

CLIMATE CHANGE IN BASQUE COUNTRY

28 BEST PRACTICES



COP23 FIJI
UN CLIMATE CHANGE CONFERENCE
BONN 2017

EUSKADI 
BASQUE COUNTRY



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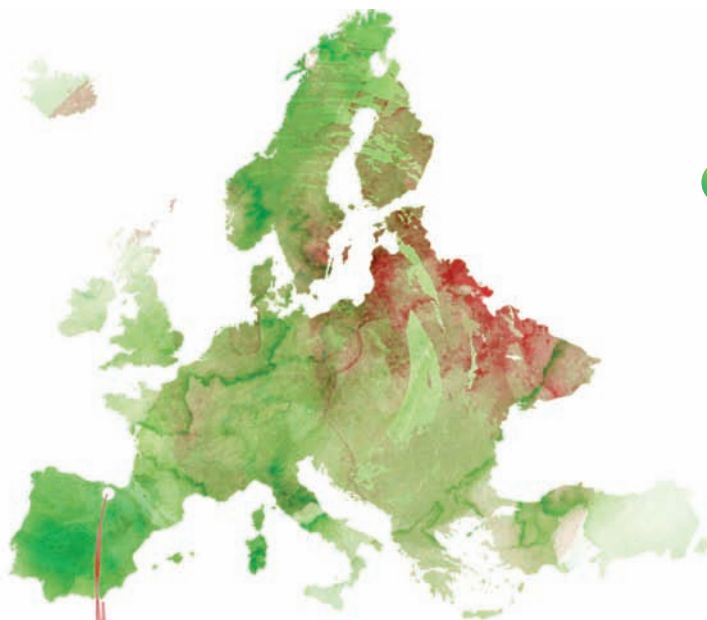
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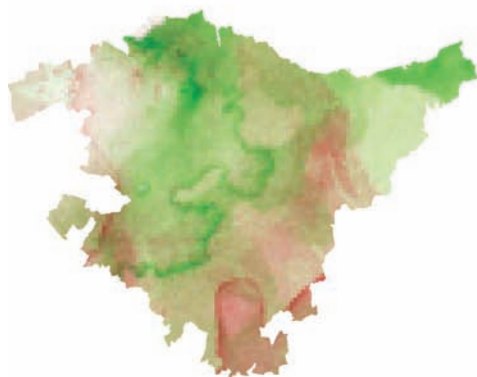


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- **Surface area:** 7,235 km².
- **Population:** 2,178,949 inhabitants.
- **Population density:** 301 inhabitants/km².
- **Number of municipalities:** 251.
- **Official languages:** Basque, a unique language with no known connection to other languages of the world, and Spanish.



- **Three internationally-renowned capitals**
 - Bilbao:** Lee Kuan Yew World City Prize 2010
 - Donostia-San Sebastián:** European Capital of Culture 2016
 - Vitoria-Gasteiz:** European Green Capital 2012

- **Per capita income:** 129%. Third place in the European ranking (European Union: 100%)

- **University graduates:** 43% of young people are university graduates (European Union: 24%).

- **Human Development Index:** 0,98. Basque Country is first ranked country

- **Environmental Performance Index:** 69,7. Basque Country is 4th ranked country place in Europa

- **Carbon sink:** 53% of the surface area covered by trees (European Union: 37.8%).

INTRODUCTION

The ratification of the Paris Agreement on the 4th of November of 2016 consolidates the framework of the Basque Government's policies regarding Climate Change and towards a low-carbon economy. The roadmap for action in the Basque Country is clearly defined in the Climate Change Strategy for the Basque Country – Klima 2050 and in the Energy Strategy of the Basque Country 2030, passed in 2015 and 2016 respectively.

The Basque Country's contribution to climate change is small in quantitative terms. The Basque share of the European Union's total emissions stands at around 0.5%. However, shared responsibility is the basic principle governing our climate change policy. The Basque Country has assumed its share of responsibility in a demanding and far-reaching commitment set out in the Climate Change Strategy for the Basque Country-KLIMA 2050 as Basque society does not want to remain on the sidelines of the global fight against climate change.

This shared responsibility and society's demands have driven the public sector and companies to implement a collaborative strategy to achieve low-carbon, competitive economy that is adapted to climate impacts.

The Basque Country is taking steps to transform combating climate change into an opportunity to produce goods and services with lower emissions, implement strategies to adapt to climate change and to train children and young people to be co-responsible and well-informed citizens. All these initiatives, furthermore, have a strategic dimension for the new Basque economy: innovation is taking place to progress towards a committee society and a sustainable Basque economy, based on clean consumption and production guidelines, not dependent on carbon, and driven by the exemplary leadership of the public sectors.

BEST PRACTICES IN ADAPTATION TO CLIMATE CHANGE

2017



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NERBIOI-IBAIZABAL, AN EFFICIENT, CONNECTED AND SMART SUPRAMUNICIPAL DISTRICT: SMART CITY SUPRAMUNICIPAL STRATEGY

"Smart City" strategy for a supramunicipal district

Nerbioi-Ibaizabal is a supramunicipal district consisting of small and medium-sized municipalities, located in the vicinity of Bilbao, which needed an efficient and stable support instrument to develop the local sustainability management. The Nerbioi-Ibaizabal Supramunicipal Office is the outcome of that need and the commitment to the supramunicipal cooperation model.

The Supramunicipal Office has set up a "Local Agenda 21" Sustainable Development Strategy, which the new Smart City Strategy comes under. This Strategy focuses on the use of the new information and communication technologies as tools to facilitate improvements in the fields of **energy, mobility and waste**. At the same time, those tools will enable the general public to have information, interact with the Local Council and be more actively involved in the management of their municipalities.

Strategy preparation process

A diagnostics and feasibility study were first conducted and which included the following aspects:

- Degree of implementation of "smart" measures in the municipalities of the supramunicipal district.
- Potential contribution of "smart" measures to achieve Local Agenda 21 targets, both those established by local plans and by the supramunicipal plan.
- Legal-jurisdictional, economic and technical feasibility of the "smart" measures.

Furthermore, more crossing-cutting matters were analysed in a complementary way. These included the existence of infrastructures and technological platforms that enable electronic formalities or the dissemination of information of interest for the general public, as they are relevant aspects that may condition and/or foster the implementation of sectoral measures.

The Plan of Action was then designed, based on the conclusions of the diagnostics. The Plan contains a total of 23 measures or initiatives, with two of them being cross-cutting, eight in the field of energy, six to do with mobility and the remaining seven in the sphere of waste.

Supramunicipal Energy Observatory and the Citizen Energy Portal

The Plan contains, among other measures:

- Implementation of a platform for energy management in local councils.
- Use of an ICT platform for the efficient management of the urban waste collection service throughout the supramunicipal district.
- The incorporation of a helpline and information technological system for public transport users.

In this context, the Supramunicipal Energy Observatory and the Citizen Energy Portal came into service in 2017. Its aim is to facilitate triple savings and environmental, economic and energy efficiency: cutting energy consumption (kWh), spending in the energy bill (€) and greenhouse gas (GHG) emissions.

It serves 7 municipalities: Arrankudiaga, Arrigorriaga, Etxebarri, Orduña, Ugao-Miraballes, Zaratamo and Zeberio. It groups together 34,887 inhabitants, 408 electricity contracts (municipal amenities and public lighting) plus a further 34 gas ones.

The estimate is that total emissions will be cut by 88.33 tCO₂, which is a 3% reduction in the total consumption of the local authority. The detected annual potential financial savings is over €70,000.

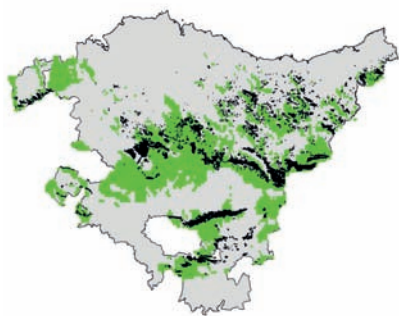
There is also a series of measures aimed at streamlining two-directional communication between the general public and the administration, such as, developing mobile apps linked to using and controlling street lighting, to the use and comfort of buildings or to promoting the prevention of and recycling waste.

The proposed measures have taken into account the different nature of the municipalities of the supramunicipal district, as some of them are eminently urban and others are smaller and rural in nature.

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Climate change threatens their habitats and species, and therefore assessing the risks and defining adaptation measures are essential.

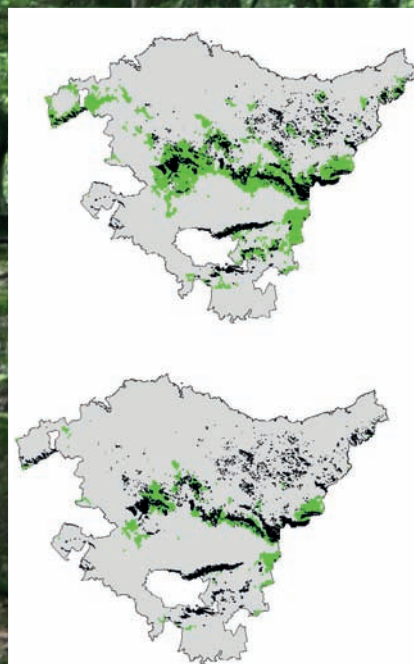


Example of bioclimatic analysis for habitat 9120 (Atlantic acidophilous beech forests with Ilex and sometimes Taxus in the shrublayer).

The current potential of this habitat according to the isobioclims is shown in green and the real current distribution in black.



The extension of the potential distribution of the optimum isobioclims for the habitat (green) is reduced considerably in the RCP 8.5 distribution in 2071-2100. Therefore, the current distribution areas (black) outside those in the future scenario will be exposed to the effects of climate change.



Example of modelling for habitat 9120 (Atlantic acidophilous beech forests with Ilex and sometimes taxus in the shrublayer).

The green in the top map represents the current potential distribution of this habitat and in black its real distribution.

The green in the bottom map shows the potential distribution of the habitat in the RCP 8.5 scenario in 2071-2100.

VULNERABILITY OF THE NATURA 2000 NETWORK IN THE BASQUE COUNTRY TO CLIMATE CHANGE

The Natura 2000 Network accounts for 20.5% of the total surface area of the Basque Country

The Basque Country has 55 sites in the Natura 2000 Network, covering a surface area of approximately 1,500 km². Climate change threatens their habitats and species, and therefore assessing the risks and defining adaptation measures are essential. The methodology to be applied to determine the future potential distribution of habitats depends on the characteristics and information available for each region.

