a [map viewer](#)
- EUROPEAN COMMISSION Directorate-General for Regional and Urban policy: The [Guide to Cost-benefit analysis of Investment projects](#) (also referred to as the 'CBA guide')
- EUROPEAN COMMISSION DIRECTORATE-GENERAL CLIMATE ACTION: [Non-paper of Guidelines for Project Managers: Making vulnerable investments climate resilient](#)

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

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

- JASPERS Guidance note: [The Basics of Climate Change Adaptation, Vulnerability and Risk Assessment](#)
- JASPERS Guidance note: [An overview of the most important sources for integrating climate change in \(major\) projects](#)

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

4.2. Transport

Investments in the transport sector are very diverse, covering roads (including bridges and tunnels), inland waterways, rail, ports / airports, and public transport infrastructure. Any disruption caused in this sector can affect many other sectors (economic and societal) directly. Potential threats are 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. [Portugal 2020](#) is funding 26 projects in the transport sector for the period 2014 - 2020 under the 'Thematic Objective 7: Promoting sustainable transport and improving network infrastructure'.

Road infrastructure

[Infraestruturas de Portugal \(IP, SA\)](#), the public-owned company responsible for the management of the national road and railway infrastructure systems has been developing some work related with the theme of climate change adaptation, mainly through the usual risk management systems and procedures associated with emergency management. Processes do not explicitly present elements related to climate change, but rather an analysis of historical information related with events occurred during adverse weather conditions. Other actors such as [BRISA](#) (private Portugal's largest transport infrastructure company), identified the following strengths and gaps regarding climate change adaptation in the sector.

Existing strengths and good practices in adapting to climate change in transport infrastructure projects include the following:

- Meteorological / climatic aspects are taken into account in the planning, design or construction of the transport infrastructure as there are standards and regulations for the construction of roads and bridges, such as pavements adapted to the climatic conditions, panels for warning of high winds, etc.;
- Increased frequency and areas of deforestation and vegetation cutting;
- Increased frequency of inspections of transport infrastructure; and
- Increased frequency of maintenance interventions, in particular in bridges and culverts.

Existing gaps in adapting to climate change in infrastructure projects in the transport sector:

- The limits associated with weather / climatic factors from which infrastructure integrity is concerned are generally unknown, except for the limits of wind speed, precipitation, and river water levels in certain transport infrastructure;

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.

- Lack of awareness of the existence of regionalised forecasts on climate factors / pressures in a climate change scenario (precipitation and floods, temperature, winds, river water level, sea level and sea agitation) and their use and integration in infrastructure; and
- Lack of consistent data on climate change impacts on infrastructure.

[Infraestruturas de Portugal](#) has developed an intervention on a coastal roadway with high risk of damage due to climate change-related extreme events. The intervention occurred at the EN-6 Cascais Marginal Road. The purpose of this work was to limit wave overtopping on this section of the coastal road, with the aim of guaranteeing the safety conditions of road traffic, as well as people and goods, even in severe sea conditions. For this project, a study was carried out, using mathematical models of sea surge, using the MIKE21-NSW model, which allowed [Infraestruturas de Portugal](#) to estimate the worst scenarios and thus to size the infrastructure accordingly. The solution found was the construction of a wave deflector parapet applied to the crown of the wall accompanied by the reinforcement of the rock formation at the base of the cliffs. Together these actions, already implemented, have allowed a reduction in the extent of the gaps in the infrastructure, ensuring an adequate and safe level of service to the users.

The Transport Group under the ENAAC 2020 is coordinated by the [IMTT Institute of Mobility and Transport](#). The following activities are planned:

- Establishment of a stakeholder network under the theme of adaptation to climate change in transports.
- Development of a survey focusing on the assessment of the transport infrastructures vulnerabilities to Climate Change.
- Identification of I&D lines under climate change adaptation.
- Identification of financing lines and potential projects for application for funding.

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

Railway infrastructure

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

Airport infrastructure

In the current study, no specific strategy on making Portuguese airports climate resilient was retrieved from desk study or interviews. But more general materials are available which apply to all types of projects, including airport infrastructure. See section 4.1 for more information.

4.3. Broadband

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

Portugal's [national broadband strategy](#) (Agenda Portugal Digital) was adopted on 31 December 2012 with targets for 2020. There is mention of climate change adaptation in this strategy, with mitigation still the primary driver in this sector. Portugal receives no funding from the ESI Funds with regard to its broadband infrastructure.

