KLIMA 2050
BASQUE COUNTRY

COMPETITIVENESS AND CLIMATE CHANGE IN THE BASQUE COUNTRY

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CONTENT

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INTRODUCTION

The increased presence of climate change on the international and European political, economic, and environmental agenda, the application of emissions trading as one of the main instruments for reducing greenhouse gas emissions, and the uncertainty that these new challenges bring to the future have generated a perception that climate change is a threat to the competitiveness of European companies.

The signing of the Paris Agreement represented the beginning of an era in which climate change will influence all levels of decision making, including those in business. Article 6 of the Agreement urges the business world to become involved in the application and achievement of the national targets presented by each country. The signs for industrial and commercial sectors are clear: the change has started and there is no turning back. From now onwards, their involvement is essential.

In this context, it is a very appropriate moment to produce a low carbon economy impact analysis on the competitiveness of the Basque Country's business landscape in the shape of relevant messages for businesses and to help them plan for the future.

In order to complete this report, the existing bibliography on climate change has been analysed, along with information available from studies, analyses, and development plans from various entities of the Basque Authorities. In addition, interviews were held with a series of experts from companies, associations, and research centres that are particularly active in, or sensitive to, this field. The document was compared during two work sessions at Confebask, where more than 30 companies provided their sectoral perspective on the challenges and opportunities presented by climate change, and where lines of collaboration in this area were identified. All of this with the final goal of addressing the future relationship between the competitiveness / energy / CO_2 emissions trinomial in terms of the positioning of the Basque industrial landscape.

1. GENERAL CONTEXT

1.1. Objectives, scope, and methodology

In order to analyse the low carbon economy's impact on Basque company competitiveness, this report has placed special emphasis on industrial activities and aspects related to mitigating climate change. In other words, focus is placed on reducing emissions and the difficulties and opportunities associated with the transition to the low carbon economy.

The report also summarises the basic analyses available regarding the region's vulnerability and infrastructure with regard to the economy's various sectors.

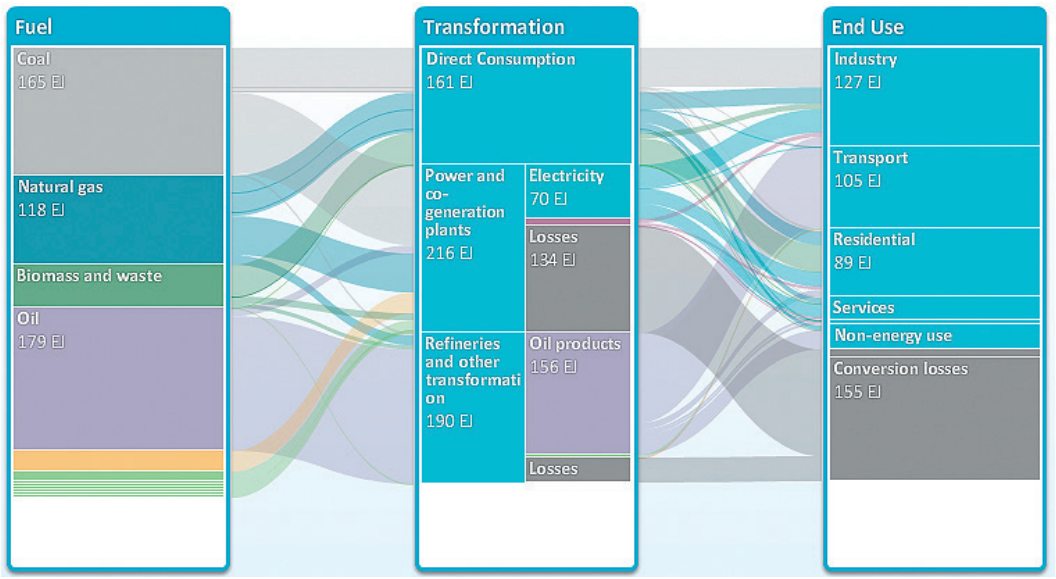


Illustration 1. Global energy consumption flows.
Source: IEA. Energy Technology perspectives 2015.

However, the adaptation of businesses to climate change is an area that is scarcely analysed at the present time. For this reason, its influence on the competitiveness of businesses will require a more in-depth analysis in coming years.

The report fundamentally analyses the industrial and services sectors linked by their contribution to the BAC's GDP. Also included are impacts on the food and tourism sector, which are likely to be relevant.

The study aims to analyse the varied problems relating to the impact of climate change on the competitiveness of Basque companies in terms of cost, opportunities created, and company responses to the transition to the low carbon economy. This is a first treatment based on the analysis of secondary sources of information (documents, existing records, statistics and previous analysis, interviews with experts, etc.), with the main goal of identifying the most relevant aspects and indicating other issues for which it may be of interest to carry out more complete analysis.

1.2. Consensus on climate change

groups that question the IPCC scientific panel's conclusions. The message is clear. In order to have a real chance at limiting global warming to a 2 °C increase compared to the pre-industrial era, greenhouse gas emissions must be reduced, starting in 2020 and reaching 50% of their 1990 levels by 2050. At the end of 2014, the world had already emitted 1,970 of the 3,000 gigatonnes (Gt) of CO_2 consistent with this target[1]. Time is running out.

This emissions reduction will affect all areas of human activity, and poses a great challenge from a technological, economic, social, and institutional perspective. It also supposes a significant change for the majority of productive and business activities, that must occur in a relatively short period of time.

Technological advancements are making an objective that many considered utopian not long ago into something believable. In 2014, the world economy grew at a rate of 3%; however, with the exception of periods of economic crisis, CO_2 emissions remained stable for the first time in the last 40 years. Following this line, renewable energies made up nearly half of 2014's new installed generation capacity[2].

Today, global business leaders and associations are proposing something that is very different from what they had been proposing in recent years. Major companies are looking for a regulatory environment that lets them adapt themselves to these changes in an orderly fashion, and have been requesting

"an ambitious agreement... that guarantees comparable efforts from the main emitting economies... to ensure fair competition within a stable framework[3]".

In fact, in the absence of a policy initiative that establishes a global carbon rate, and in line with the World Bank recommendation[4], more than 100 major international institutions and companies have decided to apply a price of between 6 and 60 US$/t CO_2 to their internal operations. The strategy of leading companies, and investor and financial group risk evaluations[5], already incorporate the need to drastically reduce CO_2 emissions, creating a state of opinion among economic agents and the public that has reached a critical momentum, and is continuing to expand with increasing speed.

1.3. Paris: A new international agreement

COUNTRY	REDUCTION TARGET	YEAR	REFERENCE YEAR
Algeria	7%	2030	–
Brazil	37%	2025	2005
Canada	30%	2030	2005
China	60-65% per unit of GDP Increase the consumption of primary energy from non-fossil sources by 20%	2030	2005
EU	40%	2030	1990
India	33-35% per unit of GDP 40% installed renewable electric energy	2030	2005
Japan	26%	2030	2013
Mexico	22-36%	2030	BAU
Morocco	13-32%	2030	BAU
Norway	40%	2030	1990
Russia	25-30%	2030	1990
Switzerland	50%	2030	1990
USA	26-28%	2025	2005

Table 1. Illustrative examples of submitted INDCs.
Source: World Resources Institute.

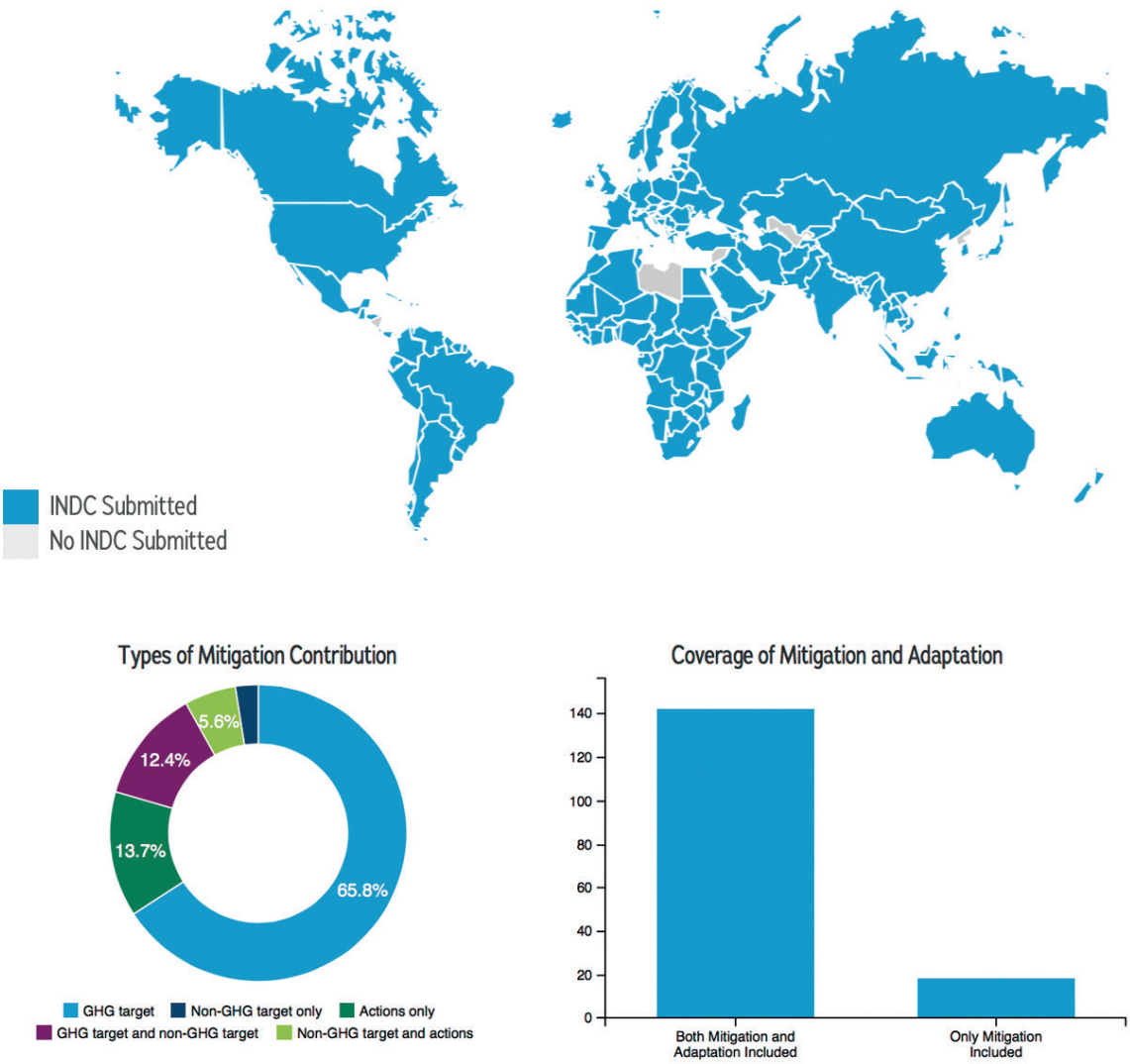


Illustration 2. INDCs submitted on 5 May 2016.
Source: World Resources Institute.