Habitat potential distributions by means of bioclimatic analysis

The bioclimatic analysis methodology is based on the Rivas-Martínez classification (2009), where each isobioclimate represents the precipitation and temperature conditions in which a certain habitat can exist. The precipitation and temperature conditions in the future scenario may modify the current isobioclimate to the point that it will become an isobioclimate that theoretically could not host that habitat. Using the climate scenarios of the Basque Country as the baseline, with a resolution of 1 km, the future potential distributions were established for 79 habitats in the RCP 8.5 scenario for 2071-2100 defined by the IPCC. Their exposure to the threat was thus calculated.

Habitat potential distributions calculated statistically

In parallel, a species distribution model based on statistical methods that seek to establish a relation between environmental factors and the presence or absence of a geographical area has been used. Specifically, a consensus model was

applied using three different techniques: generalised linear models, *Boosted Regression Trees*, and Random Forests. The results were validated using two statistics (AUC and TSS). The results of the model were converted into two binary models (presence = 1, absence = 0) and finally the number of predicted pixels were counted in the Basque Country (potential area predicted by the model for the present, 1971-2000, and for the future 2071-2100 RCP 8.5).

Species potential distributions versus distribution models

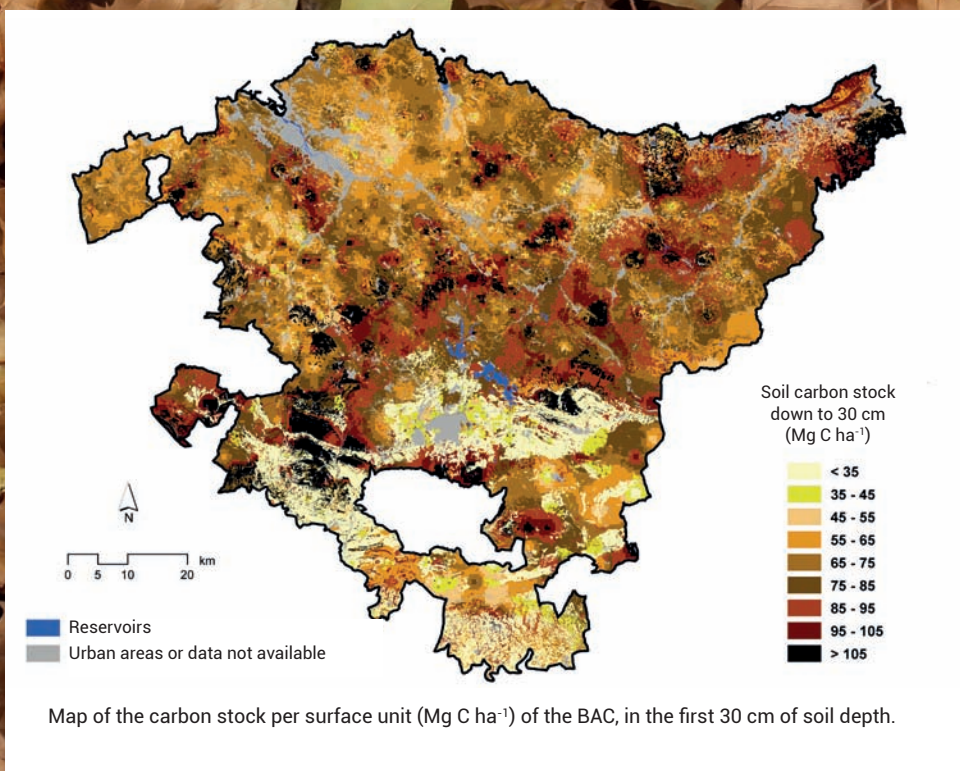
After a pilot scheme with species and habitats, it was decided to use the modelling of the habitat distribution as a tool to analyse the exposure and adaptation capacity to climate change of the Natura Network in the Basque Country. Bioclimatic analysis had been therefore considered as a useful tool to prepare a descriptive discourse that establishes how the trends in precipitation and temperature variation in the future scenario can generate those effects of the future potential distribution of the habitats.



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The tool estimates in a simple and user-friendly way the carbon dioxide absorptions obtained for a greater number of project types and coming both from plant biomass and the soil.



ORGANIC CARBON IN THE SOIL

Map of carbon stock in the BAC

Soils contain a significant proportion of carbon and act as a source or sink of atmospheric CO₂. The accumulation of organic matter in the soil can be increased by soil management practices that minimise soil disturbance and optimise crop productivity by means of soil fertility. In this regard, as has been established in the "Initiative 4/1000", a small increase in the carbon storage in agricultural land is crucial to improve soil fertility and crop production, and thus help to achieve the long-term target of limiting the increase in the global average temperature to a maximum of 1.5 or 2 °C.

The carbon stock of the soils of the Basque Country was obtained by determining the organic matter from a total of approximately 6000 samples of geolocated soil. The soil organic carbon (SOC) values obtained indicate that the use of the land and climate apparently determine the SOC levels, even though there is a high variability associated to other parameters.

CO₂ absorption projects and calculation tool

The climate change policy of the Basque Autonomous Community (BAC) is currently reflected in the Climate Change Strategy 2050 of the Basque Country.

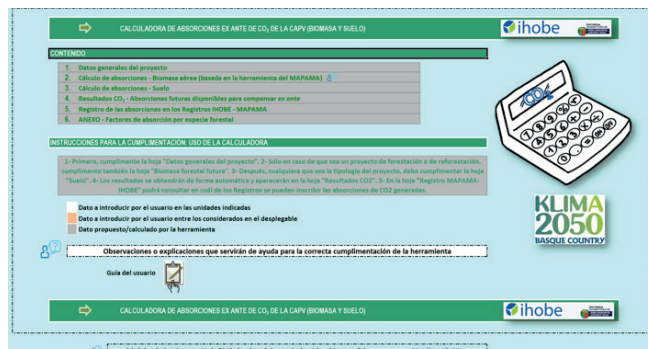
There is room for all those projects aimed at increasing CO₂ absorption in that strategic context. In order to promote those projects, the Basque Country has a practical and clear methodology that helps to guide the registrations and monitoring of a CO₂ absorption project in the Basque Environmental Impact Activities Register.

It is the first tool available that includes absorptions associated to the air biomass of:

- Reforestation with change of land use.
- Measures in forest areas destroyed by fire to re-establish the existing woodland.

Incorporating other project types that include:

- The change of management in forest, crop and grazing land.



It is a means to incentivise land use change projects

The tool comes in two versions: an *ex ante* consultation calculator (for users that do not have prior analysis) and an *ex ante* registration calculator (for users that have soil analysis: organic matter and apparent density). The calculation methodology is based on the IPCC methodology, 2006 to prepare greenhouse gas inventories.

In short, the tool estimates in a simple and user-friendly way the carbon dioxide absorptions obtained for a greater number of project types and coming both from plant biomass and the soil.

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THE LOW-CARBON ECONOMY IS ON ITS WAY

When the world leaders met at the Paris COP 21 in December 2015, they sent a clear signal to the markets and companies around the world that the low carbon economy is on its way.

In order to analyse the impact of the low-carbon economy on the competitiveness of the Basque Country's business fabric, in terms of relevant messages and foresight for the companies, a report was produced on **the basis of work sessions** in the sphere of the Basque Employers Confederation (CONFEBASK). Over 30 companies took part in the sessions and provided their sectoral views of the challenges and opportunities of climate change. **Interviews** were also held with a series of experts from companies, associations and research centres.

A challenge with risks and also opportunities

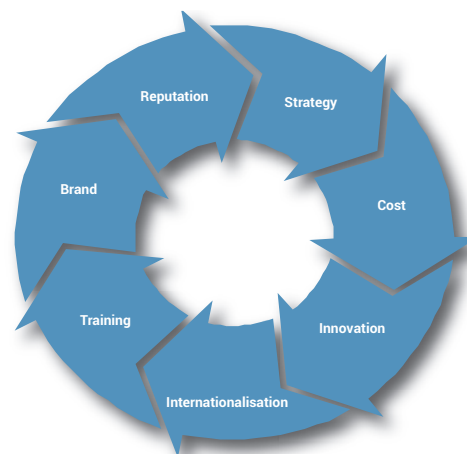
As regards the challenge of advancing towards a low-carbon economy, a series of elements have been identified that establish a framework of both risks and opportunities for companies. Those elements can be broken down into three impact factors on business competitiveness:

- **Impact on the physical environment:** Direct environmental effects on physical environments.
- **Impact arising from mitigation policies:** Effects related to the implementation of Climate Change mitigation legislation and policies.
- **Market-related impact:** Effects related to the introduction of structural changes in the markets and modifying supply and demand.

The company can set its competitive position

The perception of risk and opportunity has an important subjective component where the very positioning of the company and its attitude towards the market has a high specific importance. In any event, business competitiveness is going to be affected by the new low-carbon economy. The companies that are most active in managing global climate change perceive both risks and opportunities.

Therefore, whether the low-carbon economy is seen as positive or negative is going to depend on the decisions adopted by each company to a great extent. The company responses can be addressed from all aspects of the management of a company, by transforming the risk of climate changes into a competitiveness factor that fosters new business opportunities:



- Strategic approach.
- Cost optimisation.
- Promoting and applying innovation.
- Integral management of internationalisation.
- Empowering individuals.
- Brand and reputation.

The analysis of risks and opportunities and how a company must respond cannot be applied uniformly in all organisations. The specificities relating to each organisation's activity and the sector to which it belongs need to be identified so that it can focus its strategy and policies.

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EXPOSURE

Low exposure (E1)	Medium exposure (E2)	High exposure (E3)
The company does not have important assets (installations, workforce, billing) in the geographical area to be analysed (<30% of the total)	The company has assets (installations, workforce, billing) in the geographical area to be analysed (30% < X < 60% of the total)	The company has important assets (installations, workforce, billing) in the geographical area to be analysed (> 60% of the total)

VULNERABILITY

	Sensitivity to climate change	Adaptation capacity	
	Low S	Medium S	High S
High AC	Low V (V1)	Low V (V1)	Medium V (V3)
Medium AC	Low V (V1)	Medium V (V2)	High V (V3)
Low AC	Medium V (V2)	High V (V3)	High V (V3)

CLIMATE RISK

	V1	V2	V3
E1	Low R (R1)	Low R (R1)	Medium R (R2)
E2	Low R (R1)	Medium R (R2)	High R (R3)
E3	Medium R (R2)	High R (R3)	High R (R3)

TOOL FOR PREPARING THE STRATEGIC DIAGNOSTIC OF ADAPTATION TO CLIMATE CHANGE

Adaptation to climate change in the business sector

Iberdrola is an electric utility and leader in clean energies. It is committed to the sustainable development goals and, in particular, to climate change and it has set itself the target of halving its emissions intensity by 2030 and of being carbon neutral by 2050. Aware of the importance of managing and being ready to address the challenges of climate change, the company has decided to implement a climate change adaptation strategy. Therefore, in 2016 and in the framework of the Basque Ecodesign Center, it conducted the first strategic diagnostic of adaptation to climate change for all the activities of the company in mainland Spain and Portugal, and which was coherent with the analysis performed for the different businesses of the company in the United Kingdom and the USA. The pilot scheme identified those lines with greater potential to be affected by climate change in the coming decades, thus focusing the development of more detailed studies on specific facilities.

