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## **The Role of Regions in Climate Change Policy**

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and Anil Markandya

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# The Role of Regions in Climate Change Policy

Ibon Galarraga, Mikel González-Eguino and Anil Markandya<sup>1</sup>

*Climate change is one of the greatest challenges facing human kind. Urgent policy action is needed. Climate change policies are mainly being discussed at international level by means of the United Nations Conventions and the Kyoto Protocol. However, the bulk of the impact will be felt at regional and local level. And these levels of governance hold many of the competencies to implement the policy actions. Regional Governments are important actors and should, therefore, be incorporated into the negotiation rounds and their voices heard. This paper illustrates the important role of the regions in climate policies and considers many of the policy instruments being designed and implemented. More than 20 leading regions are showcased here. Finally, the case of the Basque climate policy is described to shed some light as to what regions could do.*

Keywords: Climate change, regional policy

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## **1. Introduction**

There is a consensus regarding the fact that the climate is changing and that human activity is, at least partly, responsible. The role played by the Intergovernmental Panel on Climate Change (IPCC) of the United Nations (IPCC), particularly with the presentation of the AR4 (IPCC, 2007), has been crucial to establish clearly the consensus in this area. The IPCC openly supported the need for decisive and early policy action regarding Mitigation and Adaptation. Other pieces of research have also significantly contributed to the public policy debate. Special mention should be made of the so-called Stern (2008) report.

Climate change policies need to be designed and implemented at the global and local level and an emphasis on close coordination is therefore needed. The United Nations Framework Convention on Climate Change (UNFCCC) and its conferences are crucial for agreements to be reached worldwide. The United States, China, India and Brazil are major players and the rest of the world should find the way to successfully push them towards more ambitious mitigation policies. Adaptation, and particularly its funding and the required technology, is also part of the international discussion.

However, another level of governance as a central role to play in climate change policies: Regional Government. This paper considers the importance of such institutions and the decisive actions that they have to put in place. There are many difficulties but the potential and effectiveness of climate change policy at a regional level is undeniable. Their closer proximity to the citizens and their greater flexibility than national Governments, along with the fact that they are responsible for many of the policy areas involved in climate policies (i.e. energy, transport, industry, housing, environment, etc.) justify the importance of the Regional Governments in climate policy discussions.

The paper reviews the experience of 23 regions worldwide, their targets and policy instruments used to face the challenge. We have also devoted some lines to the Basque Country. This region has been active locally and internationally over recent years.

Regions are becoming aware of the huge task facing them. The international community is starting to recognise the need to work closely with regions and is focusing on the most active ones.

## **2. Climate Change: facts, targets and actions**

The IPCC concluded that global warming is unequivocal. In 2007, the IPCC pointed out that "atmospheric concentrations of CO<sub>2</sub> exceed by far the natural range over the last 650,000 years, due primarily to the fossil fuel use, with land-use change providing another significant but smaller contribution" (IPCC 2007a). According to IPCC "on average the temperatures in Northern Hemisphere during the second half of the twentieth century were very likely higher than in any other period of 50 years in the past 500 years, and probably the highest along at least the past 1300 years" (IPCC, op. Cit.). This change has been more intense during the last century and continues to speed up. Rises in temperature and sea level, changes in rainfall or the increases in tropical cyclone activity endorse this.

Global warming is affecting nearly all terrestrial and marine ecosystems, beginning with the Arctic and Antarctic eco-systems and even including tropical marine environments. The effects include changes in the availability of fresh water, loss of any type of species and ecosystems, changes in agricultural productivity or an increase in tropical diseases. The poorest and most vulnerable populations will be most impacted and could lead to increased migration and social instability.

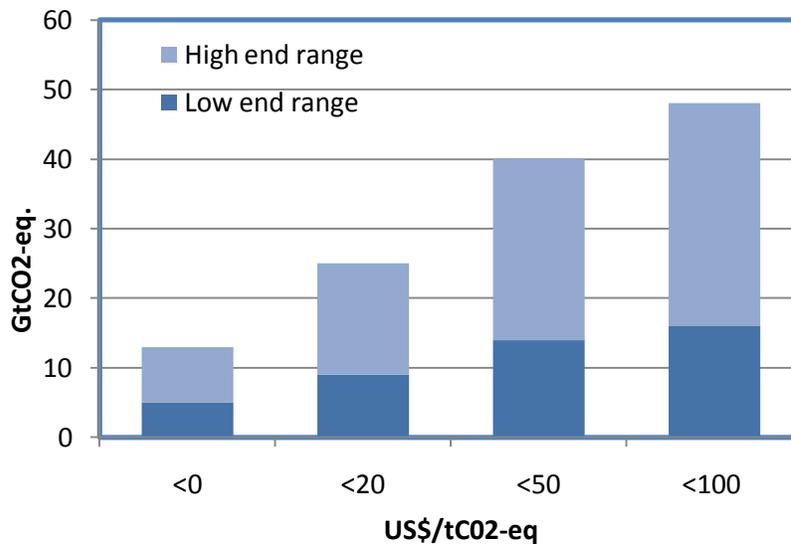
If specific mitigation policies are not established, the “average temperature will very probably increase between 1.8 and 4°C by the end of this century”. Using the ‘best estimate’ of climate change, “the most stringent scenarios (stabilizing at 445-490ppm CO<sub>2</sub>-eq) could limit the global mean temperature increases to 2-2.4 °C” (IPCC 2007, p.42). Some of the scenarios developed by scientists could even be catastrophic. Weizmann (2007) notes the disturbing fact that IPCC scenarios envisage temperature increases of 4.5 °C with a probability of 17%. Even an increase of 8 °C with a probability of 2% is considered, which would modify most of regions of the planet in an unimaginable way.

For the climate system to move towards safe concentration levels, global emissions need to peak in approximately 2020, be halved by 2050 and continue to fall until the end of the century. Taking into account an equity criterion and the economic and demographic inertia in the developing world, emission should be reduced in the developed world by 60-80% by 2050 (IPCC 2009, Markandya 2009). This target illustrates the huge scale of the challenge and the important role that all levels of government have to play to solve an externality that “represents the biggest market failure the world has seen” (Stern 2009).

Actions to limit climate change impacts can result from i) mitigation of emissions, by reducing GHG emissions or by increasing carbon sinks and ii) adaptation to its effects. Both measures are complementary and are related through sustainable development policies, particularly in the poorest countries.

From 1970 to 2004, GHG emissions increased from 28.7 to 49 GtCO<sub>2</sub>-eq (70%) and a further 10-35 GtCO<sub>2</sub>-eq are expected to be added by 2030 (see IPCC scenarios). Figure 1 shows the emission mitigation potential for different CO<sub>2</sub> price levels. There is potential to offset projected growth by an average reduction cost of around 20-50 dollars per tonne (US\$/ tCO<sub>2</sub>-eq).