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*.⁷

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

4.4. Urban Development

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

[Climate.AdadPT Local](#) provides methodologies and guidance for all stakeholders of the urban sector. This project also provides climate factsheets for the participating municipalities. Implementation manuals presented provide sufficient guidance to calculate a city's vulnerability and risk. These exist at a [national](#) level, or at a regional level, for example this fact sheet for [Porto](#) is just one of various guidance outputs of this project.

The [repository](#) of the adaptIS project presents information regarding the integration of climate change adaptation measures in the construction sector, such as: Green Roofs; Sustainable Architecture; Water consumption reduction techniques and Disaster risk reduction techniques. Additionally, the Portuguese National Authority for Civil Protection ([ANPC](#)) have also developed a Portuguese National [Platform](#) for Disaster Risk Reduction.

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

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

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

Portugal's Sixth [National Communication](#) to the UNFCCC presents a list of several adaptation measures for each sector. These measures are a direct contribution of the working groups signalled out in the institutional policy framework, for the first phase of the implementation of the ENAAC. Energy is one of the sectors with more detailed measures among the sectors. The measures identified by the Energy sector working group are divided by:

- Linear infrastructures - transport and distribution of electricity;
- Linear infrastructure - transport of petroleum products;
- Linear infrastructure - Gas transportation; and
- Fixed infrastructures - electricity, raw materials supply and production and shipping of finished petroleum products and gas.

Among the 69 identified measures for the energy sector are:

- Identification of facilities and infrastructures subject to disaster risk (flood, erosion, landslide, entry of biotic agents, others) for linear and fixed infrastructures;
- Technical and economic analysis of actions to strengthen pipelines and other linear infrastructures;
- Widespread use of forecasting systems for hydro power plants, thermal power plants, wind farms, refineries and others;
- Construction of protection walls and flood retention areas for linear and fixed infrastructures.
- Development of internal and external emergency plans for fixed infrastructures;
- Installation of pumping systems in flood zones; and
- Training and awareness of those responsible for on-site safety.

The evolution of the energy sector, although triggered mainly by concerns about security of supply and mitigation of climate change, is convergent and consistent with the adaptation objectives.

Currently, the status of implementation of the identified climate change adaptation measures by the major energy infrastructure owners and developers is unknown. It is expected to be updated by 2018 in the context of the interim report of the second phase of ENAAC. The Energy Group of ENAAC 2020 is coordinated by the [DGEG General Directorate of Energy and Geology](#).

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 \(FRMP\)](#). [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.

Portugal's Sixth [National Communication](#) to the UNFCCC identified lines of action and adaptation measures to reduce the impacts of climate change at the sectoral level. This was part of the mandate of the various sectoral groups in the 1st phase of the implementation of the ENAAC. Adaptation measures related to Water service can be summarized as:

- Wastewater reuse for compatible uses and implementation of differentiated supply systems;
- Assessment of the feasibility and possible promotion of seawater desalinating through renewable electricity resources;
- Tuning of water treatment schemes, installation of additional treatments and possible strengthening of the already installed capacity;
- Control on excess inflows to the drainage system and inflows of rainwater to the wastewater treatment systems;
- Protection or relocation of infrastructure located in flood zones;
- Promoting solutions to control rainwater at its source;
- Installation of tide gates (check valves) in susceptible areas of sea inundation;
- Interventions to strengthen or operate a system in order to increase the capacity of drainage systems; and
- Technological innovation.

Contrary to the Energy sector, in the Water sector, some of the public utilities companies who manage the water supply and water grid infrastructure, such as EPAL and AdP (Águas de Portugal Group) have been active on climate change preparedness with relevant initiatives already on course (see EPAL case study).

[Extreme temperatures and a rise in precipitation](#) are of increasing concern in Lisbon, with a particular need for improved urban water cycle management. An adaptation plan for Lisbon is currently under development, and in 2015 a [Drainage Master Plan](#) was approved for the period of 2016-2030, which includes an investment of €170 million to prevent the increasingly frequent phenomenon of flooding. [Water recycling projects](#) are underway to facilitate irrigation in green areas to adapt to the increased temperatures in the city.

Coastal protection is one of the main areas of concern given Portugal's particular vulnerability. There were several types of implementing actions under the National Action Plan on Coastal Protection 2012-2015, in priority sites, such as:

- Insertion of buffer strips in spatial planning rules;
- Monitoring of coastal systems; and
- Conclusion of risk and vulnerability assessment for most of the Portuguese coast.