Based on this experience, the Basque Government, in conjunction with the Basque Business Confederation (CONFEBASK), has developed tools and methodologies to allow companies to establish climate change adaptation strategies in keeping with the IPCC guidelines to analyse climate risk, in order to support the Basque business fabric to improve its resilience and reduce the impact of climate change on its activities.

Corporate climate change adaptation strategies

Taking into account the magnitude of the forecast climate changes, improving climate change adaptation in an organisation is vital. Therefore, action guidelines need to be established, that are based on an initial diagnostic and which have an associated assessment and monitoring system.

The process of preparing corporate strategies to adapt to climate change must include three consecutive phases. First, a baseline and the necessary additional information (diagnostic) need to be established which will then be the basis for the actions that allow the consequences of climate change on the organisation to be diminished and the ensuing opportunities to be harnessed (plan of action). Once the road map to be followed has been determined, the third step is to design an assessment and monitoring system in order to periodically measure the progress made and its impact on the situation of the company regarding climate change.

The climate change adaptation strategies must be in line with other management systems of the company, such as the environment and quality integrated systems, and may be backed up by climate change and sustainability indexes and platforms, such as CDP Climate Change, Caring for Climate and Climate Neutral Now.

A methodology has therefore been developed to conduct a strategic diagnostic, which is the first phase to define the climate change adaptation strategy and adapt the guidelines of the IPCC Quinto Fifth Assessment Report.

Strategic diagnostic of adaptation to climate change

Starting from concepts such as exposure to climate change, sensitivity, adaptation capacity and vulnerability, it provides a guide to determine the climate risk that the organisation may be facing, by business line and geographical location. This first diagnosis step allows solutions to be focused on reducing the level of the future risk.

The stages established in the methodology are as follows:

1. Defining business lines and geographical locations of the organisation on which to develop the analysis.
2. Knowledge about future climate scenarios.

Climate risk analysis

The results of the climate risk analysis provide information on which geographical areas and which activities of the organisation overall may be affected by climate risks. This diagnostic information allows the information needs to be identified and focus on objectives and actions that foster the adaptation to climate change of the organisation.

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A close-up photograph of a person's hand holding a silver pen, writing on a document. The hand is wearing a dark blue long-sleeved shirt. The document has some text and a small colorful chart. In the background, there is a blurred image of a person and a red and white striped object.

The Basque population demands ambitious policies from all its institutions. Over 75% of the general public support the Administrations investing in fighting against climate change.

CITIZEN PERCEPTION OF CLIMATE CHANGE AND ENERGY

Climate change is one of the most serious challenges of the 21st century and the action to address it is one of the fundamental properties of the EU. The *Energy-Climate Change* duality has been defined as a priority in the *Basque Environmental Scenarios 2030*, in the *Environmental Framework Programme 2020*, in the *Klima 2050 strategy* and in the *Basque Energy Strategy 2030*. However, a specific citizen perception study for Energy and Climate Change in the Basque Country has never been conducted.

This analysis has been the outcome of the partnership between the Sociological Prospecting Office of the General Secretariat of the Premier's Office of the Basque Government, the Basque Energy Board (EVE) and Ihobe. The 3 Basque capitals have also been involved, along with this interdepartmental cooperation.

The doubts about the certainty of climate change, which generates great concern, have nearly disappeared

Ninety per cent of the population of the BAC totally (59%) or quite (31%) agree that climate change is really occurring. It was 76% in 2008 and 69% in 2011.

Fifty-five per cent of the population say that they feel quite concerned in this regard, 23% very concerned and 5% extremely concerned. Seventeen per cent are slightly or not at all concerned about climate change. The percentage of those people who feel quite, very or extremely concerned is greater in the Basque Country than in France, Germany, Norway and the United Kingdom.

Conviction that human activity causes climate change

The population of the BAC mainly believes that climate change is mainly due to human activity (63%), compared to those who believe that it is partly due to human activity and partly to natural processes (32%) or that it is mainly due to natural processes (2%).

Seventy-seven per cent of the population believes that we are already feeling the effects of climate change, a notably higher percentage than in France, Germany, Norway and the United Kingdom. Twenty-four percent of the people surveyed do not know or did not answer about the type of consequences that they believe that it will have in the Basque Country. Those who did so said above all that it will be hotter and there will be more droughts.

Agreement with the need to change habits

Basque society seems to have assumed that our habits will need to be changed to fight against climate change. Eighty-eight per cent and 85% totally or quite agree that it will be necessary for us to reduce our energy consumption and that we will have to give up some amenities, respectively.

There is much agreement about the specific measures to be applied when they are about further developing renewable energies (95%), giving impetus to public transport (92%) and subsidising the purchase of electric vehicles (80%), and less so when the idea is to increase taxes on certain types of vehicles (59%) and on plane travel (34%) or raise the price of petrol (25%). Despite the willingness to take measures against climate change, it seems there is certain resistance to measures that may impact the personal economy.

Commitment to renewable energies

Eighty-three per cent of the population believes energy production and consumption is very or quite related to climate change.

The population of the Basque Country is in favour of fostering renewable energies, even though 21% would not be willing of having an energy facility nearby and a further 43% said that they would be or not willing to have it, depending on what type of facility. In any event, the vast majority (77%) are against nuclear power stations being established in the Basque Country.

Ambitious policies

The Basque population demands ambitious policies from all its institutions. Over 75% of the general public support the Administrations investing in fighting against climate change.



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BEST PRACTICES IN ADAPTATION TO CLIMATE CHANGE

2016



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- 3** OSATU: HOW TO PREVENT IMPACTS OF HEAT WAVES ON HEALTH
- 4** WATER VULNERABILITY: ADAPTING TO NEW WATER SCENARIOS
- 5** NBS URBAN: MAP OF THE POTENTIAL NATURE- BASED SOLUTIONS IN DONOSTIA-SAN SEBASTIÁN
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- 7** ADAPTING THE COASTLINE BY MEANS OF RESTORING SALT MARSHES AND DUNES
- 8** MULTIFUNCTIONAL AND SUSTAINABLE FORESTRY MANAGEMENT OF THE AMURRIO PUBLIC WOODLAND
- 9** ADAPTATION TO CLIMATE CHANGE THROUGH PUBLIC SPACES: “FAKTOR BERDE” TOOL
- 10** INTEGRATING CLIMATE CHANGE ADAPTATION IN BUILDING



**The KLIMA 2050 Strategy
places adaptation to climate
change as one of its main lines
of action.**

USING INNOVATION TO INCREASE RESILIENCE IN THE BASQUE COUNTRY

Ever since the Climate Change Strategy of the Basque Country-KLIMA 2050 was approved in 2015, the Basque Government has considered adapting to climate change to be one of its core points of action. It has therefore implemented different programmes to support climate change adaptation demonstration projects that have led to a total of 7 projects being implemented.

Apart from applying innovative solutions to adapt to climate change, those projects has included case studies being run to check the suitability of the proposed solutions in the field and to establish the extent to which they can be implemented for similar problems in other locations.

The instruments designed to implement climate change adaptation projects in the Basque Country are those detailed below.

Klimatek Projects

KLIMATEK funding lines: R&D, innovation and demonstration projects to adapt to climate change", run by the Basque Government's Ministry of the Environment and Territorial Policy, seeks to support the implementation of projects that delve further into the application of knowledge and research scenarios, vulnerability and/or impacts of climate change in the Basque Country, by means of identifying different tools, mechanisms and interventions aimed at improving the resilience of our territory. Specifically, projects are considered that include the adaptation of climate change in the natural environment, primary sector or other sectoral areas.

The projects in the 2016 call are from very different areas, including the generation of regionalised scenarios, heat waves and health, municipal-scale maps of the deployment of nature-based solutions, and water vulnerability. They are all focused on decision-marking in different policy areas of the administration.

Eco-innovation Projects

Call in the sphere of the Science, Technology and Innovation Plan 2020. In this context, work is being carried out on the "Nature-based solution for the regeneration and ecosystemic restoration of urban and peri-urban environments: The case of Donostia/San Sebastián".

Local Innovation Projects

The Berrigurumena 2016 Call for Projects that is launched annually by the Basque Network of Municipalities for Sustainability fosters the development of innovative projects at municipal level in the Basque Country. Two measures that will help to meet the goals of the Climate Change Strategy of the Basque Country 2050 are being implemented in the framework of this programme.

- a. **Faktor Berde.** Innovation and demonstration project to adapt urban public spaces to climate change in the municipality of Durango.
- b. **MapClimUrb.** Urban Climate Map for municipal planning applied to the city of Vitoria-Gasteiz.