On 12 December 2015, the Conference of Parties (COP) adopted the Paris Agreement. This agreement began its ratification process in New York on 22 April 2016 with 175 parties signing (174 countries and the EU), representing more than 95% of the world's emissions. Additional countries will continue to sign the Agreement in the coming months.

The Paris Agreement is a legally binding multilateral agreement adopted by 195 countries. The governments of these countries agreed upon the long-term target to keep the average global temperature increase below 2°C with respect to pre-industrial levels, and to attempt to limit the increase to 1.5°C, as this would significantly reduce the risks and impacts of climate change.

According to the agreement, global emissions should reach their maximum value as soon as possible, recognising that this would mean a greater effort from developing countries, and that the reductions necessary must be carried out by using the best techniques available.

Before and during the Paris Conference, countries presented their Comprehensive Climate Action Plans to reduce emissions. The total sum of Intended Nationally Determined Contributions (INDC) is not yet sufficient to keep the global temperature increase below 2°C by the end of the century. Nevertheless, the agreement lays out the path towards achieving this target.

The governments agreed to meet every 5 years to set more ambitious targets according to advances in scientific knowledge. They also agreed to inform the public, and each other, as to advances achieved with respect to their targets. In order to guarantee transparency and monitoring, a joint inventory will be produced every five years. An emissions reporting system will be created on a global level that should be transparent and efficient.

The EU and other developed countries will continue to support climate actions to reduce emissions and increase resilience to climate change impacts in developing countries. Other countries are encouraged to provide, or continue providing, this support on a voluntary basis. International support will be provided for continuous improvement in order to facilitate the adaptation of developing countries to climate change. Developing countries intend to continue with their collective target to mobilise 100 billion dollars annually until 2025, with a new target being established thereafter.

The Paris Agreement includes an independent article to deal with the question of loss and damages associated with the impacts of climate change. The countries recognise the need to cooperate and

improve understanding, action, and support in different areas such as early warning systems, emergency preparedness, and climate risk insurance.

This agreement responds to the request from leading business organisations for a stable, consensual framework that facilitates the investment planning and decision-making processes, urging the business world to get involved in the application and achievement of the national targets presented by each country, promoting greater ambition in mitigation measures and the adaptation and promotion of sustainable development. In this way, national governments have sounded a call to action for companies and investors to play a critical role in their development. Society is now waiting for a commitment from businesses that meets the climate change challenge.

1.4. The cost of carbon

The implementation of a carbon price is the principal measure planned to internalise the social cost of emissions, and to provide an incentive to transition to the low carbon economy. The main mechanisms to incorporate the cost of carbon are: a direct tax (*carbon tax*), the assignment of tradeable emission rights (*ETS, emission trading system*), and other incentives. The ETS is the most implemented mechanism on the international stage.

The ETS, such as the one applied in Europe, is easier to associate with an emissions reduction target since it involves a *cap and trade* system in which emission rights prices are adjusted through bidding and a secondary market to meet an emissions target effectively and at a lower theoretical cost. However, it is a more technically complex system, where it is difficult to anticipate price developments. In fact, reduced production associated with the economic crisis is currently allowing European emissions reduction targets to be met with very low rights prices. Some companies with reduced operations have been able to earn excess profits from the sale of rights. All of this has produced inappropriate expectations among the parties involved.

Carbon prices are implemented in some 40 countries and 20 regions, covering approximately 12% of global emissions.

The differences in prices on an international level are noteworthy[6]. Today, the system is clearly far from meeting its goal of global implementation.

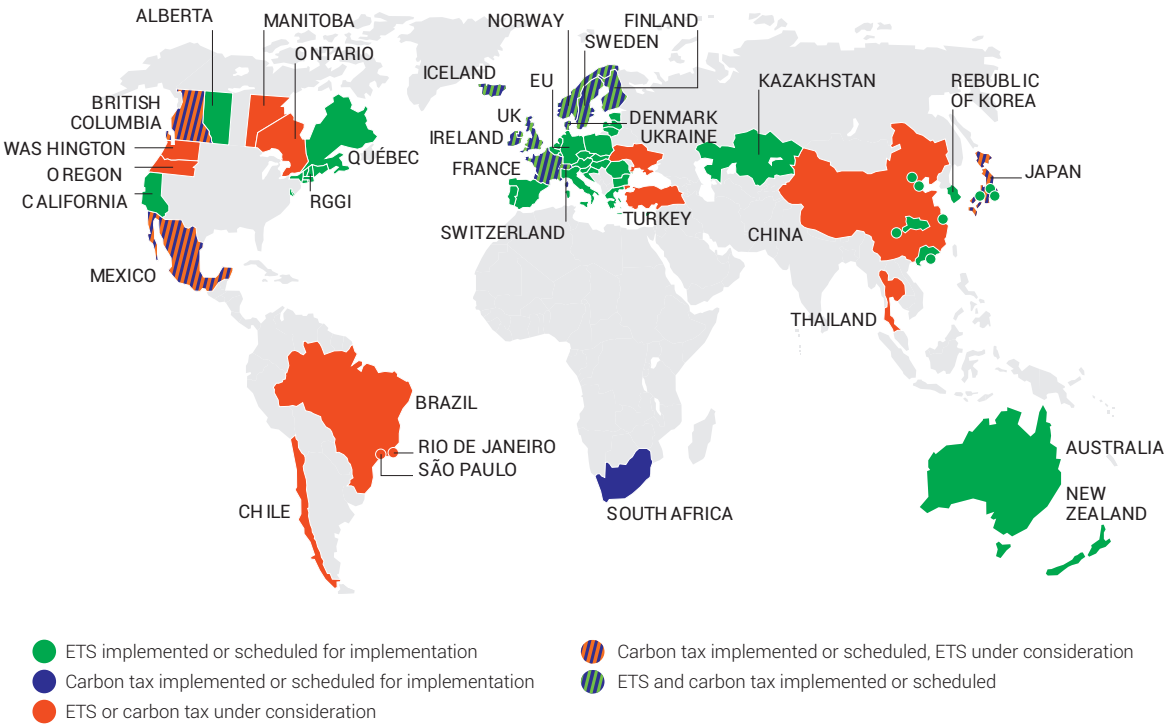


Illustration 3. World carbon price systems.
Source: World Bank. State and trends of carbon pricing 2014.

Logically, governments are taking into account the problem of the sectors that are most emissions-intensive and exposed to international competition, which are vulnerable to *carbon leakage*. The European Union exchange system (EU ETS) envisioned an increased allocation of free rights to these sectors, in function of the sector's reference technologies (*BAT: Best Available Technologies*). In addition, aid has been authorised to compensate these companies for the indirect cost of their emissions associated with electricity consumption.

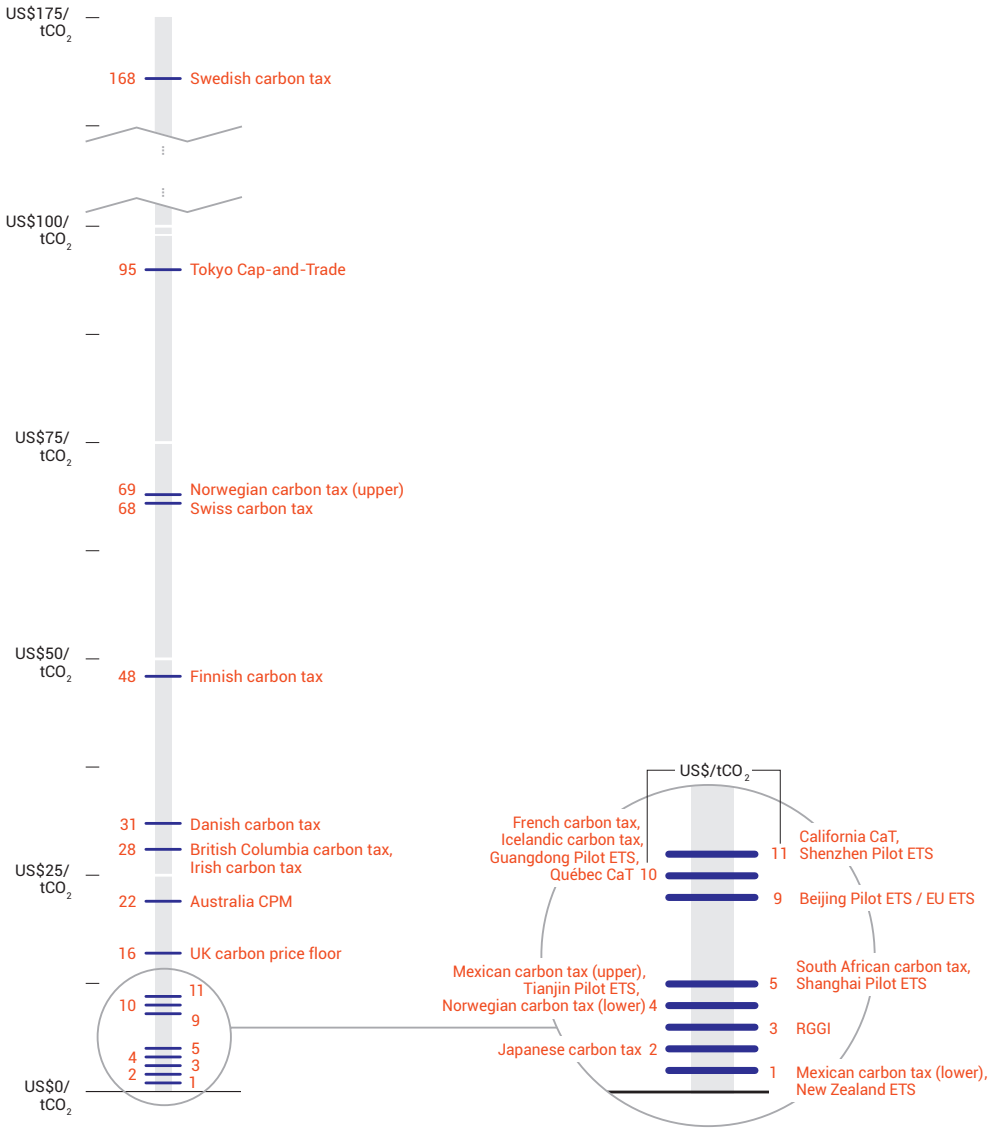


Illustration 4. World applied carbon prices.
Source: World Bank. State and trends of carbon pricing 2014.