**Figure 1: Global economic mitigation potential in 2030**



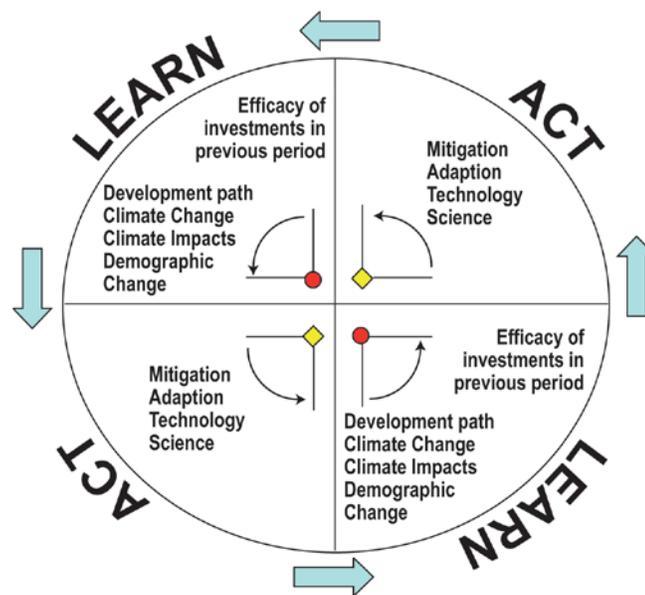
Source: IPCC (2007)

One surprising finding is that there are significant opportunities for mitigation (5-8 GtCO<sub>2</sub>-eq.) at no cost, in savings and energy efficiency, among others. Appropriate policies could eliminate the reasons (hidden costs or barriers) why the market fails to take advantage of these opportunities.

With regards to adaptation, it is very important for the climate change variable to be included in infrastructure design, in areas such as water resources planning, coastal protection or strategies for reducing natural disaster risks, to save losses and money in the future. Regions are most likely to be the administrative level that will have to deal with these decisions and their effects.

In any case, it is widely agreed that neither mitigation nor adaptation alone can prevent the impacts of climate change. Both actions must be properly coordinated at appropriate times and in confluence with other sustainable promoting policies. Moreover, climate policy is not a once-and-for-all event, but an interactive risk management process that is likely to take place over decades (see figure 2) where the square nodes represent decisions, the circles represent the reduction of uncertainty and the arrows indicate the range of decisions and outcomes.

**Figure 2: The iterative nature of climate policy process**



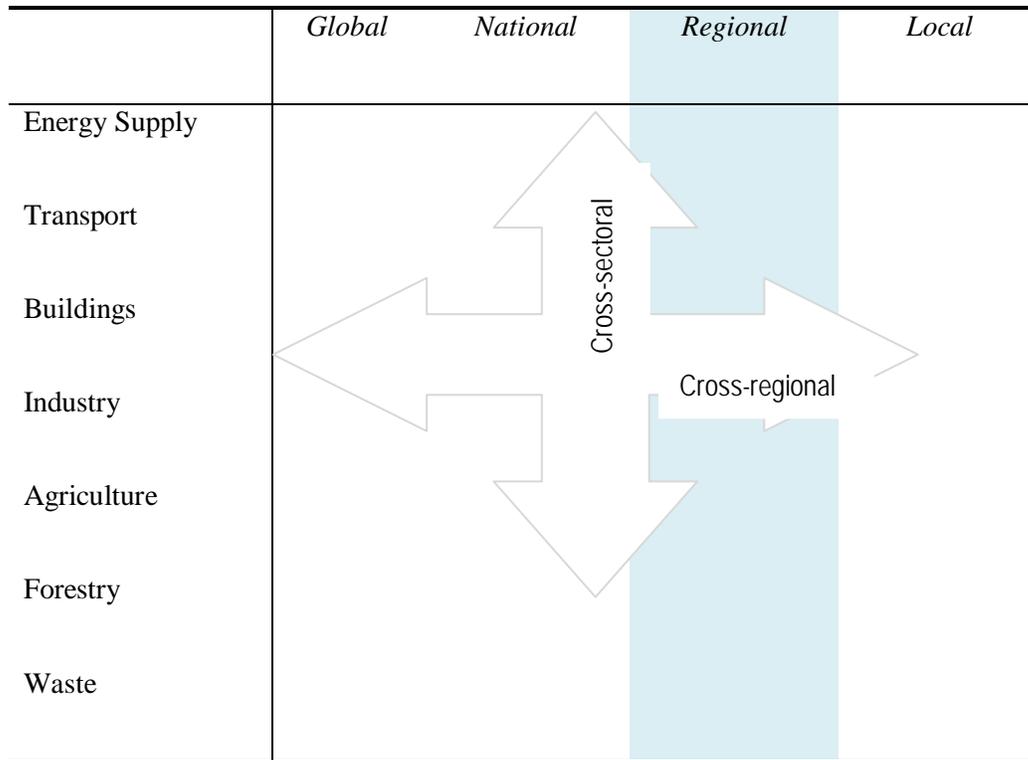
Source: IPCC (2007)

### 3. The Climate Policy Worldwide: Top-Down and Bottom-Up Approaches

The institutional policy framework on climate change is complex for several reasons (see Figure 3). On the one hand, it encompasses very diverse departments and responsibilities with little tradition of working in coordination, such as environment, transport, energy, industry, building or research department, among others. And on the other hand, agreements need to be drawn up at all levels of government: international, national, regional and local, since all these levels can directly or indirectly

affect and improve climate policies (NRG4SD, 2008). The cross-sectoral and cross-regional difficulties need to be overcome to take decisions that are multidimensional by nature.

**Figure 3: The complexity of climate policy architecture**



Source: Own elaboration

The United Nations set up the secretariat of the UNFCCC in 1992, promoted by the Conference of the parties (COPs). This led to a comprehensive international process on climate change policy. Since 1997, with the signing of the Kyoto Protocol, developed countries (Annex I) have undertaken to reduce their joint emissions by 5.2% with respect to the 1990 levels between 2008 and 2012.

Although sovereign States attend these conferences and have to meet these targets, other agents are also contributing. The role of some regional as well as local governments, NGOs, companies and associations is particularly noteworthy. The side events at the Conferences of the Parties of the UNFCCC and the Kyoto Protocol have proven to be a very interesting workplace for these institutions to meet, decisively supplement their participation through the States and be the voice of regions. The UNFCCC has repeatedly recognised the efforts of these other stakeholders<sup>2</sup>.

The UNFCCC is a "top-down" approach or structure, where decisions are taken at the top and then flow down. However, the role of regions and municipalities, which sometimes hold some of the competences required to achieve the goals, is also important. Hence, they should be involved in the

<sup>2</sup> Mr. Yvo de Boer, executive secretary of the United Nations Framework Convention on Climate Change addressing The Climate Leaders in The Climate Group Summit, (Poznan, December 2008) and Local Governments ICLEI (Poznan, December 2008).

decision process in some way. A bottom-up approach could also be very successful in designing effective policies on mitigation and adaptation.

Even though the Kyoto Protocol was a positive step forward in the fight against climate change, its successes and limitations need to be considered in terms of its renegotiation in Copenhagen 2009. Many points will need to be debated at the Copenhagen Summit, but an important one is the design of architectures where top-down and bottom-up approaches can be combined and reinforced. Only if all levels of governance are fully coordinated will ambitious climate policies be successfully implemented.