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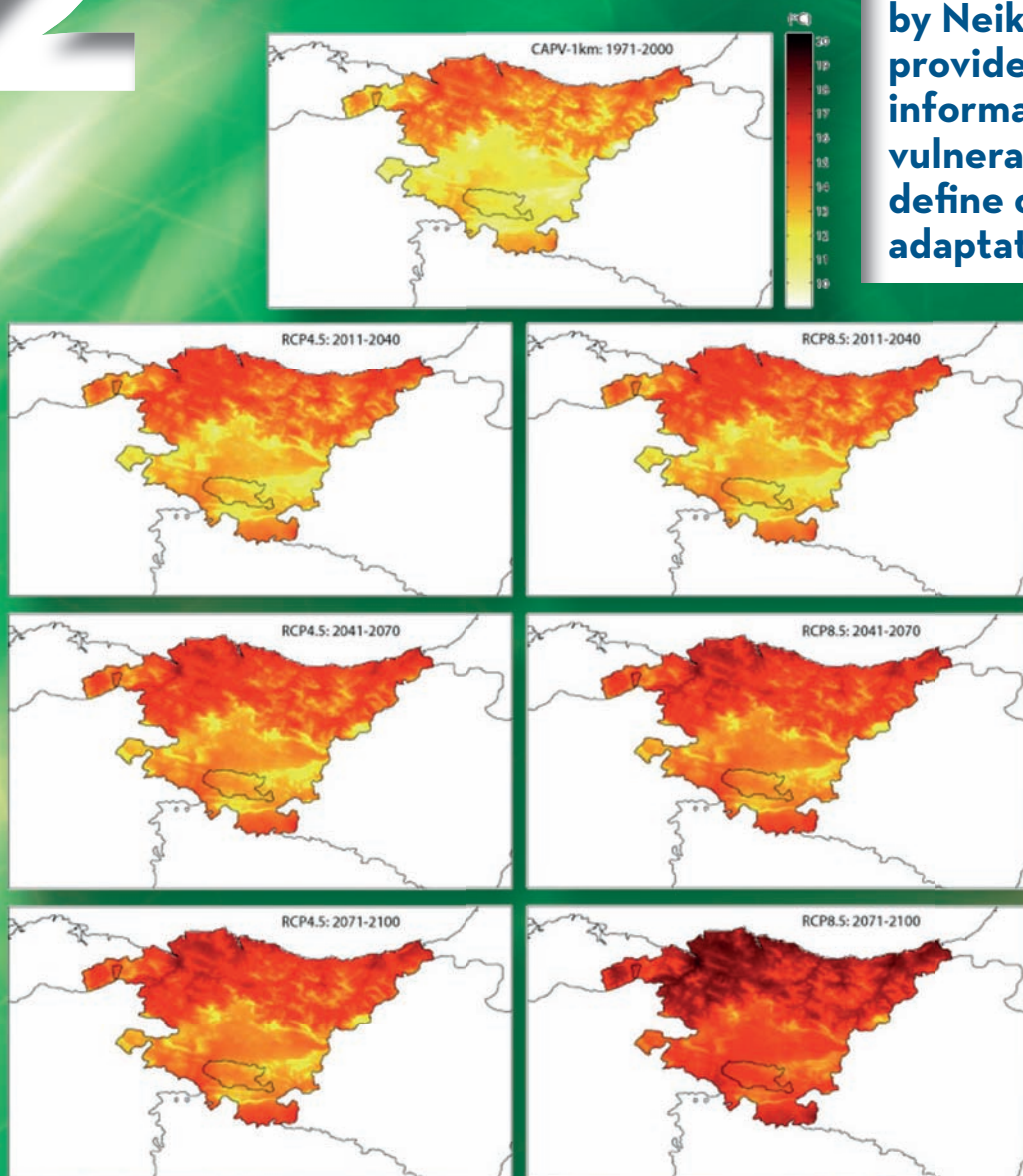
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The regionalised climate scenario, produced by Neiker-Tecnalia, provides reference information to assess vulnerability and define climate change adaptation measures.



REGIONALISED CLIMATE SCENARIOS IN THE BASQUE COUNTRY

Regional climate scenarios provide cross-cutting and benchmark information to be applied to such diverse sectors as construction, health, agriculture, water management, etc., in order to be use in the process to assess vulnerability and impacts, and when defining measures to adapt to climate change.

Up-to-date regional climate scenarios provide the Basque Country with benchmark information for studies to assess climate change vulnerability and impacts, as well as to define the adaptation measures required.

This climate information is of interest to different Basque sectors given its cross-cutting nature.

12 x 12 km scenarios

NEIKER-Tecnalia, the Basque Institute for Agricultural Research & Development, in collaboration with the Basque Meteorology Agency-Euskalmet, has prepared the regionalised climate scenarios for the Basque Autonomous Community, through the KLI-MATEK I+B+G call: R&D, Innovation and Demonstration Projects to adapt to climate change 2016, under the aegis of the Basque Government.

This project involves updating the climate scenarios using advances in climate simulation models (updating according to the 5th report), Euro-CORDEX (12.5 x 12.5 km) initiative. The new scenarios apply that methodology for different time periods (2011-2040, 2041-2070 and 2071-2100) and for the RCP 4.5 and RCP 8.5 scenarios, described in the latest IPCC AR5 report. This methodology uses a 0.11° resolution (approximately 12 x 12 km) to transfer the change to the cartography of the Basque Country signal at a resolution of 1 x 1 km. The indicators proposed by the ETCCDI (Expert Team on Climate Change Detection and Indices) have also been calculated.

New climate change section in GeoEuskadi

Given the interest of the maps and information generated in the project for future climate change adaptation policies in the Basque Country, all the information will be available to the general public, private companies and public administration, through the following channels:

- **GeoEuskadi.** It is the Spatial Data Infrastructure (SDI) of the Basque Country, where a new section, specifically on climate change, will be home to the different spatial data generated and which are of greatest interest for the general public.
- **FTP Download Service** for geographical information. Both belong to the Basque Government.
- **Open Data Euskadi**, where the climate data will be published under open property licenses.

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The OSATU project, the work of BC3, is aimed at supporting the authorities of the Basque Country in the planning and implementing of warning and prevention schemes regarding the health impacts of heat waves in a climate change context.

OSATU: HOW TO PREVENT IMPACTS OF HEAT WAVES ON HEALTH



The Basque Centre for Climate Change (BC3) has conducted the OSATU project to support the institutions of the Basque Country in the planning and implementing of warning and prevention schemes regarding the health impacts of heat waves in a climate change context. This work, in collaboration with the Basque Government's Ministry of Health and the Emergency Directorate, has been implemented through the call of KLIMATEK: R&D, Innovation and Demonstration projects to adapt to climate change 2016, under the aegis of the Basque Government.

How can we adapt to a warmer future?

The United Nations Intergovernmental Panel on Climate Change (IPCC) warned in its latest report that heat waves are already increasing more frequently due to global warming and that an increase is expected in their frequency, intensity and duration in the coming decade. In turn, the World Health Organisation (WHO) has recognised that heat waves represent one of the most dangerous extreme weather events, even though they receive much less attention than other extreme events such as hurricanes or flooding. Even in those zones where heat waves have so far not represented an important risk so far, governments will have to consider the possibility of their increasing and, consequently, of defining adaptation plans and policies. In fact, scientific studies have estimated that the probability of a heat wave such as the one that occurred in Europe in 2003 has already increased ten times: those events that occurred twice every 100 years are now expected to happen twice per decade.

Preventing the impact of and planning measures to be taken regarding heat waves are only possible, by means of an innovative approach both from the perspective of public planning and of scientific research.

Science-based decision making

The project has been planned and developed in conjunction with the Basque Government's ministries in charge of environmental, health and emergency policies, by adapting its scope to the needs and reality of public management.

- **An integrated framework at the regional scale**

Some scientific studies have calculated temperature projections and changes in the frequency and intensity of the heat waves; others have addressed the impact of heat waves on health; furthermore, there are studies that have assessed the costs associated to the operating of current warning plans. However, in this scientific context, the OSATU project represents a new position that has embraced the three previous approaches, by applying them at regional and local level.

- **The costs of climate change adaptation**

In a context of great uncertainty regarding the size and timeline of the impacts of climate change, the OSATU project provides key information to act and deal with those impacts. Specifically, a methodology has been developed to estimate the costs of adapting the current Prevention Plan progressively to an increasingly greater risk, according to the evolution of the temperature, of the critical thresholds and of other measures of the plan.

- **Transferability to other contexts**

Analysing and assessing the prevention interventions implemented in OSATU allows their transfer and application to other regions and cities.

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The EGHILUR project proposes an innovative approach to studying the impact of climate change on the flows of the Basque Country, from a river basin perspective. It specifically studies water vulnerability and applies it to the Zadorra system.

WATER VULNERABILITY: ADAPTING TO NEW WATER SCENARIOS

In general, studying the time trends of the series of flows recorded leads to better knowledge of the hydrological behaviour of the river basins and, therefore, to validating their water vulnerability, i.e., their capacity to guarantee an adequate water amount and quality to meet the basic needs of the population without harming the functioning of the ecosystems.

The EGHILUR project has been run by the Environmental-Water Processes Group at the University of the Basque Country (UPV/EHU), in conjunction with the Basque Water Agency - URA and it seeks to develop a new methodology to study water vulnerability and apply it to the Zadorra system, that guarantees the Vitoria-Gasteiz and the Bilbao metropolitan area. The project has been conducted with the support of funding under KLIMATEK I+B+G: R&D, Innovation and Demonstration projects to adapt to climate change, under the aegis of the Basque Government.

Water resilience

The analysis of the trends recorded in recent decades helps to predict future trends, both in the short- and medium-term. In this context, it is important to analyse the origin of the trends being recognised to understand whether they are linked to climate phenomena or to human activities. This will all allow the forecasts of the evolution of **water resilience** to be improved, which will help to achieve good environmental status of bodies of water, pursuant to the Water Framework Directive (WFD). Therefore, work has been carried out at regional level, by extending the analysis to a broader setting than the territory of the Basque Country, to obtain trends for the last 20, 40, 60 and 95 years in the flows of the rivers, with special emphasis on the low water levels.

In order to attempt to predict the evolution of the flows along with their uncertainties associated throughout the 21st century, a water model is going to be applied to different sub-basins of the Zadorra, in order to obtain specific results that allow the me-

thodology developed to be validated. The different envisaged climate scenarios are included in the water model as a weather variable, thus obtaining the future possible trends of the flows.

The River Basin perspective, an innovative approach to climate change adaptation

An innovative approach to expertise on the impact of climate change on the flows of the Basque Country has been taken as the basis of the project. Apart from considering changes in the climate, this approach also considers changes in land use to include those uses in the adaptation measures. The territory plays a hydrological function that has to be taken into account in the adaptation measures, as the use of the land and its changes, both those arising from the very adaptation of vegetation to changes in climate, and those arising from the decisions made today regarding spatial planning, play an essential role and the water amount and quality of the rivers. In other words, a basin perspective must be adopted in the development of adaptation measures, in line with the philosophy followed in the water planning of the BAC.

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The NBS URBAN Solutions Based on Nature project run by TecNALIA will allow the use of ecosystems to be strengthened in combination with the existing infrastructures, in order to foster adaptation based on ecosystems.

-  Market Gardens/greenhouses
-  Trees
-  Meadow/Grass
-  Woodland
-  Private Garden
-  Gardens



NBS URBAN: MAP OF THE POTENTIAL NATURE- BASED SOLUTIONS IN DONOSTIA-SAN SEBASTIÁN

The map of the potential of nature-based solutions (NBS) of a municipality allows it to be established which nature-based

adaptation measures are available there, which need to be modified, new zones that could host these solutions, and establish what its global adaptation potential is given this type of solutions.

TECNALIA Research & Innovation, the leader in climate change adaptation, and with international alliances, has developed the NBS methodology to the call of the KLIMA-TEK I+G+B: R&D, Innovation and Demonstration Projects to adapt to climate change programme 2016, under the aegis of the Basque Government.

The Donostia/San Sebastián NBS Map.

In order to ensure that the project is practical and demonstrative, the NBS methodology has been developed by applying it to the municipality of Donostia/San Sebastián. The results of the NBS mapping of this city will serve as the basis to prepare its Adaptation to Climate Change Plan.