The free allocation of rights is a relatively frequent practice. In 2013, the European Union Emission Trading System (EU ETS) only traded 40% of its rights. This practice reduces the system's efficiency, but favours its implementation in order to protect industries that are energy intensive and subject to a high level of international competition.

The adoption of measures to adjust carbon at the border (*Border Carbon Tax Adjustments*, or *Border Adjustment measures*) have also been proposed, which are tariffs that would apply to imported products in order to compensate for the carbon prices applied to domestic industries. This system could also be applied to deduct the cost of carbon rights from products exported. Given the existing difficulties of implementing a global carbon price system, this proposal is interesting in theory, but it presents some practical difficulties.

The other great push to reduce emissions is based on an incentive to produce renewable energy. The renewable energy *feed-in* tariffs suppose a higher cost, equal to approximately €150/t CO_2 eliminated, according to OECD estimates[7]. Furthermore, in principle, this policy overlaps with the EU ETS system, which guides reductions to the theoretically most efficient point, and reduces the global demand for rights.

However, all of these measures present difficulties in their application, in their fairness on an international level, and in the ability to apply them to all potentially targeted sectors of activity.

1.5. The low carbon economy

One of the main analyses geared towards balancing economic prosperity with efforts against climate change has been produced by the *Global Commission on the Economy and Climate*[8]. The main conclusions presented in its benchmark report *"Better growth, better climate*[9]*"* are as follows:

- The next 15 years will be critical. During this period, the world economy will grow by 50%, and US$90 trillion will be invested in infrastructure (mainly in developing countries) associated with the growth and remodelling of cities, the use of natural resources, and the production and distribution of energy. The orientation of these new investments will give shape to future patterns of growth, productivity, and quality of life. It is estimated that the additional improvements necessary for these infrastructures to be sustainable from a climate perspective would suppose a 4.5% increase in planned investment. These increases will most likely be amortised by reduced energy consumption.

- The estimates (based on econometric models) for the impact of measures proposed to promote the low carbon economy (mainly assigning a price for emissions) oscillate around 1.7% of 2030's GDP, which would be equivalent to a six to twelve month delay in global growth.
- These estimates do not take into account the benefits associated with reduced pollution emissions. Low carbon growth will bring advantages (less atmospheric pollution, energy security, improved quality of life and traffic, etc.), which should allow for significant savings: analysts estimate social cost reductions of between US$32 and US$73 per tonne of CO_2 not emitted. The cost of childhood mortality associated with atmospheric pollution produced by fossil fuels could reach numbers in the order of 4% of GDP in the most polluting countries. Economic and climate development goals are mutually reinforcing.
- It is crucial to send consistent messages in order to shape expectations and encourage investment and innovation. The three key resources for overcoming barriers to change are: improving efficiency in the use of resources (internalising carbon costs with a significant, predictable price, in addition to eliminating fossil fuel subsidies), investing in sustainable infrastructures (specifically low carbon electricity production), and stimulating innovation focused on energy efficiency. Putting these actions into practice requires firm, believable, and predictable policies.

In terms of the Basque Country, initial estimates[10] produced by the Basque Centre for Climate Change (BC3) benchmark research centre quantifies the cost to the Basque Government of the measures stipulated in the 2050 Climate Change Strategy at 88 million euros (€M) per year. According to the BC3, at 0.13% of annual GDP, the cost is low in comparison with the cost of doing nothing, estimated in the *Stern Report*[11] (between 5-20% GDP on the long-term).

On the other hand, the promotion of these measures would generate €57M in economic activity, with 1,030 jobs created annually for the first 5 years. The Basque Country's annual energy bill would be reduced by €55M/year, and avoiding health problems associated with pollution would mean savings of between €12M and €32M per year.

The report warns of the elevated uncertainty of these initial calculations, although it believes in the validity of its general conclusions.

2. THE IMPACT OF CLIMATE CHANGE

2.1. Climate change impact factors affecting the economy

When the challenge of moving towards a low carbon economy is addressed, different studies[12] have identified a series of components that establish a framework for companies, both in terms of risks and opportunities. These components can be summarised by three impact factors on business competitiveness:

- **Impact on the physical environment:** direct environmental effects on physical environments.
- **Impact derived from mitigation policies:** effects relating to the implementation of climate change mitigation policies and standards.
- **Impact derived from the market:** effects related to the appearance of structural changes to markets and the modification of supply and demand.

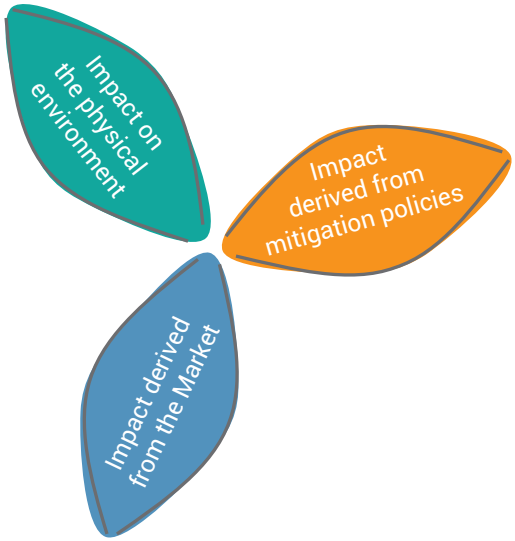


Illustration 5. Climate change impact factors.
Source: Compiled by the authors.

No region, sector, or company is beyond the new political and regulatory framework, and the effect is not neutral in any geographic area, business sector, or individual company.

The implications of the challenge to move towards a low carbon economy vary by sector and region. As an example, emissions corresponding to the industrial and energy sectors, which are of very high importance in the Basque economy, make up 55% of total GHG emissions (2014). Of these, 75% correspond to the companies included in the Emission Trading System.

Therefore, the dimension of the impact and level of risk/opportunity would vary with each economic activity, and each organisation has a different capacity to act on a number of the components that affect the balance of the theoretical impacts: geography and orography, level of political commitment, non-standardised regional regulations, real pressure in applying standards, areas of application (energy mix, renewable energy capacity, financial capacity, etc.), competitive position of the industrial sectors, technological capacity, vision and capacity to anticipate, etc.

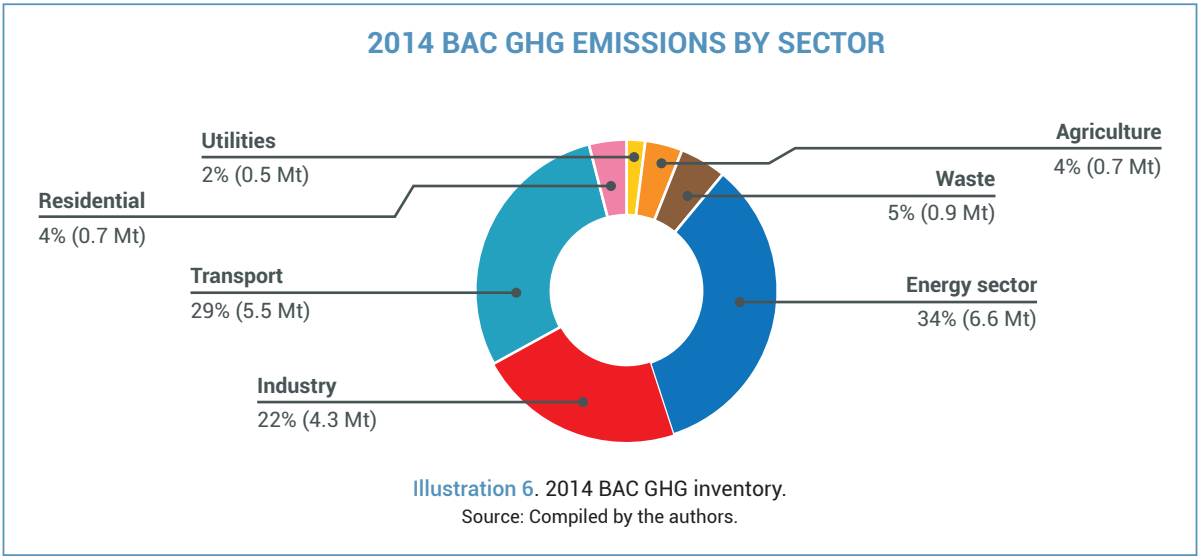


Illustration 6. 2014 BAC GHG inventory.
Source: Compiled by the authors.

2.2. Impact on the physical environment

According to the European Environmental Agency, the key effects of climate change are: an increase in sea level, changes to temperature and precipitation patterns, and an increased frequency of extreme weather events. Supporting these hypotheses, international statistics[13] confirm a progressive increase in natural disasters over the last few decades. In 2014, 980 events classified as a disaster were recorded, which is higher than in 2013 (902) and the average for the last 10 years (839).

The costs resulting from these events show variations, with the presence of strong peaks conditioned by the appearance of major disasters, and present a pattern of growth in the economic impact of losses in the years of greatest impact. According to a study published by AON[14] the losses derived from climate change have increased by 50%, and the progression appears to be one of growth.

