

## CLIMATE CHANGE IN THE BASQUE COUNTRY: IMPACT ON HEALTH AND ADAPTATION MEASURES

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### Introduction

Discussion around what the most appropriate climate change adaptation measures is complex and requires the addressing of multiple dimensions, such as the different technologies available; geographical and climatic conditions; possible interactions between sectors; economic and social factors or as well as time frame.

Experts from the public, private and academic sectors discussed the impact of climate change and possible adaptation measures in the Basque Country with a particular focus on human health, through a feedback process, during the workshop that took place at Bilbao's City Hall on 26 December 2014, under the auspices of the ECOHEALTH project..

The workshop took place with a focus on three aspects: (I) the impact of climate change on the city of Bilbao itself as well as its surroundings; (II) adaptation measures and best practices intended to reduce the impact identified; and (iii) the perception of expected benefits and costs of these measures. The selection of a specific geographic setting is a consequence of the nature of the analysis of adaptation measures.

The main results of the meeting (or workshop) is summarised in this document below, based on the blocks into which the discussion was divided: impact, best practices, and cost-benefit perception.

### Key factors

- *The adaptation to climate change must involve free-flowing dialogue between the different sectors in society*
- *Specific adaptation measures can also lead to an improvement in health and resilience of the population*
- *There is a great potential for adaptation based on changes to habits, customs and life styles*
- *The increased exposure to the natural environment has been shown to have a clearly positive impact on health and well-being*

### Climate change impact in the Basque Country

Some of the different impacts of climate change in the Basque Country expected at the end of the century include a significant increase in both air and ocean temperature, an annual reduction in precipitation and a rise in the sea level (Basque Government, 2011).

One of the things that stood out in the workshop was the impact related to water, such as the change in rainfall distribution. The increased frequency of flooding may have negative effects on human health owing to injuries, drownings, increased stress or problems arising from the inability to access medical services, along with other effects such as damage to homes and other property. Furthermore, the reduced availability of water resources due to factors such as salination of wells and a reduction of total rainfall may lead to decreased water supply in autumn and winter. Coastal areas will experience additional difficulties due to a rise in the sea level ,estimated to be between 29 and 49 cm by the end of the century due to climate change(Basque Government, 2011).

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*<sup>1</sup> The following are the public, private and academic institutions that took part in the workshop: Environmental Health and Urban Hygiene sub-area of the City Hall of Bilbao; Directorate of Civil Protection of the City Hall of Bilbao; Sub-Directorate of Purchases, Works and Strategic Services of the General Directorate of Osakidetza - the Basque Health Service; the Energy and Environmental Division of Tecnalia Research & Innovation; ETourism and Heritage area of Vicomtech-IK4, SUDS S.L. (Sustainable Urban Drainage Systems); UNESCO Chair on Sustainable Development and Environmental Education of the University of the Basque Country (UPV / EHU); Polytechnic University of Madrid; and Basque Centre for Climate Change (BC3).*

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Meanwhile, the impact of rising temperatures and the increased duration and intensity of heat waves on public health was identified, especially among those over 65 who may make up more than 25% of the population by 2020 as well as people with disabilities or who are in situations of dependency.

Other impacts that were outlined were diseases resulting from a higher concentration of pollutants, such as airborne particles, nitrogen oxides and ozone pollution, the presence of which depends on weather conditions. The last part involved a report on certain damage with a higher level of uncertainty such as those associated with increased exposure to ultraviolet rays (UV) which may have an impact on the risk of cancer-, or increased vector-borne diseases.

## Adaptation measures, best practices and co-benefits

A total of 26 adaptation measures were mentioned during the interventions, including best practices and measures with both a positive and negative environmental impact (see list of measures in Table 1). This section focuses more on measures and best practices that have a positive environmental impact, with multiple benefits in different sectors and that are perceived as being cost-effective.

Number	Measure
1	Flood prevention measures (infrastructures)
2	Improvement in water network: leaks, cost control
3	Improvement on ground cover
4	Pest prevention control
5	Improvement to emergency response plans
6	Early warning systems
7	Improvement in air quality monitoring
8	Advice and economic incentives to towns
9	Urban green infrastructure
10	Soil use planning
11	Development of adaptation monitoring indicators
12	Consideration of basin-level vegetation types for the prevention of flooding
13	Urban design and planning focused on providing improved thermal comfort for pedestrians
14	Introduction of ventilation corridors, optimal height buildings
15	Urban climate maps for planning (collaboration between climatologists and urban planners)
16	Sustainable urban drainage (SUDS) systems
17	Evaluation of ecosystems and their multi-functionality for the application of possible economic incentives for conservation purposes.
18	Integrated planning of the city to its surroundings
19	Semi-natural and natural spaces (forests ,rivers, wetlands, etc) for a resilient territory
20	Improved weather forecasting
21	Improved emergency plans
22	Important drainage infrastructure (tunnel)
23	Reliable network communication between emergency teams and citizens (through ICT)
24	Semi-automatic analysis of comments (information) in social media to shorten response times
25	Decarbonisation of transport through behavioural changes (bicycles, etc.)
26	Decarbonisation of transport through technological options

**Table 1. Climate change adaptation measures in the Basque Country prioritised by the stakeholders taking part in the work-shop**

Measures based on ecosystem management and proliferation were some of the ones that were most highlighted, owing to the many benefits that they offer the different sectors. In this regard, the green infrastructure known as Sustainable Urban Drainage systems (SUDS) generated certain interest owing to their ability to serve the dual purpose of avoiding excess runoff while simultaneously generating indirect benefits such as a reduction in excess heat in urban environments SUDS are collection and water storage systems, that maximise the opportunities of vegetated soil permeability, in contrast to paved land where runoff is significantly greater. Apart from contributing to a reduction in the risk of flooding, SUDS also have lower costs than the "gray" water retention strategies (such as water tanks, installation of pipelines) and reduce the likelihood of a collapse of sewage systems, preventing possible discharges of untreated water and thus reducing the environmental impact of flooding. These types of measures have been

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Another proposed measure included others related to energy efficiency and transport. The first case involved an analysis of the adoption of biofuels as a source of thermal energy, generating a reduction in fuel costs without even taking into account the environmental impact in terms of reducing emissions. An example is the installation of forest biomass boilers in the hospital in Gorliz (Bizkaia) representing a saving of over 20% in the hospital's heat energy costs. The final point covered was transport decarbonisation. It was stressed that while new technologies may present a significant benefit, even when involving significant costs, a change in habits, such as the replacement of motorised transport bicycles, leads to an even greater number of co-benefits, particularly due to a significant improvement in health, along with a more moderate cost.

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## Conclusions

There is a range of ways of dealing with the need to develop instruments to adapt to climate change. Adaptation should take place on many fronts, depending on the threat faced by every society, the vulnerability of its groups or the spatial and temporal scales, among other issues.

While the application of solutions based on "gray" infrastructure may be inevitable in certain circumstances, there is a wide range of measures that can be used to substitute or supplement them. Some of these measures may be interesting owing to the fact that they are based on low marginal costs of new information and communication technologies while others focused on early warning and emergency management maximise profits by avoiding significant risks to human health. Worthy of mention are ecosystem-based measures, which outweigh their costs (to the point of generating net benefits), largely thanks to the services they provide to society in other areas. These measures not only help reduce the impacts of climate change such as floods and heat waves, but also offer benefits to society as a whole, such as the regulation of air and water; the creation of environments that promote recreation, social cohesion and tourism; as well as improvements in health and quality of life of citizens, to name a few.

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