It is straightforward, effective, practical and easily replicable by other municipalities to foster its transferability, and innovative as it combines expert work with citizen participation.

The project seeks to improve awareness of the territorial potential of the Basque Country to deploy the NBS methodology in the urban setting and to provide the municipalities with tools that enable them to perform climate change adaptation actions.

Nature-based solutions, an economic, resilient and innovative way to adapt to climate change

Adapting to climate change is a proactive policy and, therefore, seeks to generate future savings, by means of avoiding damage or cutting spending on response actions. This proactive perspective does not necessarily require increasing current investments, but rather they need to be reconsidered, perhaps not by greater spending, but rather in a different way. It is important to act now to save in the future. From an economic perspective, it has been proven that it is more effective to be proactive and cut the remedial costs that may be incurred: private (recovery from physical damage in industries, insurance company costs, etc.) and public (hospital costs, reconstruction of damaged infrastructures, etc.) investments.

Including the NBS methodology, as adaptation measures in the Climate Change Adaptation Plans of the municipalities allows resources to be optimised and the adaptation process to be implemented in a more economic, resilient and innovative way.

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Policies to adapt to the foreseeable rise in sea level due to climate change are being implemented in the Urdaibai Biosphere Reserve.

INTEGRAL RESTORATION PROJECT IN THE URDAIBAI BIOSPHERE RESERVE



The River Oka estuary is located in the centre of the Urdaibai Biosphere Reserve, a Natura 2000 Network site and under the RAMSAR Convention. It is a high-value landscape and nature site that has undergone an ongoing and gradual transformation over recent centuries due to human action.

The original cane-bed and salt-marsh habitats that occupied the whole territory were dried out as the result of farming and stock-raising during the Middle Ages when earth walls were built. Furthermore, in 1923, a straight channel with breakwaters as its banks was built in the middle section (Kortezubi). All those actions reduced the natural functionality of the upper estuary of the River Oka.

The end to the livestock-farming in the upper estuary at the end of the 20th century and the gradual naturalization of the area, in the best of cases, and the ruderalization, together with the proliferation of invasive exotic species in the worst, led to the estuary coming under different forms of protection

The consequences of climate change

In the current context of climate change, with the sea level quantified as rising for this coastal area at 2 mm/year, the different estuary ecosystems (open sea-intertidal plain, sandy-intertidal plain, sandy silt, high, mid and low tide) can be expected to gradually migrate upstream as the sea level rises.

Adaptation measures as part of the integral restoration plan for the Upper River Oka Estuary

Starting from this baseline and after the Urdaibai Biosphere Reserve declaration, the goal was embraced to turn that space in a sustainable development benchmark. Work has therefore been carried out on producing the integral restoration and revitalising of the cultural and natural heritage of the Upper River Oka Estuary project. The goals are the partial recovery of its water functionality, the restoration of its river-estuary habitats and awareness-raising and encouraging the enjoyment of and accessibility in this area of special environmental value.

This work has enabled the recovery of the Barrutibaso setting and the functionality of the old watercourse of the River Oka

through Forua, by getting rid of the power lines on the right bank of the estuary, adapting and improving a 14-km network of paths and connecting both banks by means of a cycle and pedestrian footbridge.

Different interpretation and dissemination resources have been created, along with the promotion of environmental tourism, in order to disseminate the important heritage and the measures implemented in this sphere. These include the development of a smartphone app that contains information on the habitats, species and culture of the zone, and it provides a self-guided visit for each of those areas.

Furthermore, in the sphere of adapting to the consequences of the rise in sea level generated by climate change, the project includes the following measures:

- Fostering the resilience of the ecosystems to the adverse effects of climate change (increase in sea level, greater frequency of extreme events, changes in the water cycles...) by driving the environmental restoration of intertidal ecosystems.
- Eliminating the invasive exotic species to be found in the areas that have lost the characteristic of the estuary ecosystem by means of restoring the functionality of the habitat and the variation in the physiochemical conditions of the habitat which will lead to the elimination of the *Baccharis Halimifolia* invasive exotic species. Thanks to the "Restoration of habitats of community interest in estuaries of the Basque Country" LIFE project, actions have been taken to control this species in all the affected of the area in the estuary, that spans approximately around 700 Ha.

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The projects to restore dune systems and salt marshes help to buffer a scenario of a rise in the average sea level and an increase in the frequency of strong storms.

ADAPTING THE COASTLINE BY MEANS OF RESTORING SALT MARSHES AND DUNES

Dune ranges and spits are the elements that regulate the hydrodynamics of estuaries, salt marshes and coastal lagoons.

As a means of protection in a scenario of an average rise in sea level and an increase in the frequency of strong storms, it is an ecosystem that has gained in importance given the challenges raised by climate change.

The Basque Country has 250 km of coastline, with the amount of the population living in coastal regions amounting to 1,527,698 people, which accounts for 70% of the population. In this scenario, where the majority of the population would be exposed to the impact that climate change may have on the coastline, the public authorities are implementing different climate change adaptation projects. These include the salt-marsh and dune system restoration projects, as buffers against the rise in sea level and storms.

Santiago Beach (Zumaia)

The main threats to this dune system at Santiago beach are pressures from human leisure and recreational activities and the presence of invasive exotic species. Given the existing pressure, there is the need to regulate the pedestrian routes that cross the dune area and to allow a stretch of dune located to the east of the beach to evolve. The following measures have therefore been implemented: reorganisation of the pedestrian paths, improving the conditions of the eastern dune of the beach by means of treating the drainage of the road that limits the dune and planting dune vegetation.

Barbadún dunes and saltmarshes (Muskiz and Zierbena)

The CLH S.A. industrial premises on the River Barbadún estuary, used for storing hydrocarbons, was built four decades ago on the salt marshes on the right bank of the watercourse, adjacent to the dune system. At the end of the land occupancy concession, the

dismantling and decontamination of the occupied soil, and the subsequent landscape and environmental recovery of the area of the natural site made up of dunes, meadows and salt marshes, to the construction of a network of pedestrian pathways, with the elimination of part of the car parks existing in the maritime public domain and to the restructuring of the car parks adjacent to the meadow. This site is currently designated as a Special Area of Conservation (SAC).

Gorliz Dunes (Gorliz)

An important intervention has taken place at the Gorliz/Plentzia beach to renaturalize the beach and dune area.

The restoration work has not only enabled waterfronts and beach areas to be recovered, but also other important aspects of biodiversity and to improve their resilience to climate change: elimination of the road and breakwater wall to recover the original dune system, planting the dunes in order to maintain and recover the new area gained for the beach, environmental recovery of the degraded spaces and elimination of the forestry operations; environmental improvement of the areas linked to public uses and environmental recovery of the areas around existing watercourses.

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Forestry management based on increasing the uniformity and complexity of the forest allows the forest's resistance and resilience to climate change to be increased.



MULTIFUNCTIONAL AND SUSTAINABLE FORESTRY MANAGEMENT OF THE AMURRIO PUBLIC WOODLAND

Amurrio is a municipality located in the north-west of Álava (Basque Country), has a population of 10,300 inhabitants and a surface area of 96 km².

It has a well defined urban centre where 90% of the population and a highly developed service and industrial sector. It also has 9 rural administrative boards where the municipality's farming and livestock-raising is concentrated.

It should be noted that 58.18% of the surface area of the municipality is woodland and 23.65% meadows and grazing land, and 60.6% of the surface area is publicly owned.

Forestry management based on increasing the diversity and complexity of the forest allows to increase the forest's resistance and resilience to climate change, thus protecting the resource so that future generation can continue to receive the social, regulator and production benefits of the Amurrio woodland.

Adaptation to climate change in forestry management

Amurrio Local council, recognised in 2015 for its climate change commitment thanks to its achieving Compliant status, the maximum category in the "Compact of Mayors" scheme, has a management scheme for its public woodland with a surface area of 754 hectares. The scheme is highly innovative as its main objective is sustainability and adaptation to climate change. It is based on forestry management from a multifunctional approach, by improving the production functions of forest, diversifying the forest cover to reduce market and environmental risks, while at the same time balancing the production functions of the woodland with maintaining biodiversity, protecting land and watercourses and with the public use. This is all based on mixing uses: slow growth forestry, pasturing, recreational, educational, harvesting mushrooms, conservation, and it also has PEFC Certification for its 685 hectares of productive forestry use.

Benchmark project in the forestry management sector

The implementation of the Management Scheme ends in 2016, with the following objectives having been achieved. This means the experience is a benchmark project in the forestry management sector:

- There has been a 19% (116 ha) reduction of the land area forested with conifers and a 160% (94 ha) increase in deciduous woodland as the result both of the conversion of conifer areas and non-forestry use land and which in total affects 146 ha. This also includes the diversification of 25 ha of conifer woodland with mixed and pure planting of other less common conifer species.
- The increase in native vegetation land area, by means of environmental restoration measures, of around 15 ha at different points in the landscape, helps to connect and consolidate riverbank areas to help to protect water and land resources.
- Recovery of strips of riverside woodlands between 5 and 25 m wide along the watercourses and planning strips of deciduous trees as firebreaks on the edges of all the single-crop forest plantations.

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Faktor Berde is an innovative project that has developed a tool for urban public spaces to adapt to climate change. The project, applied in Durango (Bizkaia), is built on a pedagogical approach and is integrated in municipal planning.



ADAPTATION TO CLIMATE CHANGE THROUGH PUBLIC SPACES: “FAKTOR BERDE” TOOL

Durango is a municipality strategically located in the geography of the territory of the Basque Autonomous Community. It is currently immersed in reviewing its General Land-Use Plan involving a broad citizen and public participation process, which is committed to a more socially cohesive and inclusive, more resilient and greener municipality.

Durango put into practice its clear commitment to strive in the area of climate change in 2009, by approving a Municipal Byelaw to Fight Climate Change. As the result of that byelaw, a Municipal programme to Fight Climate Change (2010-2015) was passed. It in 2015, it achieved “Compliant” status of the Compact of Mayors. Its II Local Agenda 21 Plan (2013-2020) currently contains a specific strategic line entitled “Progressing in Improving environmental quality and fighting climate change”. In addition, its goals include: maintaining the percentage of land used for artificial purposes in the municipality, cutting water losses, increasingly renewable energies and encouraging non-motorised mobility.

Innovative tool to adapt to climate change in public spaces

The main objective of the “FAKTOR BERDE” project is to develop a climate change adaptation tool applicable to the planning, design and implementation of the urban public spaces of Durango, and integrated in municipal planning, by means of:

- Defining a replicable methodology that allows decision-making in the planning, design and execution of the public spaces as a key urban aspect in the adaptation to climate change.
- Applying the methodology in Durango, thus contributing to the resilience of the municipality to climate change through the public space.