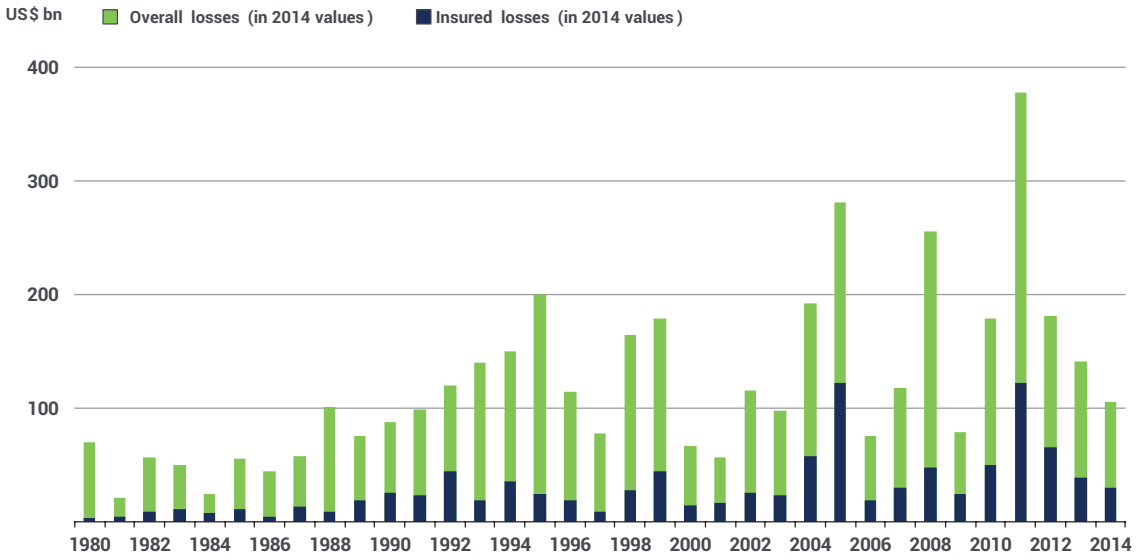


Illustration 7. Losses caused by natural disasters (1980-2014).
Source: Munich Re, Geo Risks Research, NatCatSERVICE. January 2015.

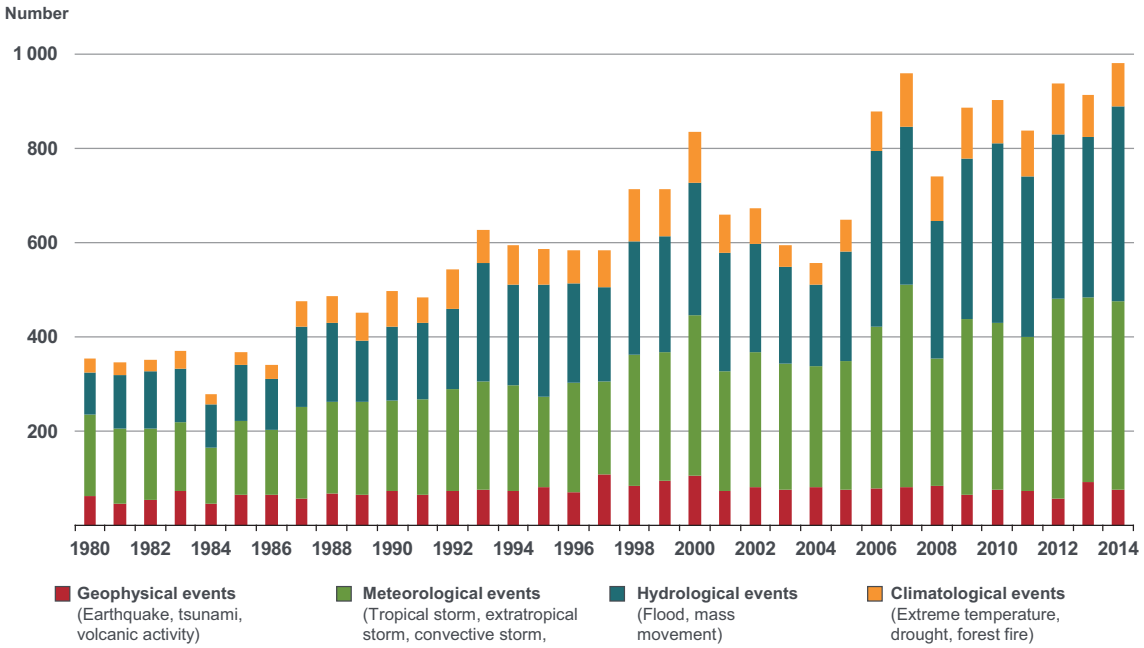


Illustration 8. Number of global disasters 1980-2014.
Source: Munich Re, Geo Risks Research, NatCatSERVICE. January 2015.

Analyses carried out by the European Environmental Agency assign the Basque Country with a medium level of risk for these potential impacts.

The Iberian Peninsula is located in an area of transition between a temperate oceanic climate and a dry subtropical climate, with a great variety of climates. It is necessary to improve the scale of these studies, and use regional climate models in order to propose appropriate adaptation strategies.

The studies on climate change carried out in the BAC predict a 10% increase in intense rainfall by the end of the 21st century, and a possible 'mediterraneanisation' of the climate, with an increase in the number of dry days, and a greater concentration of precipitation into short periods.

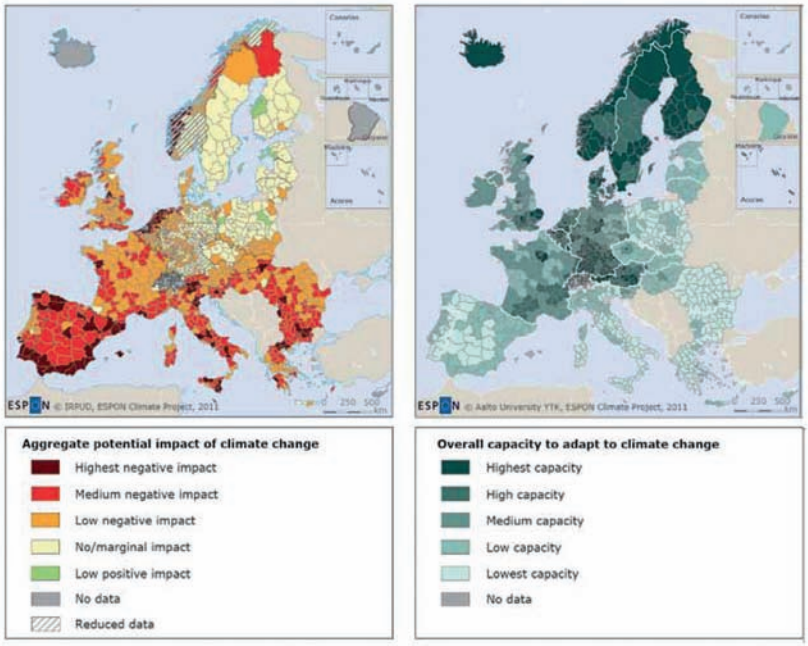


Ilustración 9. Riesgo y capacidad de adaptación al cambio climático.
Fuente: EEA. Climate change, impacts and vulnerability in Europe 2012.

The *2050 Climate Change Strategy of the Basque Country Klima 2050* includes a reflection on the possible impacts of climate change in the Basque Country, together with an analysis of adaptation requirements. The conclusions of this reflection, in relation to the main economic sectors, is summarised below.

2.2.1. Population impact

The expected changes to the climate will have an effect on the population. The three main events derived from climate change that affect the population are: heat island, rising sea levels, and flooding. A preliminary quantification estimates that they will affect more than 30% of the population.

The Basque Country's main municipalities are adopting adaptation policies that consider the impact on the business sector.

		MUNICIPALITY		POPULATION	
		NUMBER	PERCENTAGE	POPULATION	PERCENTAGE
Exact values	Heat islands	40	15.9	1,382,400	63.3
	Rise in sea levels	21	8.4	764,000	35.3
	Floods	137	54.6	1,737,800	80.3
Cumulative impacts	3 impacts	8	3.2	692,416	31.9
	2 impacts	37	14.7	679,903	31.3
	1 impact	101	40.2	450,101	20.7
	0 impacts	105	48.8	350,755	16.3

Source: Compiled by the authors.

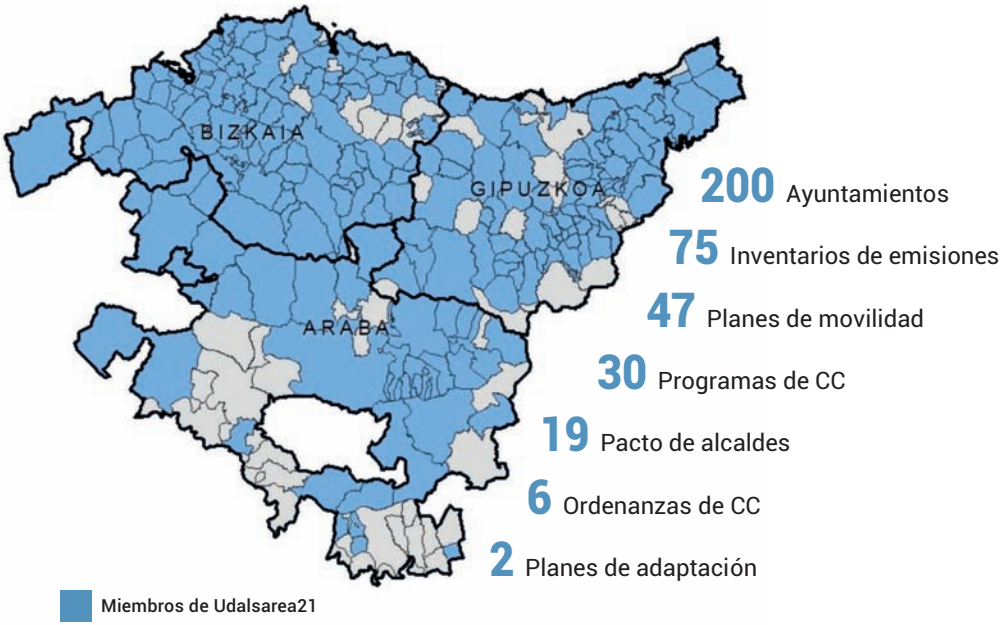


Illustration 10. Effect of the analysed extreme events associated with climate change in the BAC in relation to possible populations and municipalities affected.
Source: Udalsarea. Adaptation to Climate Change in the BAC on a municipal scale.