## **4. The Role of regions in Climate Policies**

### **4.1 Why are regions so important?**

Looking at a problem that affects the whole globe through the eyes of a small region is a difficult, if not overwhelming task. It is not easy for regions or international institutions to realise the importance of any small player in climate change policy. Yet reality is moving in that direction. The success of the UNFCCC and the Kyoto Protocol can only be secured if effective participation is guaranteed and the principle of “common but differentiated responsibilities” is put into practice (Aldy and Stavins, 2008). And this should be carried out at all levels of governance. The IPCC, the United Nations and other international organisations are now fully aware of this and call for cooperative coordinated efforts among municipal, regional, national and international institutions.

In this scenario of needed global coordinated efforts, it is important to highlight the role that regions can and should play in the designing and implementing of climate policies, to complement the existing national efforts but also to guarantee that the later are effectively implemented.

There are good grounds for considering regions to be vital as regional governments are often the main implementing bodies for global agreements on climate change policies. This is because their range of responsibilities requires them to do so. For instance, the competencies of many regions in Europe (in decentralised countries) include environmental policy, transport policy, fiscal policy (to some extent), research and education policy, building, transport and industrial policies. Therefore, many member states of the EU and other national governments worldwide cannot successfully guarantee their commitments without their regions being on board. To some extent there is a paradox, let us call it the paradox of the “lent targets”, that is, the National Governments are the ones that are legally bound to achieve the Kyoto targets while it is the regional governments that implement many of the policies to achieve those goals. The architecture underpinning the relationships among national/federal states and regional governments then becomes extremely important.

Other arguments can be added to this discussion such as the fact that regions are close enough to people to better tailor actions to their needs. Regions should be able to identify the priorities and difficulties to implement the policy more clearly, while being strategic enough to establish links among all the different policy areas that need to be coordinated for climate change policy.

It may also be worth noting that regions can also play a crucial role in the proper citizen consultation processes prior to any strategies or technologies being adopted. This should ensure a much better and effective implementation of policy actions. At the same time, focusing citizens on low carbon actions, designing options to meet local conditions and networking with other local stakeholders are also

grounds for the role of regions in fighting climate change to be recognised. “Preparing for climate change is not a “one size fits all” process. Just as the impacts of climate change will vary from place to place, the combination of institutions and legal and political tools available to public decision-makers are unique from region to region” (CSES, 2007).

The Bali roadmap already highlighted the importance of exploring any type of synergies for all stakeholders, whether public or private, to work closely together.

## **4.2 What could regions do?**

Once the importance of small players has been recognised, the focus must now shift to understanding how regions can be effectively incorporated into the decision making process driving climate policy worldwide.

The first thing that comes to mind is to emphasise the idea that regions can and should network among themselves. The aim is to benefit from the *vis a vis* working possibilities and exchange of best practices, along with the regional governments being represented in international forums.

The United Nations has long realised the need and potential of regional governments, but is now taking decisive action to promote coordinated efforts. In the words of the United Nations Development Programme (UNDP) Europe representative, Ms. Molinier<sup>3</sup>, “it is worth stressing that for the first time, the plan [2008-2011 strategic plan of the Global Environment Fund of U.U.N.N.] explicitly states the role of regions and local authorities in the fight against climate change”.

The UNDP and the United Nations Environmental Programme (UNEP) are actively working with regional networks and associations to successfully foster decentralised cooperation among regions in developing strategies for mitigation and adaptation. Drawing up of Integrated Territorial Climate Plans (ICTP) and supporting the access to financial mechanisms to enable the necessary investments are part of the priorities set for regions.

Associations such as The Forum of Global Associations of Regions (FOGAR), the Network of regional Governments for Sustainable Development (Nrg4sd), The Climate Group (TCG), The Association of European Border Regions (AEBR), the Conference of Peripheral Maritime Regions (CPMR), the Northern Forum, The Latin-American Organisation of Intermediate Governments (OLAGI) and The Integration Zone of the Centre-West Region of Southern America (ZICOSUR) are some of the organisations that have been set up by regions for this purpose. All of them seek to contribute to re-shaping regional dimension for development and environmental policies, to supporting regional policy actions and exchange of best practices, to promoting cooperation agreements among members and to being the voice of regions in international forums.

It is important to recognise the extremely active role achieved by some of these networks in all international negotiation processes, including the annual UNFCCC conferences and Conference of the Parties, where they have managed to systematically raise the issue of the need of coordinated-effective action and for climate action to be promoted at the regional level worldwide. They have likewise been accredited with observer and consultative status at many of the United Nations conferences. This enables them to access the main international negotiation processes and actively seek full international recognition.

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<sup>3</sup> [http://www.worldsummitofregions.org/pub/doct/98\\_en\\_intervention\\_c\\_molinier.pdf](http://www.worldsummitofregions.org/pub/doct/98_en_intervention_c_molinier.pdf)

These organisations have to overcome many obstacles as they are unknown in International forums, they lack a strong structure, they have limited financial and human resources and they usually pull together with partners from different countries and cultures. However, their strong belief in the importance of the network, their hard work and willingness to succeed are helping to offset and overcome the difficulties.

## **5. Case Studies: Climate Change Policy in Leading Regions**

Many regions have been highly active in developing their climate change policies. Some have acted as a forefront for national policies, showing the International Institutions the potential for coordinated efforts at all levels of governance. The United Nations and other International organizations have recognized the leadership and the importance of these regions.

This section will highlight the activities of these leading regions and the policy actions implemented. The section focuses on 23 leading regions and policy instruments implemented in different areas. This section has greatly benefited from the work being carried out by TCG to gather policy experiences worldwide and promote the role of regions.

### **5.1 Climate Change Overall Objectives**

National targets for GHG reductions are not always easily assumed by regions as the overall socioeconomic context of a country might differ from the regional reality. Thus, some regions take on federal or national targets, while others develop their own goals. In practical and political terms, it is also important to note that national targets are not always legally binding targets for regions, only for Countries, so cooperation and coordination is especially important.

While some regions have taken on national targets, others have gone far beyond establishing their own more ambitious goals. The case of the state of California (USA) is indeed a very good example as it has passed a Law that commits the region to achieving 1990 GHG emission levels by 2020. In a country where the federal Government has not yet committed to the Kyoto Protocol targets, such commitments are far more important. Future discussions will clarify the new Obama Government's true intentions to climate change global action. Meanwhile, the State of California is leading the way.

Other European regions such as Flanders, Bavaria or the Basque Country have also led climate change policy for many years and have being particular active in international forums and discussions.

Table 1 summarises the targets of 23 regions that are at the forefront of climate change policy. The regions in Europe seem to have either accepted the targets of the member states or adapted the sharing of the burden to their particular realities following the same principles active in EU burden sharing criteria. Other regions worldwide have gone for far more ambitious goals but on a much longer timescale, which makes it extremely difficult to establish a clear comparison of targets. In any case, what seems to be clear is that these 23 regions are taking climate change mitigation policies very seriously and are being recognised by the international community as essential partners for the global climate change policy.