- Generating educational mapping to adapt to climate change, of the public space of the municipality; a set of maps and data displays that both the stakeholders involved in the decision making and the general public can understand.
- Developing a tool that fosters the implementation of urban adaption solutions in the public space.
- Developing future scenarios that showcase the consequences of the application of different degrees of the “FAKTOR BERDE”.
- Developing specific solutions to adapt to climate change through the public space for Durango, including a planting plan indicating species to be used for the scope of the “Green Factor”, defined according to the desired future scenario.



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Building and urban planning using climate change criteria are key to reduce the vulnerability of the cities to changes in climate variables. The Basque Country is among the regions of the Spanish State with most LEED and BREEAM certificates in relation to its population.

A modern, multi-story office building with a dark, curved facade and large glass windows, situated on a waterfront. The building is illuminated from within, and its reflection is visible in the water. In the background, a hillside with residential buildings and a bridge are visible under a clear sky.

Edificio IDOM (Bilbao, Bizkaia)

A large, flat rooftop garden with a variety of low-lying, colorful plants in shades of green, yellow, and orange. The garden is bordered by a low wall and a gravel path. In the background, industrial buildings and a large bridge are visible under a clear blue sky.

Tejado del Palacio de Europa (Vitoria-Gasteiz, Alava-Araba)

INTEGRATING CLIMATE CHANGE ADAPTATION IN BUILDING

In 2050, 70% of the world population will be living in cities. This implies the quantitative and qualitative need to ensure appropriate mitigation and adaptation to Climate Change in urban areas. Building and urban planning using climate change criteria are fundamental to make cities less vulnerable to changes in climate variables.

They are essential as a series of measures to achieve better adaptation to climate change, which also improves the quality of life of the general public. The adaptation guidelines begin in the **planning and urban** development stage and continue to the **building phases**, where adaptation criteria should be integrated in the design of the buildings in order to increase their resilience.

Thus, adaptation measures in line with each climate risk should be established. For example, high construction solutions, green roofs, and specific engineering defences should be studied to address river flooding; or to reduce the impact associated to the rise in average temperature and the greater frequency of heat waves, bio-architecture principles, such as the orientation of the building, can be considered.

In the Basque Country, there is a clear commitment to sustainable building. The Basque Country is among the regions of the Spanish State with the highest LEED and BREEAM certificates (18) in terms of population and has a publically acclaimed ground-breaking system of excellence in building, known as Cases of Excellence in Sustainable Building and Refurbishment.

IDOM building: Adaptation to climate change integrated in the design phase

Open at the end of September 2011, Bilbao's Idom-ACXT headquarters is an example of sustainable building. The new building has a surface area of 13,800 m² and is located on the right bank of the Deusto Channel, where a former port warehouse has been refurbished. Innovative climate change measures have been enshrined, including both mitigation (it is a building with a Gold LEED sustainability certificate and Class A energy certification), and adaptation.

From the adaptation perspective, during the design phase of the building, Idom conducted a climate change risk study.

The study included an initial risk screening associated to climate change, along with a detailed analysis of the river flooding risk, which is identified as the greatest risk. The study offered some no-regret type adaptation measures which, as it was the design phase, could be included in the design with low implementation costs. Some examples were to raise the location of the sockets in the underground garage, oversizing the ventilation grid of the transformer and a green roof.

Green façade on the Europa Conference Centre in response to heat islands

The Europa Conference Centre is at the very heart of Vitoria-Gasteiz. The building that dates back to 1989 can be considered to be one of the first that integrated social, congress and sport purposes in a single building and was the beginnings of the current network of Civic Centres. In order to improve the conference and exhibition facilities of the city to host the main acts when it was European Green Capital 2012, different refurbishing work was carried out under strict sustainability and environmental criteria.

The green area outside the building has been expanded, using native plants and therefore adapted to the climate conditions. Furthermore, the green façade and green roof features help both to mitigate the micro-climate around the Europa Conference Centre in spring and summer, by bettering the response to heat islands and to improve the building itself thermally and acoustically, while likewise functioning as a means of dissemination, and achieving a new public use natural space in the city.



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BEST PRACTICES IN ADAPTATION TO CLIMATE CHANGE

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The Basque Government is advancing towards a low-carbon economy and is committed to climate change mitigation and adaptation.

KLIMA2050, A NECESSARY CLIMATE CHANGE STRATEGY TO ADOPT A NEW DEVELOPMENT MODEL



Principle of shared responsibility

Una de las regiones más vulnerables a los efectos directos del cambio climático (súbdas de temperatura, inundaciones, sequías...) es el Sur de Europa. Desde el Gobierno Vasco hemos hecho nuestro el principio de responsabilidad compartida que rige las políticas internacionales de reducción de emisiones a pesar de que Euskadi solo aporta el 0,5 % de las emisiones totales de la Unión Europea.

Towards a low-carbon economy

Basque society is progressing towards a low-carbon economy and has assumed its share of responsibility regarding the implementation of a climate change mitigation and adaptation policy with a demanding and far-reaching commitment.

Important achievements in recent years

Limiting greenhouse gases, increasing the capacity of carbon sinks, evolving towards more efficient electricity generation and with fewer emissions, the drop in industrial energy consumption, fostering mobility with lower emissions, energy efficiency at home, using livestock and agriculture biomass and stabilising waste generation are some of the achievements obtained in recent years.

Ambitious gas reduction targets

The recent approval of the Basque Climate Change Strategy-KLI-MA 2050, according to the commitment assumed by the Euro-

The Basque Country seeks to cut greenhouse gases by 40% by 2030.

pean Union, **establishes a target to cut greenhouse gas emissions by 40% by 2030 compared to 2005, and by 80% by 2050. Furthermore**, renewable energy accounting for 40% of final consumption is expected to be attained by 2050.


The Strategy has 9 key objectives, which include committing to a low-carbon energy model, zero emissions transport, increasing the efficiency and resilience of the territory and of the natural innovation, and driving innovation, improvement and transfer of knowledge.

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**Energy consumption
to be cut by 12%
by 2020, to reach
the target of 25%
by 2025.**

THE PUBLIC SECTOR OF THE BASQUE COUNTRY, EXEMPLARY IN CUTTING ENERGY CONSUMPTION



The Basque Country is over 90% dependent on mainly fossil energy resources. This has implications for the balance of payments and for the financial resources that are used to pay these energy bills, items that cannot be allocated to other economic activities and to job generation. Thanks to the energy policies implemented in the Basque Country in the last 30 years, the Basque energy system is highly diversified both in the type of energy that it uses and as far as the input channels and countries of origin are concerned.

Cross-cutting measures throughout the public sector

The challenge for the coming decade will be to achieve greater energy sustainability, where the Basque public sector is going to be a trail-blazer. This leadership will mean cross-cutting measures being implemented throughout the Basque general administration to achieve less reliance on oil derivatives by means of **innovative energy efficiency and saving solutions in public build-**

ings, very low or zero consumption buildings for new constructions, replacing diesel in the public transport and vehicle fleets, and the use of competitive and local renewable energy sources.

A Sustainability Decree passed

With the **recent passing of an Energy Sustainability Decree**, the Basque Government assumed **some ambitious savings targets** for all their facilities. It is thus showing a clear vision of leadership and example both for the rest of the Administration and for society as a whole.

Savings of 200 million euros

The decree sets a timeline of a decade to work on amending the whole of a deep-rooted energy consumption culture in the Administration that will gradually be replaced thanks to the use of highly efficient innovative technologies and cleaner energies by the target year of 2025. The associated investments will be EUR 90 million, and it is estimated that the achievable savings in the energy bills thanks to the introduction of these improvements will be around EUR 200 million. As the first interim goal, the Decree establishes **cutting energy consumption by 12% by 2020, to attain the target of 25% in energy savings by 2025**, all of which is in terms of the benchmark of the total energy consumption of the Basque public sector.

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The Energy Sustainability Decree envisages a 12% cut in energy consumption for 2020.

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The vehicle is designed to achieve the greatest energy efficiency and range.

12 m URBAN BUS WITH 100% ELECTRIC TRACTION AND CLIMATE CONTROL



Designed to achieve greatest energy efficiency

Irizar S.Coop, a business group which designs, manufactures and markets buses and coaches, apart from being present in the communications and electronics sectors, has developed and created the i2e, the company's first 100% electric bus. This vehicle is designed using its own technology and with the focus on maximising energy efficiency throughout its life cycle.

Three aspects stand out when optimising the efficiency of the vehicle. On the one hand, the traction system and batteries at 70% efficient are twice that of a conventional bus. The other factors are the raw materials used and the management of its components at the end of its useful life, which mean a **recoverability and recyclability rate of materials and equipment over 90%**.

Only electric bus complying with rollover safety regulations

The **i2e is the first and only electric bus on the world market that complies with the R66 rollover safety regulations**, meaning it therefore meets the highest passive and active safety requirements. Furthermore, it exceeds the R 107 type approval as regards accessibility for people with reduced mobility. Thanks to its electric technology, it eliminates emissions of GHG and other substances such as NOx and particles while it is operating. Furthermore, the absence of the conventional combustion engine means there is great flexibility when it comes to designing the seat distribution and location of wheelchairs inside the bus.

With a carbon footprint of 8.45 gr CO2 eq per km and passenger, its **footprint is 86% lower than a conventional diesel bus**. The fact that the i2e model is the outcome of the joint work of the

companies of the Irizar group with the Basque industrial fabric is particularly important.

At the cutting edge in innovation

This vehicle uses innovative technology applied to the energy storage management systems, to the automatic climate control, to the batteries with ultracaps and to the use of regenerative energy. Gipuzkoa companies of the Irizar Group, such as Jema, Datik and Creatio, along with Hispacold and Masats, have been key in this process.

The Basque Science and Technology Network has played a fundamental role in the project, which endorses the technology capabilities of this Network and which make this bus an example of the use of the capabilities of the technology and industrial fabric of the BAC.

● **During its service life, each bus prevents 800 Tm of CO2 eq from being emitted.**


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The Ingeber System
reduces the energy
bill of Metro Bilbao
as it transforms
the braking energy
of the trains into
electricity.

METRO BILBAO ENERGY RECOVERY SYSTEM



Transforming the energy generated when braking into electricity

Since it started operating in 1995, Metro Bilbao S. A., a company belonging to the rail public transport sector, has always been committed to respecting the environment and fighting climate change by means of preparing different strategies and improvement targets. The actions implemented include the project to recover part of the energy consumption, **by transforming the energy generated when the trains brake into electricity**, which means that this energy that was previously lost as heat to be returned to the electricity grid, and it is deducted from the total Metro Bilbao energy bill.