The measures implemented are currently focused on the institutional commitment (the *Compact of Mayors*) and on the diagnostic and quantification stage (GHG inventories, producing guides for the development of municipal climate change adaptation programmes, and a Basque Country urban planning manual for climate change mitigation and adaptation).

There are already a number of initiatives that are starting to define specific action plans: 30 climate change programmes, mobility plans, Climate Change ordnance model implemented in 6 municipalities, and 2 municipal adaptation plans.

2.2.2. Industry and energy

URA, the Basque Water Agency, has analysed the risk of flooding in its area of influence (internal basins). The areas of risk include numerous industrial spaces that, especially in the Cantabrian watershed, occupy zones close to natural channels in industrial municipalities such as Irún, Eibar, Elgoibar, Soraluce, Bergara, Oñati, Arrasate, Eskoriatza, Bilbao, etc.

Vulnerability is especially centred on possible damage due to extreme events, flooding in industrial areas, and electricity consumption spikes during heat waves.

An increase to minimum and maximum temperatures is expected that, together with a drop in precipitation, will cause problems for power plant and industrial machinery cooling, while at the same time reducing their efficiency. The reduction in precipitation will effect hydroelectricity production. The forecast increase in extreme events will impact on exposed infrastructure, causing damage to distribution and transportation networks.

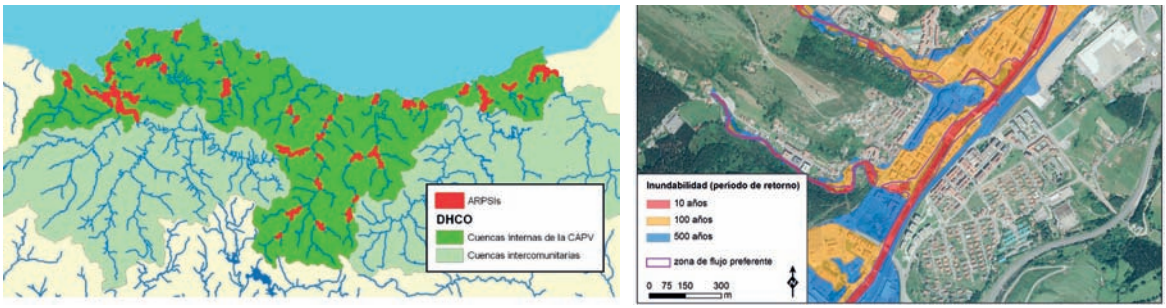


Illustration 11. URA: Flood risk analysis in internal watersheds. 100 year example return period, Llodio.
Source: Compiled by the authors.

2.2.3. Transportation infrastructure

The main vulnerability of Basque Country transportation infrastructure is associated with extreme precipitation, which can cause flooding and landslides. Logically, the principle impacts are expected on elevated roadways near water courses, as well as stretches located in areas of increased hydrogeological instability, including networks near estuaries and the coast.

Source: Noticias de Gipuzkoa. February 2016.

It is expected that linear infrastructure will suffer greater fatigue of materials and auxiliary equipment over-heating due to increases in temperature and the concentration of CO_2, producing damage and a loss of their functionality.

The need for structural intervention in certain stretches of the network as a result of a change in climatic conditions will not pose insurmountable technical, budgetary, or competency challenges. On the other hand, it does suppose the more significant challenge of adequately analysing, interpreting, and planning for the impacts and implications that the interventions to mitigate climate change may have on the network; as well as the analysis of a possible change in the model of mobility, with the increased use of public transport, and other sustainable forms of mobility (bicycle and walking).

The various mitigation measures will mean opportunities related to the construction sector and, above all, linked to the development of new technical systems that anticipate the reduction or elimination of negative impacts.

2.2.4. Natural resources and the food sector

The main direct impacts of climate change on land ecosystems are produced through two effects: an increase in surface temperature that would vary between 1-4 ºC, and an increase in precipitation in the winter and decrease in precipitation in the summer, which translates into an annual reduction of between 15-20%, with extreme precipitation increasing by 10%.

	E	F	M	A	M	J	J	A	S	O	N	D	med
2000	-1,6	1,5	-0,1	0,8	1,7	1,5	-0,2	0,2	0,8	-0,5	-0,8	1,5	0,6
2001	1,2	0,2	3,6	0,1	0,6	1,0	-0,4	1,5	-1,3	2,7	-1,9	-3,2	0,5
2002	1,9	1,5	1,7	0,6	-0,3	0,4	-1,3	-1,3	-0,3	1,0	1,7	2,5	0,9
2003	0,1	-1,1	2,8	2,3	0,8	4,3	1,3	4,0	1,2	-0,7	1,3	0,4	1,6
2004	1,6	-1,2	-1,4	-0,1	-0,1	2,7	0,0	1,1	1,2	1,8	-0,9	0,1	0,6
2005	-0,6	-3,3	0,5	1,4	1,9	3,3	1,1	-0,1	0,0	2,0	-0,8	-2,5	0,4
2006	-0,9	-1,9	2,1	1,5	1,8	2,5	3,3	-0,9	2,0	3,4	3,1	-1,1	1,4
2007	0,8	2,3	-0,4	2,5	0,8	1,2	0,0	-0,6	-0,8	-0,3	-1,4	-1,0	0,5
2008	1,8	2,2	0,1	1,3	1,2	0,5	-0,3	0,1	-0,6	-0,9	-0,8	-1,0	0,5
2009	-0,2	-0,6	0,1	0,4	1,4	2,2	1,3	1,3	0,4	1,3	2,1	-0,4	1,0
2010	-0,8	-1,0	0,1	2,3	-0,6	0,2	1,0	0,3	-0,1	-0,4	-0,5	-1,7	0,1
2011	0,4	0,8	1,0	4,3	2,4	0,9	-1,0	1,2	2,2	1,3	3,0	1,0	1,7
2012	0,7	-3,0	1,3	-0,2	1,9	2,1	-0,4	1,8	0,1	0,0	0,1	0,5	0,6
2013	0,7	-1,3	0,2	0,5	-2,6	-1,0	2,5	0,2	0,6	2,1	-0,3	-0,4	0,3
2014	2,2	0,5	0,8	2,9	-0,1	1,9	0,1	-0,3	2,0	3,0	2,3	-0,1	1,5
med	0,5	-0,3	0,8	1,3	0,8	1,6	0,5	0,6	0,4	1,1	0,4	-0,4	0,8

ºC -5 -4 -3 -2 -1 0 1 2 3 4 5

Illustration 12. Deviation (with respect to the 71-00 period) in BAC average monthly temperature.
Source: Euskalmet.

The conditions are different in the territory's two watersheds. The Atlantic watershed, with average annual rainfall of 1,323 mm, is characterised by steep slopes (62% of its surface area has gradients of more than 30%), so its problem is mainly associated with the events relating to intense precipitation: landslides, erosion, and flooding.

In the Mediterranean watershed, on the other hand, with 874 mm of precipitation annually and gentler slopes (26% of its surface area has gradients of more than 30%), the impact of climate change mainly manifests itself in the form of droughts and water deficits, which will be the main effects to which this watershed's ecosystems will be subjected.

The Atlantic watershed will suffer impacts in the mountainous areas, above all those higher than 900 m, due to increased temperatures (especially beech forests and mountainous areas). The two watersheds will face an increased danger of uncontrolled fires. In addition, pollination will be affected throughout the territory, and changes are expected in the interaction between species.

The increased concentration of CO_2, the increase in temperatures, and the changes in precipitation systems will have significant effects. In the agricultural sector, they will cause an increase in certain types of crops (winter wheat and grapevine). With regard to forest mass, thermal stress on crops and planted forests will increase, infestations and diseases will increase, and new invasive species will appear. These climate conditions will force crops and plantations to be moved latitudinally. Fires will reduce carbon reserves in the soil. All of this translates into damages and losses in productivity for crops and plantations.

Temperature variations will have an impact on agro-food chain management, increasing the need for refrigeration during various stages of the transformation, transportation, and distribution processes.

Climate change will also bring opportunities, due to the possibility of changing crops, and access to new niche markets. The increase in winter temperatures, together with the increase in CO_2 concentration will increase growth in some crops.

On the coast, expected impacts are those deriving from the rising average sea level, variations in the extreme marine climate (waves and meteorological tides), the warming of the sea, and a change in the precipitation system, with the consequent effect of the current width of beaches receding by 34-100% due to rising sea levels.

In the fishery sector, it is expected that the warming, acidification, and stratification of the water will have important consequences for ecosystems and marine resources, although there are still large knowledge gaps with regard to concrete possible impacts on the primary productivity of the sea. Changes will occur in marine biodiversity and population dynamics, with individual size decreases, trophic decoupling, and the expansion of certain toxic algae and invasive species, as well as population displacement. The characteristics of the environment itself impose a limitation on the capacity to act on the ecosystems, even if it may be possible to promote the adaptation of the economic sectors affected (the fishing fleet) and control certain man-made impacts (pollution) which erode the resilience of marine ecosystems.

In terms of livestock, precipitation and temperature variations will affect reproduction, metabolism, the salubrity of productive processes, the availability of forage resources, and animal stress.

2.2.5. Tourism resources

It is estimated that tourism causes between 3.9% and 6.0% of global CO_2 emissions, mainly due to transport (which represents 75% of the sector's total emissions).

The vulnerability of tourism in the Basque Country to climate change is already a noticeable reality. For now, the effect is positive in the sense that summers are warmer and drier, and a greater number of tourists have been attracted. However, it is clear that very negative effects may be produced in the future, associated with droughts, increasing sea levels, etc. To date, detailed studies on these risks in the Basque Country have not been carried out, and obviously no progress has been made in terms of adaptation plans.