These examples should be useful for other regions willing to set their own climate policies and contribute to national and international policies. Networking and exchange of best practices is essential among regions to guarantee effective policies. National and international policies might be too far from regional reality so as to be useful for regional climate policy.

**Table 1: Regional Climate Change Policies**

Region	Mitigation Targets	Policy Instrument	Country targets 2012 (Kyoto Protocol or similar)
The Basque Country	<ul style="list-style-type: none"> <li>• Increase renewable energy consumption to 12% by 2010 and 15% of electricity demand.</li> <li>• Limit GHG emissions growth to no more than 14% above Kyoto base year levels.</li> <li>• Increase the removal capability of carbon sinks to 1% of Kyoto base year emissions.</li> </ul>	Plan/strategy	Spain: 15% increase of 1990 levels. (Within EU <sup>4</sup> objective burden sharing). Legally binding.
Bavaria	<ul style="list-style-type: none"> <li>• 10 million tons of CO<sub>2</sub>e by 2010. Equivalent to 6 tons of CO<sub>2</sub>e per capita.</li> </ul>	Plan/strategy	Germany: 21% decrease of 1990 levels. (Within EU objective burden sharing). Legally binding.
British Columbia	<ul style="list-style-type: none"> <li>• A reduction of 33% of 2007 GHG emissions levels by 2020 and 80% by 2050.</li> <li>• The public sector to be carbon neutral by 2010.</li> </ul>	Specific Legislation	Canada: Cut by 6% by 2010. Legally binding.
Brittany	<ul style="list-style-type: none"> <li>• Reduce CO<sub>2</sub> emissions by 20% by 2020; and 80% by 2050</li> <li>• Produce 20% of energy from renewable resources by 2020</li> </ul>	Plan/strategy	France: 1.9% decrease of 1990 levels. (Within EU objective burden sharing). Legally binding.
California	<ul style="list-style-type: none"> <li>• Achieve 1990's GHG emission levels by 2020.</li> </ul>	Specific Legislation	U.S.A.: None yet.

<sup>4</sup> In 2007 the EU committed to what is known as the “Climate action and renewable energy package”. The overall goals are to achieve a **reduction of emissions 20% below 1990 levels by 2020** and **increasing the share of renewables in energy use to 20% by 2020**.

Catalunya	<ul style="list-style-type: none"> <li>• A reduction of 5.33 MtCO<sub>2e</sub>/year for 2008-2012. (Equivalent to Spanish +15% of 90's levels by 2012).</li> <li>• 11% of renewable energy in total primary energy consumption by 2015.</li> </ul>	Plan/strategy	Spain: 15% increase of 1990 levels. (Within EU objective burden sharing). Legally binding.
Connecticut	<ul style="list-style-type: none"> <li>• 10% below 1990 levels by 2020</li> <li>• 80% below 2001 levels by 2050</li> </ul>	Specific Legislation	U.S.A.: None yet.
Flemish Region	<ul style="list-style-type: none"> <li>• A reduction of 5.2% emissions in 2008-2012 compared to 1990 levels.</li> </ul>	Plan/strategy	Belgium: 7.5% decrease of 1990 levels. (Within EU objective burden sharing). Legally binding.
Manitoba	<ul style="list-style-type: none"> <li>• Reducing emissions by over three megatons (Mts) by 2012</li> </ul>	Specific Legislation	Canada: Cut by 6% by 2010. Legally binding.
New South Wales	<ul style="list-style-type: none"> <li>• A reduction of 60% by 2050.</li> <li>• A reduction to 2000 levels by 2025</li> <li>• Carbon neutral Government by 2020</li> <li>• 10% of energy from renewables by 2010 and 15% by 2020</li> </ul>	Specific Legislation	Australia: 8% increase of 1990 levels. Legally binding.
North Rhine-Westphalia	<ul style="list-style-type: none"> <li>• Reduce 81 MtCO<sub>2e</sub> per year by 2020</li> <li>• Reduce primary energy consumption by 20% by 2020</li> <li>• Increase the share of renewables in electricity supply from 8.7 TWh in 2005 to 20 TWh by 2020</li> <li>• Increase the share of renewables in heat production from 5 TWh to 20 TWh by 2020</li> </ul>	Plan/strategy	Germany: 21% decrease of 1990 levels. (Within EU objective burden sharing). Legally binding.
Ontario	<ul style="list-style-type: none"> <li>• A reduction of 6% of 1990 levels by 2014, or 61 Mt</li> <li>• A reduction of 15% per cent of 1990 levels by 2020, or 99 Mt</li> <li>• A reduction of 80% of 1990 levels by 2050</li> <li>• Double the installed capacity of renewable energy to 15,700 MW by 2025</li> <li>• Increased electricity conservation to 6,300 MW by 2025; 2,700 MW by 2010</li> </ul>	Plan/strategy	Canada: Cut by 6% by 2010. Legally binding.

	<ul style="list-style-type: none"> <li>• Install 100,000 solar roof systems in homes across Ontario</li> </ul>		
Québec	<ul style="list-style-type: none"> <li>• A 6% reduction by 2012 compared to 1990 levels</li> </ul>	Specific Legislation	Canada: Cut by 6% by 2010. Legally binding.
Queensland	<ul style="list-style-type: none"> <li>• A 60% reduction by 2050</li> <li>• Government to be carbon neutral by 2020</li> <li>• 10% of energy from renewable sources by 2010 and 15% by 2020</li> <li>• 18% by 2020 – the proportion of gas in power sourced by retailers and major industries</li> </ul>	Plan/strategy	Australia: 8% increase of 1990 levels. Legally binding.
Sao Paulo State	<ul style="list-style-type: none"> <li>• An stabilisation of GHG emissions to a 20% reduction by 2020 compared to 2005 levels.</li> </ul>	Plan/strategy	Brazil
Scotland	<ul style="list-style-type: none"> <li>• Reduce by 50% by 2030 and by 80% by 2050 compared to 1990 levels.</li> <li>• Generate 50% of electricity from renewables by 2020 (~8 gigawatts) with an interim target of 31% by 2011(~5 gigawatts), and 20% of total energy use to come from renewables by 2020.</li> </ul>	Specific Legislation	United Kingdom: 21% decrease of 1990 levels. (Within EU objective burden sharing). Legally binding.
South Australia	<ul style="list-style-type: none"> <li>• Increase of 108% of 1990 levels during 2008-2012</li> <li>• Reduce greenhouse gas emissions within the State by at least 60% to an amount that is equal to or less than 40% of 1990 levels as part of a national and international response to climate change</li> <li>• To increase the proportion of renewable electricity generated so it comprises at least 20% of electricity generated in the State by 31 December 2014</li> <li>• To increase the proportion of renewable electricity consumed so that it comprises at least 20% of electricity consumed in the State by 31 December 2014</li> <li>• To increase the use of public transport to 10% of metropolitan weekday passenger vehicle kilometers travelled by 2018</li> </ul>	Specific Legislation	Australia: 8% increase of 1990 levels. Legally binding.