In response to the winter of 2013/2014 where Portuguese coastal areas were greatly affected by storm surges a Coastal Working Group was created, with contributions from academia and governmental organizations for a deeper reflection on the coastal areas and the definition of a set of measures. They aim to reduce the exposure to risk in the short (2020), medium (2050) and long-term, respecting the principles of on sustainable development within climate change scenarios.

Under the framework of ENAAC 2020 the following activities are planned:

- Knowledge improvement on the coastal and marine systems behaviour including monitoring, data collection and its organization into a repository of geographical information making it available for the public.

- Research for better understanding of climate change impacts on the population in order to define proper adaptation measures, including the options: a) protecting the area; b) adapting the area; and c) withdrawing the population.
- Implementation of adaptation measures, including structural defence interventions and local adaptation, such as shots of artificial feeding and projects for increasing resiliency, development of warning and protection systems.
- Enhancing the effectiveness and enforcement of the legal instruments that determine the uses and activities in risk areas.

The following projects support work produced in the context of the ENAAC, focusing on vulnerability assessment and cost-benefit analyses of adaptation:

- GestAqua.AdaPT – Adapting Reservoir Management Strategies to Climate Change in Alentejo;
- SOWAMO - Sowing Water in the Monchique Mountain.

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.

Climate change adaptation measures in the Waste sector are not identified on a national basis. There is not a standardized approach to the subject among the waste collection and treatment operators. [Lipor](#) (the Intermunicipal Waste Management of Greater Porto) has however developed a [Corporate Strategy](#) for the accomplishment of sustainable waste management. This strategy aims to establish structured guidelines for waste recovery and treatment and [directly discusses climate change adaptation](#) vulnerabilities and possible responses for the waste sector.

In terms of adaptation, the waste sector is essentially marked by two types of vulnerability:

- Intrinsic vulnerabilities associated with the effects that climate change may have on the operational units of waste management and on units, points and service networks; and
- Extrinsic vulnerabilities, perhaps greater, associated with the effects that climate change can have, namely on patterns of consumption and production of waste.

In Portugal, no specific national tools or other instruments have been identified for the waste sector that could assist in addressing climate adaptation.

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

Large waste treatment plants 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

Cascais Municipality (2012-2016)	
Project description	This project focused on Cascais' location; highly dependent on its overall Climatic conditions for tourism, yet highly vulnerable to Climate Change impacts, namely on its natural capital.
Photograph	n/a
Budget	Not available
Climate Change Vulnerability and Risks	In the history of the municipality, two types of Climatic Events stand-out, due to their regularity, impact and importance for the region: floods and fires. In more recent years, heat waves are also a growing concern for public authorities and several awareness raising campaigns have been targeting such issues.
Climate change adaptation measures	<ul style="list-style-type: none"> • 'Green Corridors' aims to implement in the city of Cascais, through the re-ability of the existing riparian galleries and the unification of the parks gardens and florists, a connected and integrated green infrastructure. This should reduce the city vulnerability to floods as well as heat waves while at the same time contributes to a greater quality of living and increased sustainability of the municipality; • 'Water savings in distribution' aims to implement in Cascais the WONE System – Water Optimisation for Network Efficiency – in order to reduce the water waste in distribution from the current 17% to 6% and by doing so reduce Cascais vulnerability to Drought; and • 'Training and Raising Awareness' aims to raise awareness for climate change impacts, scenarios and adaptation possibilities for the municipality workforce as well as specific target-groups such as the Neighbourhood tutors through participatory workshops and the dissemination of knowledge and information.
Good practice	The project included the organisation of 7 participatory workshops with different stakeholders engaging more than 120 people, and the use of 2 questionnaires (one for the municipality, one for the general public). The participatory process had a great influence in determining which concrete actions should be prioritized and implemented in Cascais as well as in the overall strategy regarding Climate Change

	adaptation in Cascais. The scientific expert-based priorities ranked in a multicriteria exercise in 2010 were unanimously disregarded and transformed by all stakeholders - experts and citizens - into new adaptation measures and a new priority ranking list. Without the participatory process, it would not have been possible to compare the visions from the scientific experts, with the vision from the municipality experts and the citizen's opinions and ideas. The final strategy builds on existing scientific knowledge, expert-based field knowledge and the experience of many municipality departments, but is also validated by the citizens.
Further information	https://ambiente.cascais.pt/pt/page/plano-acao-adaptacao-as-alteracoes-climaticas-cascais