The Basque Water Agency (URA) and Ministry of the Environment (MAGRAMA) studies identify various tourist towns as zones that are at risk of flooding; these including Irún, Hondarribia, Plentzia, Bakio, Bilbao, Getxo, Ea, Mundaka, Zarautz, Orio, Zumaia, and Donostia-San Sebastian.

In collaboration with the Basque Government, the sector is implementing a series of initiatives related to environmental sustainability, with various actions related to eco-labelling, quality, innovation, and sustainability, including energy efficiency in accommodation.

2.2.6. Level of risk and opportunities

The impact on the physical environment presents general risks (structural) to a large share of Basque industry and Public Administrations (PAs), with opportunities mostly focused on certain economic activities (analysis services and monitoring, construction and technological development related to adaptation).

These changes to meteorological variables, together with socio-economic trends, will alter energy demand patterns and consumption behaviour. Due to these changes, the price of energy will be affected.

There are adaptation options, but many of them are costly and provide little operational flexibility, meaning greater difficulty for small business to access large investments. Both the physical location and the type of activity of companies will lead to an unbalanced distribution of damages and unfairness. Nevertheless, benefits associated with the generation of activity, innovation, and employment in activities relating to monitoring and adaptation are also expected.

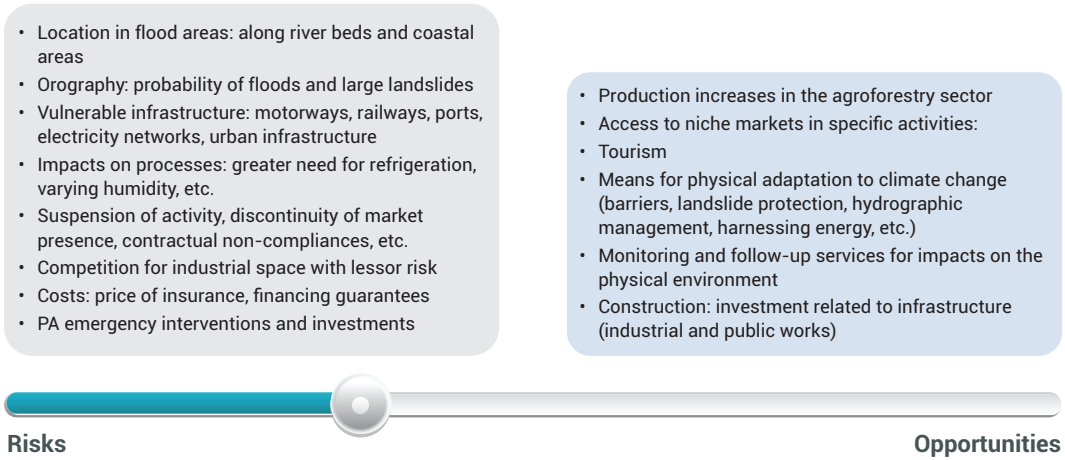


Illustration 13. Risks and opportunities associated with impacts on the physical environment.
Source: Compiled by the authors.

2.3. Impact derived from mitigation policies

The implementation of Climate Change regulations and mitigation measures have an effect on company competitiveness, and are an incentive to leverage investments in areas such as energy, efficiency, and transport, with positive long-term effects.

As previously mentioned, the main measure expected to drive the transition towards a low carbon economy consists of the internalisation of the social cost of GHG emissions by assigning a price to this. Measures implemented by companies to reduce emissions reduce these costs and allow the trading of excess emissions rights that are not consumed.

The European market (EU ETS – *Emission Trading System*) is the world's main carbon rights market. Operating since 2005, this system affects the energy sector, aviation, and certain industrial facilities with processes that produce high emissions (steel, aluminium, cement, paper, oil refining, and glass, among others), and power plant facilities with more than 35 MW power.

The EU ETS coexists alongside additional carbon taxes and rates in various European regions (in Denmark, Finland, France, Iceland, Norway, Sweden, and the UK), and another series of standards and strategies geared towards reducing emissions that is driven by the European Commission (in terms of energy union, carbon capture and storage, renewable energy, efficiency and energy certification for buildings, eco-design and labelling, etc.), and by some countries (such as measures proposed by the *Grenelle Environment* commission in France, which includes measures for building, urban planning, transport, energy, biodiversity, agriculture, etc.[15]).

The European system stipulates the protection of energy intensive industries (EII) in order to avoid *carbon leakage*. Industries are considered to be exposed to carbon leakage if: (1) the direct and indirect cost of carbon is at least 5% of the sector's GVA and the intensity of trade with third countries is greater than 10%; or (2) carbon costs are greater than 30%; or (3) trade is greater than 30%.

These sectors will receive 100% of their allocation (for direct emissions) free of charge until 2020. In addition, the European Union lets States establish direct aid to compensate for the indirect cost of carbon associated with their electricity consumption: Germany, the UK, Holland, Spain, and Flanders have decided to facilitate this type of aid[16].

2.3.1. Companies subject to the carbon rights system

Energy intensive industrial sectors (which are those subject to the carbon rights system) provide the Basque economy with 7.1% of its GDP and 3.7% of its employment. They constitute a substantial part of the economy, comparatively higher than for the State overall (2% of GDP and 0.7% of employment[17]), reflecting the Basque Country's industrial vocation.

The current carbon rights directive affects 55 industrial facilities in the Basque Country, with a total of 6.5 million tonnes of CO_2 emissions in 2013; making up 34% of the BAC's greenhouse gas emissions. These emissions have been reduced by approximately 40% since 2005 due to a combination of investment, and also in large part to a reduction in the volume of activity during the period of economic crisis.

LIME	CEMENT	COGENERATION	COKING	METALLURGY	PAPER
Calcinor	Cementos Lemona (Grupo CRH) FIM (Italcementi)	Bunge REPSOL (General Química) ESNELAT INAMA Moyresa	Productos de Fundición (PROFUSA)	Alcoa ArcelorMittal (Bergara) BEFESA (Grupo Triton) CELSA (Arregui) Gerdau (Azcoitia, Vitoria)	Kartogroup (Celulosas de Hernani) CEMOSA CEL Technologies & Systems Munksjö ONDULINE Papel Aralar Papelera del Oria Iberpapel PAPRESA LECTA Smurfit Kappa Zubialde

	POWER GENERATION	OIL REFINING	IRON AND STEEL	GLASS AND ENAMELS	OTHER GENERATION FACILITIES
	BP (Bahia Bizkaia Electricidad) ESB (Bizkaia Energía) Iberdrola (Hidroeléctrica Ibérica)	REPSOL (PETRONOR)	ArcelorMittal CAF CELSA (Nervacero) Gallardo (Azpeitia) Gerdau Olarra TUBACEX Tubos Reunidos	VIDRALA Guardian PEMCO Esmaltes VICRILA	ArcelorMittal Bahía de Bizkaia Gas Bridgestone CERM Enagas Mercedes Benz Michelin Unilever

Table 2. Basque companies subject to the emissions rights regime in 2013
Source: Compiled by the authors.

Almost all of these facilities are formally in the carbon leakage system, so the allocation of emissions rights is temporarily free of charge. The majority belong to large companies: 23% of companies affected are traded on the Spanish stock exchange, and 45% are part of multinational groups.

As mentioned, the total emissions volume of this group of companies reached some 6.5 million tonnes of CO_2 in 2013. They make up approximately 70-80% of all industrial and energy emissions (including refinery, thermal plants, cogeneration, and coking facilities).

The behaviour of the Basque Country industrial emissions curve is, in large part, determined by the variations in facilities subject to the ETS.

There is considerable concentration, with 12% of installations producing 65% of all emissions.

For the 2005-2008 period, for which detailed data is available, the installations analysed would exceed the theoretically reachable emissions , following the best available improvements established by the benchmark (BAT), by 13-15%. For the time being, this situation is not hindering competitiveness given that the target assigned for the following period exceeded real emissions by 9.5-17.6% due to EU ETS rights allocation procedures and the drop in production associated with the economic crisis.

Approximately 40% of these installations present an emissions level that is in line with the target set by the European Union in its *benchmark*, which theoretically corresponds to the emissions recorded by the most efficient 10% of European installations in each process, and serves as a baseline for rights assignment calculations. The average efficiency of these installations in relation to their theoretical *benchmark* is 87.7%.

Steelworks have an average efficiency of 94.2%, and cement plants have an average efficiency of 91.9%. Among paper mill facilities, some are very efficient, with averages of around 200%, probably due to the use of biomass; but there are also some facilities that are very deficient, with efficiency indexes of less than 50%.

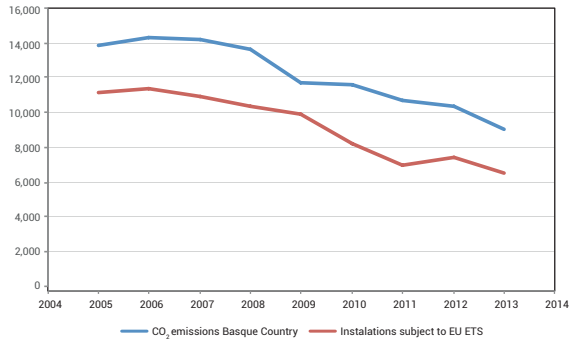


Illustration 14. Industrial emissions in the BAC.
Source: Ihobe. Emissions record.

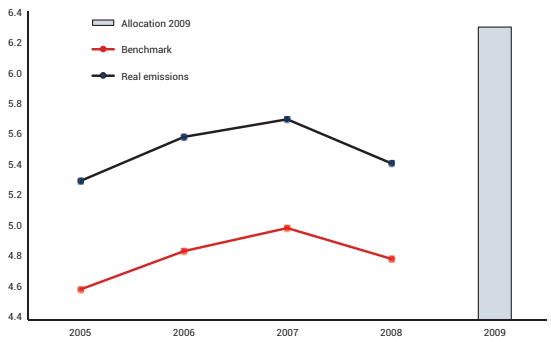


Illustration 15. Real emissions, *benchmarks* and allocations.
Source: Ihobe. Emissions record.