	<ul style="list-style-type: none"> <li>• To improve the energy efficiency of dwellings by 10% by 2014</li> <li>• To improve the energy efficiency of government buildings by 25% from 2000-01 levels by 2014</li> <li>• To reduce South Australia's ecological footprint by 30% by 2050</li> <li>• To reduce waste to the landfill by 25% by 2014</li> </ul>		
Upper Austria	<ul style="list-style-type: none"> <li>• Reduce 65% by 2030</li> <li>• Generate 100% of electricity and heating energy from renewables by 2030</li> <li>• By 2030 complete exit from use of oil and coal during warming and generation of current</li> </ul>	Plan/strategy	Austria: 13% decrease of 1990 levels. (Within EU objective burden sharing). Legally binding.
Victoria	<ul style="list-style-type: none"> <li>• Reducing Victoria's overall emissions to 60 per cent by 2050 (based on 2000 levels).</li> <li>• Renewable energy target of 10% by 2016.</li> <li>• Reducing emissions from households by 10 per cent by 2010.</li> <li>• Committing to reduce government energy use by 20 per cent by 2010 (based on 2000 levels).</li> </ul>	Plan/strategy	Australia: 8% increase of 1990 levels. Legally binding.
	<ul style="list-style-type: none"> <li>• Reductions of 3% per year by 2011 in areas of devolved competence as well as specific sectoral targets in relation to residential, public and transport.</li> </ul>	Plan/strategy	United Kingdom: 12.5% decrease of 1990 levels. (Within EU objective burden sharing). Legally binding.
Wallonia	<ul style="list-style-type: none"> <li>• A 7.5% CO2 emissions reduction for the 2008-2012, compared to 1990 levels.</li> <li>• The Walloon Region wants to reduce the final energy consumption by 8% in 2010 compared to 2000 (-11% in industry, -5% in residential, -11% in tertiary and -6% in transport).</li> <li>• By 2010, the Walloon Region aims to generate 8% of electricity from renewable energy sources (1.8% in 2000) and</li> </ul>	Plan/strategy	Belgium: 7.5% decrease of 1990 levels. (Within EU objective burden sharing). Legally binding.

	produce 12% of overall low temperature thermal consumption (heating, sanitary hot water, low temperature industrial applications) from renewable energy sources (5% in 2000).		
Western Cape	<ul style="list-style-type: none"> <li>• 15% of renewable energy generated (electricity only) in the Western Cape in 2014 off a current consumption baseline of 4200MW</li> <li>• A 14% CO2 emissions reduction by 2014 based on 2000 levels</li> <li>• 10% of renewable energy purchased by Provincial Government by 2010</li> </ul>	Plan/strategy	South Africa: No targets
Yukon	<ul style="list-style-type: none"> <li>• Increase energy efficiency in the Yukon by 20% by 2020.</li> </ul>	Plan/strategy	Canada: cut by 6% by 2010. Legally binding.

Source: The Climate Group ([www.theclimategroup.com](http://www.theclimategroup.com)), Nrg4sd ([www.nrg4sd.net](http://www.nrg4sd.net)) and own elaboration.

**Table 2: Regional examples of different policy instruments used in climate change policies**

	<b>AREAS</b>					
<b>INSTRUMENTS</b>	<b>Energy efficiency</b>	<b>Renewable energies</b>	<b>Transport</b>	<b>Agriculture, Forestry and land use</b>	<b>Waste</b>	<b>Examples</b>
<b>Taxation</b>	British Columbia, Connecticut, Manitoba, Ontario	British Columbia, Connecticut, Manitoba	Basque Country, British Columbia, Catalunya, Flemish region, Ontario, Québec	--	--	Carbon Tax (British Columbia), Transportation Tax Reform (Flemish region), Duty on gasoline and fossil fuels (Québec)
<b>Tax exemptions</b>	Basque Country, Ontario	Manitoba, Ontario	British Columbia, Flemish region, Québec	--	--	“Clean Technologies List” (Basque Country)
<b>Subsidies/grants/loans</b>	Basque Country, Bavaria, British Columbia, Brittany, California, Catalunya, Connecticut, Flemish region, Manitoba, New South Wales, North	Basque Country, Bavaria, British Columbia, Brittany, California, Catalunya, Connecticut, Flemish region, Manitoba, New	Basque Country, Catalunya, Ontario, Québec, Sao Paulo State	Basque Country, Bavaria, British Columbia, California, Manitoba, Ontario, Québec, Scotland, South Australia, Victoria, Wales, Wallonia	New South Wales, Québec, Scotland	Sustainable Agriculture Practice Programme (Manitoba, Ontario)

	Rhine-Westphalia, Ontario, Québec, Queensland, South Australia, Wallonia, Yukon	South Wales, North Rhine-Westphalia, Ontario, Québec, Queensland, Sao Paulo State, Scotland, South Australia, Victoria, Wallonia, Yukon				
<b>Cap and trade systems</b>	All EU regions, British Columbia, Connecticut, California, Manitoba, New South Wales, Ontario, Québec	All EU regions, British Columbia, Connecticut, California, Manitoba, New South Wales, Ontario, Québec, Wales	All EU regions, British Columbia, Connecticut, California, Manitoba, New South Wales, Ontario, Québec	All EU regions, British Columbia, Connecticut, California, Manitoba, New South Wales, Ontario, Québec	All EU regions, British Columbia, Connecticut, California, Manitoba, New South Wales, Ontario, Québec, Scotland	EU ETS, Western Climate Initiative (British Columbia, California, Manitoba, Ontario, Québec), Regional Greenhouse Gas Initiative (Connecticut), Carbon Reduction Commitment (Scotland)
<b>Voluntary agreements with companies, public institutions and consumers</b>	Basque Country, New South Wales, Wallonia	--	Basque Country, New South Wales, Sao Paulo State	Wallonia	--	Sector Agreements (Wallonia, The Basque Country)
<b>Energy /emission</b>	Basque Country, California,	California, Connecticut,	British Columbia,			NSW Government Action Plan for Energy Efficiency

<b>standards</b>	Connecticut, Manitoba, Ontario, Québec, Queensland, South Australia, Victoria, Wales	Manitoba, Ontario, Québec, Queensland	Connecticut, California, Manitoba, Ontario, Québec	--	--	(New South Wales), Building Code (Ontario, Basque Country), GHG emission standards for transport (California, Quebec)
<b>Certification/labels</b>	Basque Country, Manitoba, New South Wales,	Basque Country, Manitoba, New South Wales, Wallonia	New South Wales, Sao Paulo State	Connecticut, Sao Paulo State	--	Green Ethanol Project (Sao Paulo State)
<b>Prizes/awards</b>	Bavaria, Scotland	Scotland	Basque Country	--	--	Saltire Prize (Scotland)
<b>Public system-infrastructure</b>	--	--	Basque Country, British Columbia, Bavaria, Catalunya, Flemish Region, New South Wales, North Rhine-Westphalia, Queensland, Sao Paulo State, Scotland, South Australia, Victoria	--	Basque Country, North Rhine-Westphalia	NRW Hydrogen HyWay (North Rhine-Westphalia)