The first rail company in Europe

Metro Bilbao was the first European rail company to use this new energy recovery technology. Subsequently, London, Brussels and Malaga were some of the cities that have changed over to this system. The **Ingeber System, developed by the Traction Division of the Ingeteam Group**, is being used in five Metro Bilbao electricity substations after four years of research and three million euros invested in high technology.

Return on the investment

The Ingeber system is designed for operators of short journeys with many stops (suburban trains, tramways and undergrounds). **The investment is recovered in six years and the average life of the equipment is around thirty years.** The Metro Bilbao substations are no longer mere energy load points and have become reversible, as they can return to the grid the energy surpluses generated that were previously burnt in the resistance housings of the train-units.

 **This system has allowed the total emissions of Metro Bilbao to be cut by 6%.**

This system cuts the Metro Bilbao CO2 eq emissions by 6%

In 2011, Metro Bilbao imported from the high voltage grid 75.751.362 kWh for 4.6 million kilometres travelled by its trains. In 2014, with a larger network and a total of 4.9 million kilometres travelled, 80.192.028 kWh of energy would have needed to be imported, while the real figure for the electricity used by the underground railway last year was 71.358.325 kWh. 70% of the energy used by Metro Bilbao is to operate the trains and the remaining 30% for stations and workshops. **By implementing the reversible cell system, energy consumption has fallen by 5.363.342 kWh/year.**

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The project aims to introduce changes in driving habits staff to reduce energy consumption.

Modo Esperar -1 GFB

Modo de servicio para cargar el itinerario...

St	Estación	Longitud	Salida	Chapa
Pin	Estación	00:00:00	00:00:00	Caja
Pin	Estación	00:00:00	00:00:00	Caja
Pin	Estación	00:00:00	00:00:00	Caja

10:49:37



EFFICIENT RAIL DRIVING



Changes in the habits of the driving staff

The “eco-driving” project seeks to introduce certain changes in the habits of the driving staff, in order to reduce energy consumption, cut environmental pollution, improve the comfort of the passengers and reduce the risk.

One of the characteristics of rail travel is that there is a rail traffic schedule (service diagram) establishing the departure and arrival times, the travel times between stations and the crossing points in the single-direction sections of track. Driving efficiency therefore basically lies in the “traction, shunting and braking” of the train drivers.

Statistical analysis of consumption

The technological developments included in the Series 900 are going to allow Euskotren to statistically analyse consumption by driving staff on each journey, and thus enable more efficient driving to be identified from the energy perspective and establishing them as the target way of driving.

 **Cutting traction energy consumption is achieved by standardising the driving.**

The main objective is to cut traction power consumption using the technological developments implemented in the modern Series 900, by standardising the driving of the train drivers as far as possible.

Technology equipment

The technology equipment in the Series 900 units (train module) includes a Kinematic Recorder Module, which records the real driving parameters; an efficient profile repository module, which stores the efficiency profiles for each route; and a train driver interface module, where driving staff can see the “efficient target speed” instructions.

The Land Management Application is used to perform the statistical calculation to establish the profiles for lower energy consumption, along with the profiles to be sent to the train.

This new step means that the real consumption variables associated to the different journeys between stations and services can be downloaded to the operating database.

As the phases in the project advance, a theoretic efficient way of driving can be established and which will be “loaded” in the train to appear on the driving panel as the “efficient target speed”.

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The Basque Country, with 100 companies, accounts for 47% of the organisations certified in ecodesign in Spain.

ECODESIGN: THE WINNING FORMULA OF THE INDUSTRY OF THE BASQUE COUNTRY



A successful private-public partnership

The Basque Ecodesign Center is a public-private partnership initiative **between industrial companies of the Basque Country and the Basque Government to develop innovative projects through Ecodesign**. The partner companies of the Basque Ecodesign Center –CIE Automotive, Eroski, Euskaltel, Fagor, Gamesa, Iberdro-la, Ihobe, Ormazabal and Vicinay Cadenas - total 79,738 jobs, €56,205 million in turnover and 12,788 suppliers.

The Basque Country, a cutting-edge region in ecodesign

The entity is turning the Basque Country into a cutting-edge region in product and service ecodesign and in the application of life cycle concept, making it a benchmark in the European Union. Its objectives include improving the efficiency in the use of resources and preventing waste generation and greenhouse gas emissions, fostering eco-innovation of products and services, and consolidating the environmental potential of industry.

A turnover of EUR 952 million

Basque Industry is a stakeholder that is helping to position the Basque Country as a cutting-edge region in this area. The ecodesigned products and services of Basque companies account for around 30% of their turnover and it now stands at EUR 952 million for Basque ecodesigned products and services.

Cutting the amount of raw materials used

From the **courses of action analysed in 156 companies**, it can be seen that the majority have managed to implement ecodesign to reduce their environmental impact, mainly by means of reducing the amount of raw materials used by 15.6%. Cutting energy consumption during the use phase of the products has improved by 11.5%.

11.5% drop in energy consumption

After applying ecodesign strategies, the companies that have ecodesigned their products have achieved a **11.5% drop in energy consumption** per product unit. Taking into account that the industrial sector consumed 27.034.880 MWh in 2011, if all the companies of the sector applied ecodesign strategies, this could mean a savings of 3.757.848 MWh and around 1.730.000 tons of CO₂ compared to current consumption in the Basque Country.

100 companies certified in ecodesign

The Basque Country is the community with the highest number of Environmental Product Declarations (EPD). **In total, 22 EPDs have been granted to Basque companies, which represents 65% of all the EPDs in Spain and 6% in Europe.**

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The bimep centre is an example of commitment to research in the area of renewable energies.

BIMEP, ENERGY FROM THE SEA



The Basque Country has a specific strategy to drive R&D in the energy area known as EnergiBasque. Among the 9 prioritised work areas, 7 give impetus to fighting climate change: thermo-electric solar, marine energy, wind power, storing energy, power electronics and making industry more efficient. Bimep, the research centre dedicated to marine energy, stands out among the examples of the commitment to reach in the area of renewable energies.

A facility for demonstrating prototypes

Bimep is **an offshore test facility for research, demonstration and running wave energy converter systems**. Developers and promoters of those systems can use this facility to validate their designs and test their economic and technical viability.


A 5,2 km² area located 1,700 metres off the coast

The facility, located in Armintza-Lemoiz, consists of sea and shore facilities. The part at sea **comprises a 5.2 km² area located 1,700 metres off the coast, marked out with buoys and restricted to shipping, and four underwater cables laid on the sea bed with a total capacity of 20MW**. They are connected to the shore part, where there is an electricity substation to distribute the energy generated, along with offices for the developers to use during the test period.

From the prototype to the pre-commercial phase

Bimep, together with its twin facility - the Mutriku wave power generation plant -, offers developers an integral service, with the goal of streamlining the transition of these technologies from the prototype phase to the pre-commercial phase.

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 **Bimep is an offshore test facility for research, demonstration and running wave energy converter systems.**

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BC3 is pooling its endeavours with that of other centres around the world to work together on the challenge of combating climate change.

BC₃, A SUCCESSFUL COMMITMENT TO EXCELLENCE IN CLIMATE CHANGE RESEARCH

bc³
BASQUE CENTRE
FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

Excellence in Research Centre (BERC)

BC3 (Basque Centre for Climate Change) is a centre for excellence in research jointly set up by the Basque Government and the University of the Basque Country in 2008 with the aim of contributing to the long-term research into the causes and consequences of climate change to generate knowledge in this multidisciplinary science.

Fourty researchers led by Prof. Anil Markandya

Led by one of the most renowned climate change scientist, the Emeritus Professor Anil Markandya, the BC3 pools its endeavours with that of other centres around the world to work together on the challenge of combating climate change. The centre has become an international benchmark thanks to its team of 40 highly qualified researchers in the following areas: transitioning to a low-carbon economy, health and climate, climate and natural environment, and climate policy.

BC3 in the Top Class worldwide of the climate change think tanks

The Think Tank World Ranking in the field of the economy and climate change policy, an initiative of the ICCG (International Center for Climate Change Governance) conducts a comparative study of the centres that work to connect scientific knowledge with economic policies and guidelines related to climate change. After analysing 295 international organisations, it ranked BC3 first in Europe in 2013 and second worldwide in 2014, consolidating its European leadership and endorsing BC3 as Top Class worldwide.

309 scientific articles published

With a scientific production of 309 articles (85% indexed) in the most important international journals in this knowledge field, BC3 has managed to attain a level of self-financing over 60%, mainly due to their success in the European Commission funding programmes, showing its capacity to attract talent and competitive funds thanks to the levels of excellence reached.

Maintaining the level of excellence

BC3 aims to conserve its level of excellence in the future by committing to multidisciplinary research into climate change, where the economic partners will play a key role and will be its value added; by achieving an approach oriented to policies or to the decision-making process; and by working internationally with the leading centres worldwide.

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Converting the Zorrozaurre peninsula into an island to relieve storm water flows from the river estuary and thus avoid flooding.



AN ISLAND IN THE CITY TO ADAPT TO CLIMATE CHANGE

Transforming the peninsula into an island

Bilbao, the most populated city in the Basque Country with 346,574 inhabitants, is tackling the impact of flooding due to heavy rainfall and the possible rise in sea level. **This action includes regenerating the post-industrial areas of what is now the Zorrozaurre peninsula and converting it into an island by opening up the Deusto canal.** This will help to relieve the flood waters of the river estuary and reduce the risk of flooding.

The city's latest major urban regeneration operation

The Zorrozaurre project is the latest **major urban regeneration operation in Bilbao. It represents a sustainable and integral plan**, which recovers a degraded space and converts it into a new district of Bilbao. The district will be easy to reach, with affordable housing, areas for environmentally-friendly businesses, and cultural and social facilities.

Measures to combat climate change

After analysing Zorrozaurre's current situation and establishing its vulnerability with neap tides and periods of heavy rain, it was seen that specific measures were needed. Those actions include the construction of different infrastructures to **cutting the risk of the river estuary flooding** and reducing the leaks and breakages in the pipes by means of implementing a remote control system.

Building on elevated platforms

The plan includes Zorrozaurre island as a whole and its river boundary with the San Ignacio district. The island has a surface area of 838,781 m², over half is owned by public institutions and the rest privately. The use of this post-industrial area will be mixed, combining housing, offices, shops and private and public infrastructures. The emphasis has been on mobility where tramway and bus lines coexist with cycle lanes and walkways. The buildings will be built on raised platforms between 4.50 and 5 metres above sea level.

A 75-meter wide canal converted into river

The opening up of the Deusto canal, which is 75 metres wide, will ensure flow alleviation of 1,190 m³ of water/second between the Olabeaga district of Bilbao and where it meets the River Cadagua. This will reduce the risk of flooding over a long period.