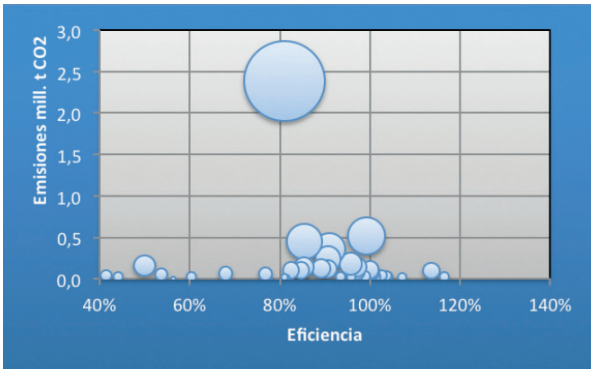


Illustration 16. BAC facility average annual emissions and efficiency.
Source: Ihobe. Emissions record.

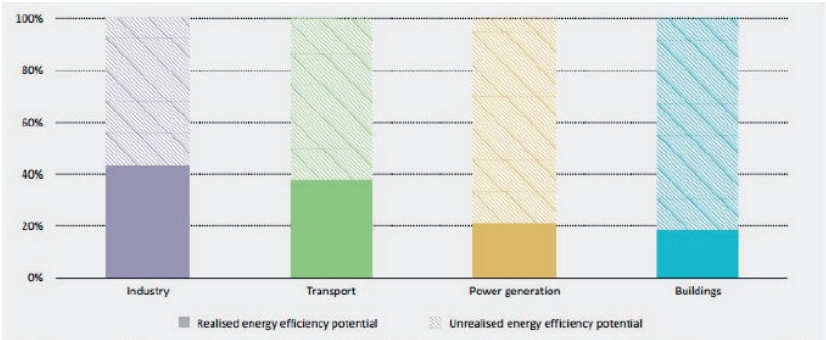


Illustration 17. Long-term economic efficiency potential.
Source: IEA.

Among the facilities with significant volumes and efficiencies far from the target set by the BAT are co-generation facilities (with an average of 56.5%) and oil refineries.

On the whole, we can confirm that Basque companies subject to the carbon rights system are moving towards international best practices in efficiency, although this benchmark is not regarded as a ceiling for sectoral efficiency objectives.

A report published by the IEA[18] reveals the potential efficiency that still exists in different business sectors, even if realising this potential requires important changes to the current political and regulatory scenario.

In general, the large companies interviewed within the framework of this project have shown concern for the potential impact that the future internalisation of carbon costs will have on their competitiveness. All of them continuously monitor the development of the regulations, generally through the corresponding European sectoral associations. The pressure that the European Union exerts is progressively higher, and the targets indicated for the future require substantial additional effort.

Some of the companies apply a carbon price internally in their investment project evaluations. There is a general perception that the main investments in energy efficiency have already been made, and that effectively reaching new targets depends mainly, and in the short-term, on the organisational and managerial capacity necessary to be able to schedule production with appropriate rhythms and without abrupt changes, in order to optimise the parameters depending on management.

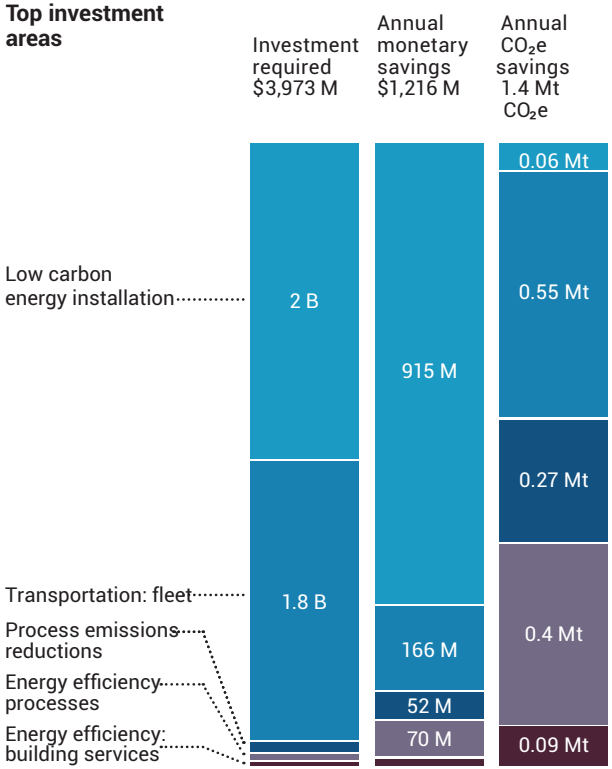


Illustration 18. Investment related to climate change and results expected by leading CDP certified companies in industrial sectors.
Source: CDP Climate performance leadership index 2014.

In the medium- and short-term, a potential for certain improvement is generally recognised, which is confirmed by the international companies most active in implementing climate change adaptation measures[19], always conditioned by important organisational and investment efforts, which occasionally transcend individual company capacity. As an example:

- Companies from the steel sector point out that the *benchmark* is calculated for installations whose commercial orientation allows them to work using a *make-to-stock* approach, and therefore schedule

hot loads, saving part of the energy intake of the rolling mill furnaces. This course of action is essential to many market segments.

- However, in the medium- and long-term, it is clear that the overall efficiency of steel making processes can be improved, given the quantity of effluents and products that the process emits at very high temperatures. If the expectation for the development of carbon prices justifies significant R&D efforts oriented in this sense, results must be obtained.
- In the cement sector, emissions produced by the process's reactions are difficult to reduce, unless the market evolves and clients begin to accept cement of a lower quality. The greatest potential is to substitute fossil fuels for biomass from waste such as tyres. As the effective inspection of the management of this kind of waste improves, an opportunity may arise to significantly improve emissions in this sector.

The experience of the leading companies in terms of investment (CDP industrial leaders) shows attractive economic return on investment rates for businesses, regardless of the positive impact on reducing emissions that they favour.

Locally, energy intensive companies generally show concern about the development of electrical energy costs in Spain, which is a determining factor for competitiveness, and is closely linked to the low carbon economy. Many of them express a strong perception of comparative disadvantage when compared to other European countries, due to:

- The reduced budgetary efforts of the Spanish State, when compared with surrounding countries, to finance aid that compensates for the cost of indirect emissions for companies subject to carbon leakage.
- The uncertainty associated with forecasting electrical energy costs, especially since the implementation of interruptibility auctions of which there is still little experience.
- The access to new users that compete for the interruptibility allocation, by auctioning blocks of 90 and 5 MW. This group of companies would see their position improved if there was an auction associated with blocks of 20 or 30 MW.

INDICATIVE COST		% COST INCREASE	
PRODUCT	(€/t)	CARBON RIGHTS	ELECTRICITY COST INCREASE
		20 €/t	10 €/MWh
Rolled steel	575	0.6%	1.2%
Clinker	100	16.6%	1.5%

Illustration 19. Example of the impact of energy costs and carbon rights on industrial competitiveness.
Source: Orkestra Institute Energy Chair.

The impact of carbon and energy costs on the competitiveness of these companies is relevant. For illustrative purposes, estimates of the impact on costs are included, which were calculated from production, emissions, and electrical energy consumption statements.

The Orkestra Institute Energy Chair is carrying out an extensive research project on energy prices and industrial competitiveness that is focused on the realities of large consumers in the Basque Country.

2.3.2. Emissions from diffuse sectors

In the so-called Effort Sharing Decision, EU member states have set reduction targets for the sectors responsible for diffuse emissions (those not covered by the EU ETS). Together with the renewable energy target, this decision aims for a 20% reduction in all greenhouse gas emissions by 2020 when compared with 1990, or a reduction in emissions of 14% compared with 2005, which amounts to the same thing. The Commission intends to establish different reduction targets for sectors that are and that are not regulated by the EU ETS, taking into account the greater potential of the former (see illustration 14). In this way, regulated sectors will be required to reduce their emissions by 21%, while sectors responsible for diffuse pollution should reduce their emissions by 10%[20].

In contrast to sectors covered by the EU ETS, it is the responsibility of the member states to define and implement measures to limit emissions in diffuse sectors, such as those relating to mobility and transport, adaptation of buildings, application of renewable energy, improving farming and agro-pastoral practices, reusing organic waste for the production of biogas, etc.

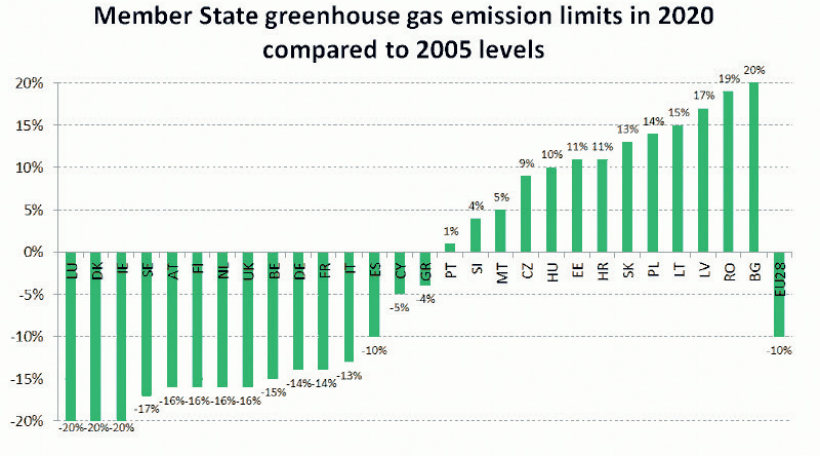


Illustration 20. EU approved diffuse GHG emission limits.
Source: EU.

The European Commission has also put a series of measures into practice that affect these areas, such as new CO_2 emissions standards for vehicles, energy efficiency in buildings, industrial fluorinated gas restrictions, eco-design and labelling requirements.

The *2050 Climate Change Strategy of the Basque Country Klima 2050* specifies a series of targets and lines of action directed towards these goals. Among those that stand out due to having a more direct impact on company competitiveness are the following:

- Improvements in energy efficiency.
- Encouraging renewable energy.
- Energy efficiency and renewable energy in urban environments, moving towards "zero emissions" buildings.
- Strengthening intermodality and modes of transport with reduced GHG emissions.
- Replacing oil product consumption.
- Integrating vulnerability and adaptation criteria in transportation infrastructure.
- Increasing collection and selective separation ratios, as well as later reuse, recycling, and recovery.
- Zero-emissions public administration.