<b>Legislation/ regulation</b>	British Columbia, California, New South Wales, Ontario, Scotland, South Australia, Victoria, Western Cape	British Columbia, California, New South Wales, Ontario, Queensland, Sao Paulo State, Scotland, Victoria, Western Cape	British Columbia, California, Manitoba, Québec, Scotland	British Columbia, California, Connecticut, Scotland	Ontario, Québec, Scotland, South Australia	Greenhouse Gas Reduction (Renewable and Low Carbon Fuel requirements) Act (British Columbia), Global Warming Solutions Act of 2006 (California), Carbon Right Legislation (New South Wales), Geothermal Exploration Regulation Act 2005 (Queensland), Sustainable Energy Facilitation Act (Western Cape), Energy Efficiency Target Act 2007 (Victoria)
<b>Information and training</b>	All	All	All	All	All	Stop Co2 initiative (Basque Country)
<b>Procurement</b>	All	All	All	All	All	New South Wales, Québec

Source: Nrg4sd ([www.nrg4sd.net](http://www.nrg4sd.net)), The Climate Group ([www.theclimategroup.com](http://www.theclimategroup.com)) and own elaboration.

## 5.2 Targets by Sectors

Although adaptation methodologies are being widely developed, the main actions in this field are directed at promoting detailed and high level research. Yet, greater emphasis is needed on better understanding the changes that global warming might generate at regional and local level.

Regions need to be prepared to deal with the uncertainty surrounding adaptation policies and many of them are developing adaptation strategies. The main efforts are devoted to understanding the vulnerabilities, resilience and expected impacts, and adapting policy planning to greater flexibility. However, information regarding specific policy goals in this field is not that easily found. Preventive action for extreme weather events (flooding, hurricanes, heat waves or draughts), advanced coastal management, reducing biodiversity loss, adaptation of forest management and agriculture, preventive water management actions, air quality, public health and better land use planning are among the policy actions defined in many of the regions. Some of the examples from regions that are active in defining adaptation policies are: South-western Coastal Bangladesh in India (Forestry and agriculture), Tuscany in Italy (biodiversity loss), Quebec in Canada (public health, water management, permafrost melting, air quality or forestry), Cataluña (water management, coastal management), Western Cape in South Africa (Biodiversity loss, water stress) and the Basque Country in Spain (air quality, water management and land use planning).

Some cities have also been developing adaptation plans to adapt to their specific needs<sup>5</sup>. Some examples are the City of London in the UK (Tidal flooding, weather severity or air quality), Singapore (heat stress, marine biodiversity, public health and water supply), Vancouver in Canada (agriculture, flooding, air quality, biodiversity loss and other) or New York in the USA (air quality, sea level rise, heat waves).

In contrast, much more detailed policy actions have been implemented in mitigation in the areas of energy efficiency, renewable energy, transport, sustainable agriculture, forestry and land use policy and waste management to name a few, as it will be shown in this section. Table 2 shows a summary of the instruments applied. Note that this information does not pretend to be exhaustive but attempts to give an overall insight about the policies being implemented in regions.

**Energy efficiency (EE):** As one of the main areas of action, EE is at the heart of many policies designed to fight climate change. It is fair to say that traditionally many regions and states have been implementing EE policies with the aim of reducing production costs and fostering competitiveness of local industry, motivated to some extent, by the desire to reduce energy dependency. Now that climate policies are being developed, EE has taken on a new dimension and has become a central area of action for climate change policies.

The kind of policy instruments used to foster EE range from energy taxation, subsidies schemes to promote the use of energy efficient technologies and appliances or voluntary agreements with industry, institutions (both public and private) and consumers. Technical codes as well as energy standards are used frequently. Many regions have implemented specific legislation for EE and many others have included this policy area as one of the main action lines within the Climate Change legislation and/or strategies.

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<sup>5</sup> More information in The H. John Heinz III Center for Science, Economics and the Environment, 2007, "A Survey of Climate Change Adaptation Planning" available in [http://www.heinzctr.org/publications/PDF/Adaptation\\_Report\\_October\\_10\\_2007.pdf](http://www.heinzctr.org/publications/PDF/Adaptation_Report_October_10_2007.pdf)

The analysis (see Table 2) suggests that subsidy schemes are the most used policy instrument together with energy standards for housing, electric and electronic appliances and industry.

**Renewable energy:** The most frequent policy instruments used in regions have been the “feed-in tariffs”, most of which are being regulated by National or Federal Governments. Regions have all implemented subsidy schemes to fostering renewable energies together with defining renewable energies as one of their regional energy and industrial priorities. It is important to highlight the level of commitment of those regions that have defined further more ambitious goals than National/Federal governments legislating the renewable energy targets. Some of the interesting cases include North Rhine-Westphalia, Sao Paulo for Bioenergy, California and New South Wales.

**Transport:** At least two major approaches to this policy area can be seen among the regions; on the one hand, those that have developed an intensive public transport system (i.e. European regions) and are willing to invest in sustainable public systems. On the other hand, other regions whose public systems have not been developed significantly in the past are now aiming for encouraging more sustainable vehicles (i.e. US regions).

Of course many regions are aiming for a good combination of both approaches by investing public resources heavily in the public system (Basque Country, Flemish region, Cataluña, Bavaria or British Columbia) and also by implementing tax exemptions schemes for low carbon fleets and legislating on the emissions of vehicles (California, British Columbia, etc.). Other instruments such as voluntary agreements, low carbon procurement (government vehicles) and subsidies are also well known and implemented.

**Agriculture, Forestry and Land Use:** Traditionally, the policy instruments used in this sector have been more related to subsidies and special supporting programmes to foster sustainable agriculture and forestry practices. This is true for most regions and it is difficult to extract more general conclusions.

**Waste:** Many of the environmental regulations affect waste management and treatment directly or indirectly. Therefore, little has been specifically developed to contribute to climate change policy. Requirements for methane collection and capture (Ontario) or crediting under GHG abatement schemes (New South Wales) are some of the few specific examples to be found. Other actions are devoted to promoting recycling, reducing waste and better management systems (energy recovery mainly) and are part of other environmental or waste specific policies.

## **6. In Depth case Study: The Basque Country**

The temptation is always to opt for the case of California when selecting one region to study: a region that is frequently analysed in climate change literature. The legally binding targets set by this region as well as the contrast with the unimpressive climate policy of the Federal Governments of the US make California a very interesting case study.

However, bearing in mind that the vast majority of regions are far from being similar to California in terms of size, GDP and economic structure, we have opted for a smaller and heavily industrialised example that could set the ground for other similar regions: the Basque Country. This

region has been recognised by EU institutions<sup>6</sup> and the United Nations<sup>7</sup> as being one of the most active regions in climate change policy over recent years. Additionally, the Basque Country, as the co-chair of the nrg4sd, has been very active in the defence of the role of regions in fighting climate change at the international forum. It participates annually at CoP meetings of the UNFCCC and has designed and is implementing an ambitious climate change policy.