EUR 12.1 million investment

The investment required to open up the Deusto Canal is estimated to come to EUR 12.1 million and the work is expected to last 19 months. Thanks to this project, Bilbao will be ready for the climate of the future.



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The city continues to drive vertical public transport with lifts, ramps and elevators.

DONOSTIA-SAN SEBASTIÁN: A CITY WITH LOW-CARBON MOBILITY



Donostiako Udala
Ayuntamiento de San Sebastián

A city with beaches and mountains

Donostia-San Sebastián is a city of 186,125 inhabitants overlooking its three urban beaches and surrounded by mountains. This topography clearly divides the city into low-lying and mountainous areas. Fifty per cent of the population live in the low-lying areas, which have the main public transport services and the infrastructures for cyclists and pedestrians, and the other half live in the areas with steeper slopes.

25 years boosting public transport

For 25 years, the city has activity driven an integrated transport policy where the emphasis is on pedestrians, bicycles and public transport. Over that time, innovative measures and integrated strategies have been introduced to increase the number of pedestrians, cyclists and people using public transport in order to reduce the use of the private vehicles and provide more pedestrian areas, which make the city into an even more attractive destination.

Promoting intermodal transport

The goal has been to implement mitigation actions such as "Promoting intermodal transport and of means of transport with lower greenhouse gas emissions" and "Replacing the use of oil derivatives", aimed at achieving the target of zero emissions transport. The specific actions include the introduction of the **single ticket for municipal and interurban public transport throughout the Basque Country, impetus to developing sustainable mobility plans at the urban supramunicipal level** and in the business centres and disseminate the use of means of transport with lower greenhouse gas emissions by means of economic support and positive discrimination measures.

Pedestrians, bicycles and vertical public transport

Donostia-San Sebastián is transforming the suburban areas into more friendly areas for people on foot with the phasing in of pedestrian zones. The city is in the last phase of introducing cargo-bikes and is working on the European **"Cycle Logistics Ahead" project. In 2016, it will be the European Capital of Culture 2016 and the bicycle will be the official vehicle.**

Reducing the use of combustion engine vehicles

Donostia-San Sebastián has fostered the use of public transport by creating bus lanes, increasing the frequency and speed of public transport, better information and cleaner vehicles. DonostiaBus, the municipal transport operator, is working to achieve a progressive decrease in the use of combustion engine vehicles and is **piloting a 100% electric bus built by Irizar and has added 10 hybrid buses to its fleet.**

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The capital is working on recovering degraded zones and on connections through green corridors.

VITORIA-GASTEIZ: NATURE-BASED CLIMATE CHANGE SOLUTIONS



645 hectares in a green belt with five large areas

Vitoria-Gasteiz, with a population of 245,036 inhabitants, has 645 hectares on its periphery and which is known as the Green Belt, that consists of five large parks, and two more in the pipeline, along with very important wetlands and various zones included in the Natura 2000 Network. The city is working on returning degraded zones to their natural state and on linking up the different green zones by means of green corridors.

Usefulness of the green infrastructures

The City is currently immersed in a **Green Infrastructure Strategy**, in line with the Climate Change Strategy of the Basque Country. The main goal is **to explore the usefulness of green infrastructures in the mitigation of and adaptation to the effects of climate change.**

Natural areas in the Lakuabizkarra district

The Lakuabizkarra district has numerous green areas that are barely used by the public. There are also empty public plots with no

prospect of immediate use. Twenty-four actions aimed at created natural areas have been proposed in order to improve the quality of the district. These actions will improve the visual impact, connectivity and will help increase the number of carbon sinks and air quality.

The roots of the future, 250,000 trees and the general public

The scheme was launched in 2012 with the aim of making the Green Belt more functional with green connections and of improving the quality of some degraded areas. The interventions are envisaged for 51 areas with little or no tree cover and as of the winter of 2015, 164,893 plants, trees and bushes have been planted. **The involvement of 19 companies and institutions, along with the media, over 3,000 students and 2,000 members of the public has meant that 47 areas could be improved.**

Inner Green Belt

The Avenida de Gasteiz, the main route into the city, underwent an integral urban redevelopment between 2012 and 2014. This route is part of the Inner Green Belt and of the Urban Green Infrastructure system, one of whose features is the green frontage of the Europa Congress and Exhibition Centre, which has improved its acoustic and thermal insulation, leading to savings of 60% in the energy bill and helping the reduce the heat island effect.

Another green infrastructures envisaged are improving the green connectivity along the River Errekaleor, agro-ecological practices in Aldaia, conserving vegetation in Medizabala, improving the biodiversity in the Este Park and landscape and ecological enhancement of the Santo Tomás roundabout.

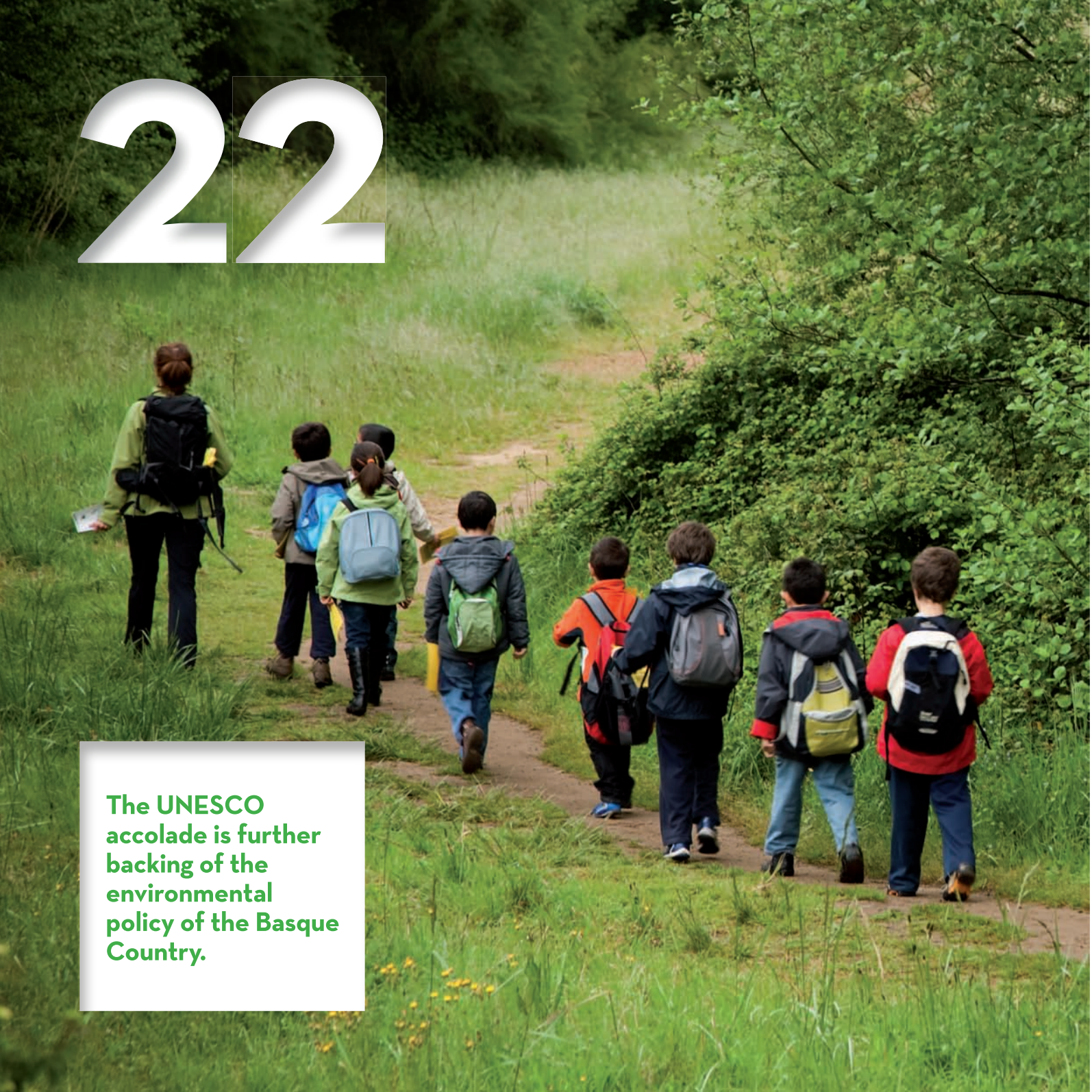
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A group of nine people, including an adult and eight children, are walking away from the camera on a dirt path. The adult, on the left, is wearing a green jacket and a black backpack. The children are wearing various jackets and backpacks in colors like blue, green, orange, and red. They are walking through a lush green field with tall grass and yellow wildflowers. In the background, there are dense green trees and bushes.

The UNESCO accolade is further backing of the environmental policy of the Basque Country.

TOWARDS SUSTAINABILITY THROUGH EDUCATION



We are training our young people to be responsible citizens

In the Basque Country, we are committed to showing our school children how to care for the environment. It is the best way to ensure that Basque society in the near future is made up of responsible citizens who are committed to the environment. We are therefore driving the introduction of the School Agenda 21 in our educational centres and it is a key educational strategy for the sustainability of the planet.

The UNESCO includes the Basque Country among the best practices in education for sustainable development

The School Agenda 21 in the Basque Country has been recognised by UNESCO as one of the 25 best practices in education for sustainable development worldwide. This recognition endorses the work carried out by Basque schools to improve the environment and shows that our children and young people are ready to face the new environmental challenges.

Endorsement for the environmental policy of the Basque Government

The UNESCO accolade is, furthermore, an endorsement of the environmental policy of the Basque Country, which has positioned the Basque Country among vanguard European region, both in terms of the results obtained and of the policies and instruments applied.

Towards a more sustainable, peaceful and fairer world

The network of School Agenda 21 centres is helping to transform society and prepare students to advance towards a more sustainable, peaceful and fairer world. It implements specific proposals and

actions regarding climate change, equity, the ecological footprint and biodiversity, among other areas. All the courses of action are designed to be forward looking, actively involve the school children and to work with public institutions and social stakeholders.

Over 220,000 school children

70% of the compulsory education centres of the Basque Country are part of the School Agenda 21, which means over 220,000 students are taught that respecting the environment is an essential aspect. Schools in this educational programme also implement different action to become sustainable centres.

An ally for the Climate Change Strategy of the Basque Country to 2050

The School Agenda 21 and, therefore, the educating of our young people in environmental values will be a notable contribution to achieving the targets set in the Climate Change Strategy of the Basque Country to 2050. The roadmap lays out the way for us to prepare to mitigate the impact of climate change, to tackle pollution and conserve our biodiversity.

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