ADAPTA CLIMA-EPAL (2011)

Project description	The project ADAPTA CLIMA-EPAL aimed to provide to the Empresa Portuguesa das Águas Livres (EPAL) an adaptation strategy in the medium and long term to reduce the vulnerabilities of their activities to climate change. This process involved all entities which are involved in the activity of EPAL (public, private and consumers).
Photograph	n/a
Budget	Not available
Climate Change Vulnerability and Risks	The analysis of scenarios and vulnerabilities identified, selected and evaluated adaptation options of EPAL to climate change, in order to minimise adverse impacts and maximise the new opportunities that may arise.
Climate change adaptation measures	The project set priorities for adaptation measures based on a cost-benefits analysis in accordance with criteria established in collaboration with EPAL. Special attention was given to assessment of costs associated with adaptation measures identified, in particular with regard to planning and management of enterprise assets.
Good practice	This project uses regionalised climate scenarios which generated the mean and variability of climate variables such as temperature and precipitation. These scenarios are based on global climate models (e.g. HadCM3) and validated with observed climate series in the areas under study. The projections produced enable assessments of the frequency of future extreme weather events, such as high rainfall in short periods of time and prolonged severe droughts.
Further information	http://cciam.fc.ul.pt/prj/adaptaclima-epal/?lang=en

Adaptation to drought in Alentejo

Project	The purpose of the study was to better understand the autonomous adaptation taking place by farmers and communities in the Alentejo
---------	---

description	region. The study also evaluated the already-implemented adaptation measures with different methods such as cost benefit analysis, INVEST modelling, sharing of experience, literature review and participatory multi criteria analysis on barriers and opportunities.
Photograph	n/a
Budget	Not available
Climate Change Vulnerability and Risks	Alentejo, a southern region in Portugal is characterised by a semi-arid Mediterranean and is particularly vulnerable to drought and desertification
Climate change adaptation measures	The study collected over thirty diverse adaptation measures currently being used by different farmers and organisations in the region. Innovative measures include creating microclimates (with lakes, windbreaks, etc.) or locating crops in specific microclimates in the farm (shade of hills, etc.). Many adaptation responses consisted in implementing good practice to improve general sustainability and farm resilience. Some examples include conservation tillage (no tillage, zone tillage, keyline, contour, etc.), diversification (of crops, species, varieties, genes, creating agro-silvo-pastoral landscapes, etc.), improving soil quality (increasing organic matter, mulching, rotating livestock, introducing sewage sludge on soil, etc.). Other measures focus on harvesting rainwater and using water more efficiently such as off-stream dams, water retention landscapes, precision drip irrigation with organic fertiliser, reusing grey water, using renewable energy for water pumping to reduce the costs of irrigation. Finally, several measures focused on raising the adaptive capacity namely with awareness raising about sustainability and climate change, training courses in permaculture, and the development of community plans for an eco-village.
Good practice	In the region of Alentejo, several adaptation measures have been implemented without being specifically designed for adaptation to climate change (farmers in the region face climate extremes such as droughts and heat waves from time to time). These measures are thus mostly considered as autonomous adaptation and are of initiative of local stakeholders. The project looked at different bottom-up projects in Alentejo retrospectively and prospectively to identify innovative solutions and approaches for climate change adaptation. Bottom-up adaptation solutions were then confronted with top-down dynamics/processes to implement comprehensive and integrated strategies.
Further information	https://climate-adapt.eea.europa.eu/metadata/case-studies/autonomous-adaptation-to-droughts-in-an-agro-silvo-pastoral-system-in-alentejo

HOW TO OBTAIN EU PUBLICATIONS

Free publications:

- one copy:
via EU Bookshop (<http://bookshop.europa.eu>);
- more than one copy or posters/maps:
from the European Union's representations (http://ec.europa.eu/represent_en.htm);
from the delegations in non-EU countries
(http://eeas.europa.eu/delegations/index_en.htm);
by contacting the Europe Direct service (http://europa.eu/europedirect/index_en.htm)
or calling 00 800 6 7 8 9 10 11 (freephone number from anywhere in the EU) (*).

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

Priced publications:

- via EU Bookshop (<http://bookshop.europa.eu>).

Priced subscriptions:

- via one of the sales agents of the Publications Office of the European Union
(http://publications.europa.eu/others/agents/index_en.htm).