In terms of climate change, the Basque policy started out with the approval of Environmental Sustainable Development Strategy 2002-2020 that defined fighting climate change as one of the main five priorities. The fine tuning of the strategy and the detailed setting of policy goals and actions are being carried out through the so-called Environmental Framework Programme. The first was approved for 2002-2006 and the second for the period 2007-2010. The latter gave a decisive push to climate policy by encouraging the development of the BASQUE PLAN TO COMBAT CLIMATE CHANGE 2008-2012 (BPCCC)<sup>8</sup>.

The BPCCC defines the aim of the Basque Country “to take irreversible steps towards a socio-economic model non-dependant on carbon by 2020, so that the Basque Autonomous Community is less vulnerable before climate change”. The plan sets two priorities to do so: (1) to act against climate change and to get prepared for its consequences and (2) to promote innovation and research to move towards a low carbon sustainable economy.

There are four strategic objectives defined to achieve this. These are:

- Limiting GHG emission growth to 14% with regard to 1990, having increased the total emissions (including imported energy) by around 21-22% in 2007.
- Increasing carbon sinks by 1% with respect to 1990 especially managing forests, agricultural soil and pastures.
- Minimising the risks on natural resources.
- Minimising the risks on human health, on the quality of urban habitats and on socio-economic systems.

The plan oversees 120 policy actions in the fields of energy, transport, housing, education, industry, environment, land use planning, water, education and so on, that have been organised in four policy programmes:

- Less carbon Programme to deal with mitigation policy actions in the areas of energy efficiency and saving, renewable and carbon sequestration.
- Adaptation Programme to enhance research and monitoring, vulnerability studies, adaptative planning and preparation of infrastructures.

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<sup>6</sup> The report “Regions 2020” of the European Commission. Available in [http://ec.europa.eu/regional\\_policy/sources/docoffic/working/regions2020/index\\_en.htm](http://ec.europa.eu/regional_policy/sources/docoffic/working/regions2020/index_en.htm)

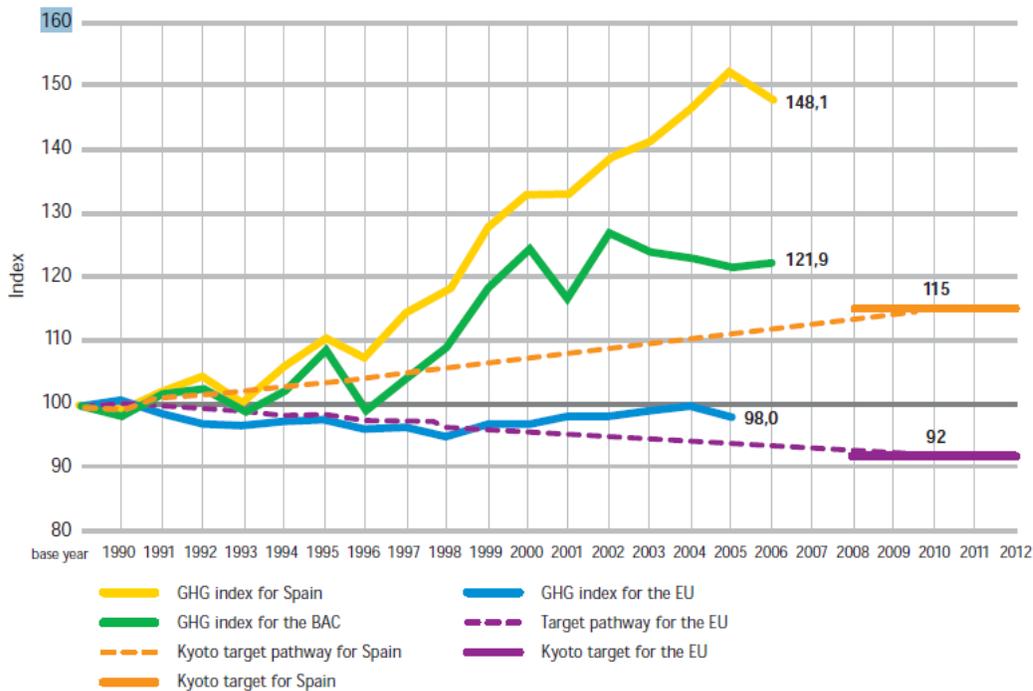
<sup>7</sup> The 3rd UN World Water Development Report, “Water in a Changing World”, 2009. Available in <http://www.unesco.org/water/wwap/wwdr/wwdr3/>

<sup>8</sup> Available in [http://www.ingurumena.ejgv.euskadi.net/r49-6172/en/contenidos/plan\\_programa\\_proyecto/plan\\_cambio\\_climatico/en\\_cc/indice.html](http://www.ingurumena.ejgv.euskadi.net/r49-6172/en/contenidos/plan_programa_proyecto/plan_cambio_climatico/en_cc/indice.html)

- Knowledge Programme to promote basic and applied high level research.
- Citizens and Administration Programme to manage issues related to green procurement, awareness raising, education and training.

The BPCCC aims to reduce emissions from a level of 22% above 1990 emission levels. The situation is better than in the rest of Spain (around plus 50%) but still is far behind the average EU index of -2%<sup>9</sup>. (See Figure 4).

**Figure 4: Trends in GHG emissions in the Basque Country (BAC), Spain and the EU 1990-2006**



Source: BPCCC

The Basque Country has set itself a very ambitious target: to reduce 4.30 million tons of CO<sub>2</sub>e on average for 2010. Table 3 shows how will these reductions be achieved. Main reductions will be due to energy efficiency measures and renewable energies.

<sup>9</sup> Note that as a heavily industrialised region, one expects that GHG emissions per capita throw a bad result in comparison with other less industrialised ones while GHG emissions per unit of GDP show a different reality.

**Table 3: Contribution of each line of action to the objective of emission reduction**

Lines of action	Reduction target for 2010 (average for 2008-2012 (Mt CO <sub>2</sub> e)	Measures to 2012 <sup>75</sup>
<b>ENERGY EFFICIENCY &amp; SAVINGS</b>		
More efficient use of fossil fuels	1.01	All thermal electricity generated by combined cycle natural gas plants.
Savings & efficiency in industry	0.57	Improvements in energy efficiency for a saving of 583 Ktoe on 2001 figures by 2010
Savings & efficiency in means & use of transport	0.33	21% improvement in efficiency in transport in terms of CO <sub>2</sub> emissions
Savings & efficiency in residential & service sectors	0.09	Improvements in energy efficiency for a saving of 58 Ktoe on 2001 figures by 2010
Encouragement for CHP	0.08	600 MW of installed capacity from CHP.
<b>ENCOURAGEMENT OF RENEWABLES</b>		
Encouragement of renewables	1.06	Production from renewables to meet 15% of electricity demand
Encouragement of renewables (bio-fuels) in transport	0.53	177 ktoe of consumption requirements met by renewables
Encouragement of renewables in the residential & service sectors	0.02	152,000 m <sup>2</sup> of solar power used for heating
<b>REDUCTION OF NON-ENERGY EMISSIONS</b>		
Reduction of non-energy GHG emissions from industry	0.31	89% drop in fluorinated gas emissions on 1995 levels by 2012.
Reduction of non-energy GHG emissions in the waste sector	0.17	Less than 40% of MSW landfilled
Reduction of non-energy GHG emissions from agriculture & forestry	0.12	Construction of 3 livestock waste treatment plants
<b>TOTAL</b>	<b>4.30</b>	

**Source: BPCCC**

The plan also foresees the possibility to reduce additional 0.5 million ton through domestic emission offsetting projects and certified reductions. Carbon sequestration is also included in the plan aiming at additional 223,163 ton of CO<sub>2</sub>e reduction by 2010 (see Table 4).

**Table 4: Potential for absorption by carbon sinks to 2010**

Human activity fostering carbon absorption	AUs generated (2010)	% of base year emissions
Afforestation & reforestation	117,014	0.56%
Forest management	63,164	0.30%
Cultivated land management	23,341	0.11%
Grazing land management	19,644	0.09%
<b>Total AUs<sup>7a</sup></b>	<b>223,163</b>	<b>1.07%</b>
Base year emissions (t CO <sub>2</sub> e)	20,939,000.00	

**Source: BPCCC**

This plan coordinates efforts with other sector-specific plans and targets such as the Energy Strategy 3-E2010, The Environmental Action Programme 20067-2010, the Sustainable Transport Plan, The Science, Innovation and Society Plan and not included in any other existing plan or strategy. It wishes to mobilise 630.3 million euro of which 79.5 million to refer to additional resources not included in any other existing plan or strategy.

It is important to highlight the set of indicators and feedback system (FS) that has been foreseen in order to guarantee the effective implementation of the plan. Both indicators and the FS should allow further fine tuning of the climate policy.

The Basque Climate Change Office (BCCO) was set up in order to coordinate all the efforts to implement the plan effectively. It gathers representatives from the main departments involved in climate policy and is organised at two levels: the decision making board and the advisory technical committee. The later has the mandate to analyse and prepare the reports to be approved by the decision making board.

- The main four tasks of the office are defined in the BPCCC and are:
- Taking active part in the implementation of the BPCCC.
- Promoting knowledge and research.
- Coordinate climate planning.
- Communicate and raise awareness.

The effectiveness of the climate plan has not been tested so far. An interesting ex-ante study of the economic impact of CO<sub>2</sub> mitigation policy in the Basque Country can be found in Gonzalez and Dellink 2007, which shows that the costs for achieving the Kyoto targets may remain limited if the appropriate combination of changes in fuel-mix and restructuring of the economy is induced. A reduction in emissions of 15% will induce a decrease in GDP of approximately 1%.

The evolution of the GHG emissions is presented together with other environmental indicators annually in the “Environmental Indicators Report”. The information for years 2007 and 2008 shows a

slight change in GHG emission trend going down from a 22% increase with respect 1990 to 21%, but it is too early to properly evaluate this policy.

## 7. Conclusions

Climate change is a great challenge for policy makers as it requires a quick and decisive response affecting many different areas of policy and all levels of governance. International negotiations are so far taking place at the national level. These are necessary but not enough. Unless efforts are coordinated with regional and local governments, successful and effective implementation of policy actions is not guaranteed.

Many arguments can be used to support the latter. Firstly, many of the policy areas are competencies of the regional governments so they are the ones who should guarantee that actions are put in place. The paradox of the “lent targets” helps to illustrate this issue as it shows that while nations negotiate mitigation targets and the ensuing agreements become legally binding, regions are the ones who can actually achieve those and are not legally bound by agreements. Secondly, this level of governance is very close to citizens and can thus tailor the policies to adapt them to the specific needs.

At the same time, one cannot ignore the argument that incorporating regions in international negotiations can be very difficult as the number of players will increase to unmanageable numbers. There are some suggestions that could help to overcome this problem. On the one hand, it may be possible for regions to be officially recognised as part of National/Federal Delegations, with some real negotiation capabilities within the National/Federal strategies and their participating in the decision making process. On the other hand, few representative networks or association of Regions and Local Governments should be present in international negotiation processes and official discussion rounds to ensure that their voice is heard. This will not increase the number of participants significantly while allows incorporating the view of these levels of governance.

Some leading regions worldwide have realised the need to raise their voices in international forums and the potential of networking. Mitigation and adaptation policies are not a unique recipe that can be applied equally at national or regional level, but regions do share many common factors that make exchange of best practices very interesting. Networks such as The Climate Group, nrg4sd, FOGAR or ICLEI have worked hard to be recognised by international organisations. United Nations' agencies are more than willing to take them on board. Whether they will officially participate in negotiation rounds remains to be seen.

The paper has devoted a section to the analysis of the policy instruments used in some 20 regions worldwide to fight climate change. Carbon taxation, subsidies, cap and trade systems, public procurement, energy and efficiency standards and legislation are the most common ones. Interesting examples have been highlighted for those willing to deepen the understanding of some of these tools. The carbon tax in British Columbia or the economic sector agreements in Wallonia are together with the Global Warming Solutions Act of 2006 (California) some of these examples.

## References

Anger, Niels and Sathaye, Jayant. 2008 Reducing Deforestation and Trading Emissions: Economic Implications for the Post-Kyoto Market. Discussion Paper No. 08-016. Center for European Economic Research, Mannheim, Germany.

Aldy, J. E. y Stavins, R. N. (2008) "Climate Policy Architectures for the Post-Kyoto World", Environment: Science for Sustainable Development, mayo-junio.

Center for Science in the Earth System (2007) "Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments". Published by The Climate Impacts Group, King County, Washington and ICLEI.

Galarraga, I. (2007) "La Apuesta del País Vasco en la lucha contra el cambio climático". En *Ekonomi Gerizan: "Desarrollo Sostenible y cambio climático"* editado por la Federación de Cajas Vasco-Navarras.

González, M. and Dellink, R. (2009) "Impact of climate policy on the Basque economy", *Economía Agraria y de los Recursos Naturales*, 2006, 12, 187-213.

Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4): Climate Change 2007.

Markandya, A. (2009) "Can Climate Change Be Reversed Under Capitalism?" forthcoming, *Development and Change*.

Network for Regional Governments for Sustainable Development (ng4sd) (2008) NRG4SD Post Bali Policy Paper on Climate Change. [www.nrg4sd.net](http://www.nrg4sd.net)

Stern, N. (2008) "Richard T. Ely Lecture: The Economics of Climate Change". *American Economic Review*, 98:2, 1-37.

Weitzman, M., L. (2007) "A Review of the Stern Review on the Economics of Climate Change". *Journal of Economic Literature*, vol. XLV, pp. 703-724.

Web page references:

<http://www.theclimategroup.org>

<http://www.nrg4sd.net>

<http://www.worldsummitofregions.org/en/index.php>

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