In the industrial field, it is estimated that emissions produced by sectors not subject to the carbon rights system make up only 20-30% of all emissions produced by Basque industry.

The development of emissions by these activities appears to show worse behaviour than that of activities subject to the system[21]. For now, no direct emissions control is planned for these industrial facilities. Therefore, in principle, the impacts most relevant to the competitiveness of these companies will not come from administrative restrictions as much as from the purchasing decisions of businesses, institutions, and consumers, in line with their own criteria and sustainability demands.

In general, this involves medium and small businesses that work in a sub-contracting system, which are generally related to the dispersed and not easily analysed (but important) metal-mechanical industry[22]. In the manufacturing sector, 87% of companies employ at least 20 workers. According to Eustat, the *metal products manufacturing* sub-sector (excluding steel making and machinery and equipment manufacturing) included 3,478 companies in 2014 with 39,893 workers (22.7% of Basque industrial employment).

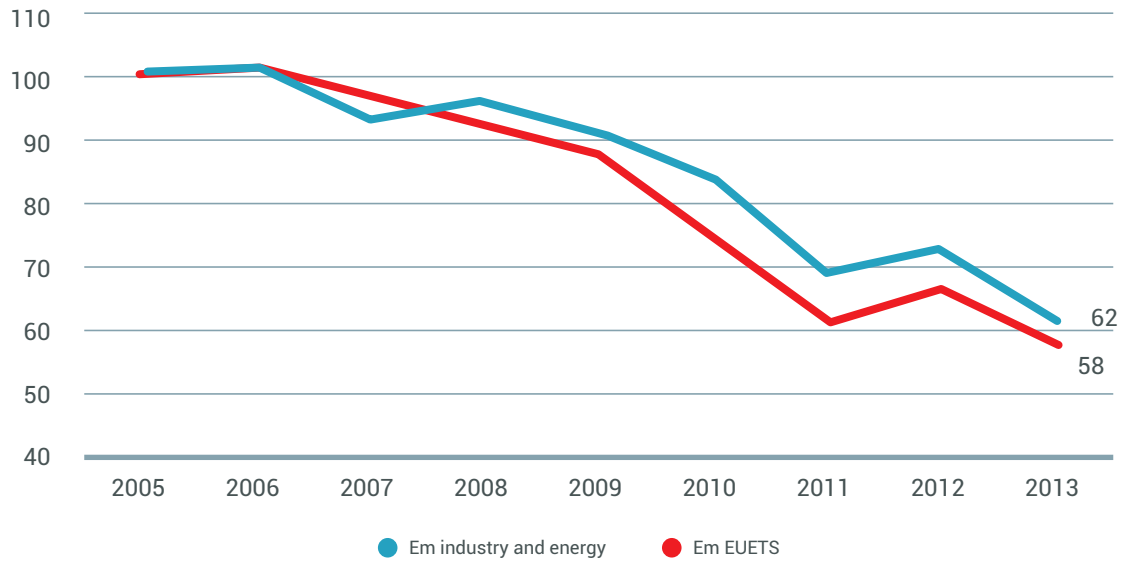


Illustration 21. Evolution of indexed industrial and energy sector emissions vs ETS.
Source: BAC GHG inventory.

In any case, Basque Government Agencies have abundant information on CO_2 emissions produced by these types of diffuse industrial facilities through their energy consumption. According to Ihobe Public Company data included in its Environmental Indicator Data Bank (between 2008 and 2013), the most energy intensive industrial sub-sectors are reflected in illustration 22.

It would seem advisable, as demands related to the carbon footprint develop, to create a programme that allows for the situation to be assessed and emphasis given to the opportunities of these companies, which make up a substantial part of the Basque Country's industry, while at the same time allowing for efficiency improvement measures to be implemented.

The illustrations included show a number of ratios between emissions and electrical energy consumption in illustrative sub-sectors, as well as the origin of their carbon emissions.

2.3.3. Level of risk and opportunities

Given the relevance of the most directly affected industrial activities, the Basque Country has equipped itself with a combination of active policies capable of strengthening the low carbon economy, allowing a proactive strategy to be adopted that strengthens opportunities.

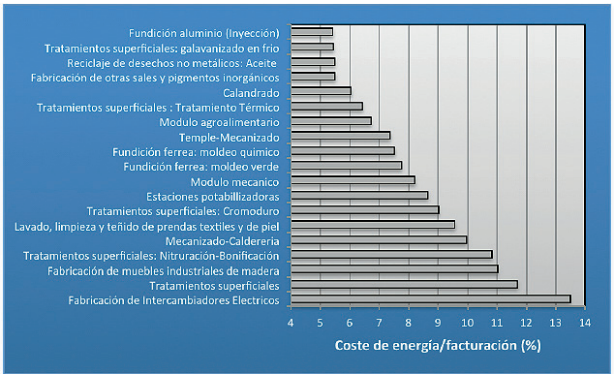


Illustration 22. Diffuse sectors with greater energy consumption impact.
Source: Ihobe. Environmental indicator data bank.

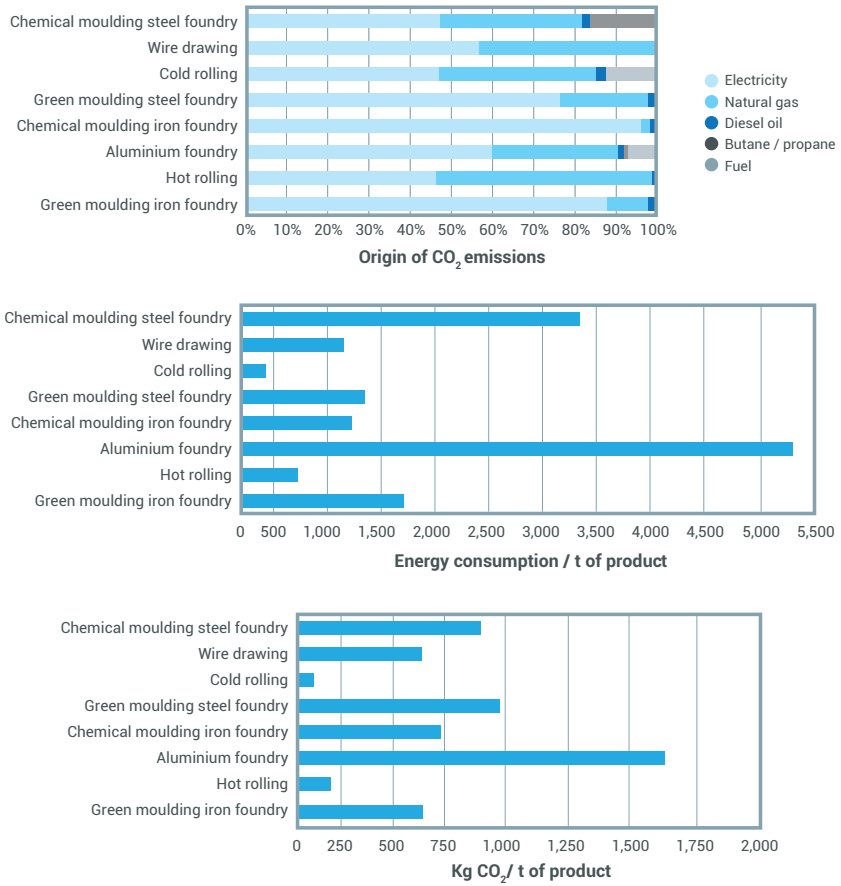


Illustration 23. Consumption and emissions in the metallurgy sector.
Source: Ihobe. Environmental indicator data bank.

The commitment of the *2050 Basque Climate Change Strategy (Klima 2050)*, combined with the *2020 Basque Country Energy Strategy*, and specific sectoral strategies such as the *EnergiBasque Strategy, Advanced Manufacturing Strategy, the Smart Specialisation Strategy* (RIS3) and the *Science and Technology Plan* already lay out specific lines of action that include aspects such as efficiency, renewable energy, and sustainability, and provide instruments for their promotion in the Basque industrial sectors.

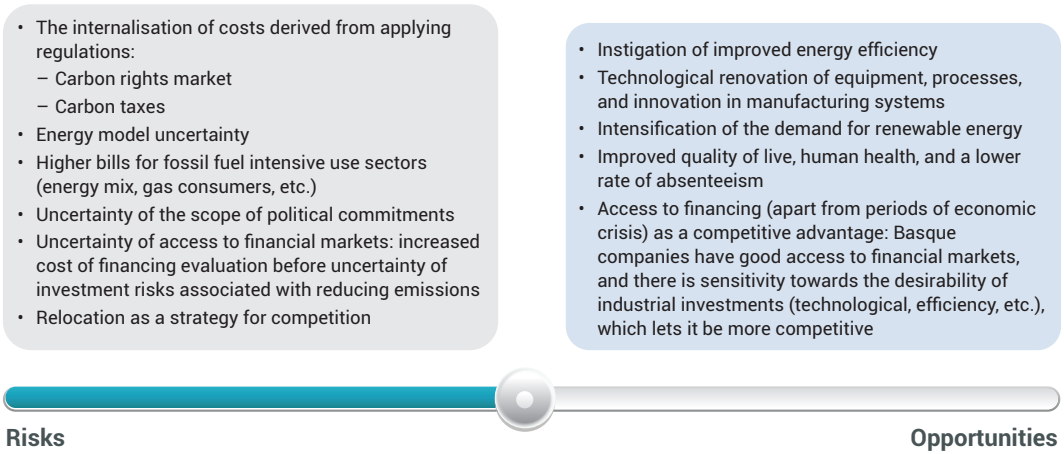


Illustration 24. Risks and opportunities associated with impacts derived from mitigation policies.
Source: Compiled by the authors.

2.4. Impact derived from the market

Perhaps one of the impacts that is most relevant, and most difficult to measure, is that derived from the market. This involves changes in demand (purchasing behaviour) related to climate change or the comprehensive transformation of certain segments of the market caused by the low carbon economy.

Concerns over sustainable energy and reducing carbon footprints are rooted in the business models of the most competitive Basque companies. Driving eco-design since 2001, the Basque Ecodesign Center's experience shows that both leading companies in direct contact with highly demanding global clients, as well as the companies that make up their supply chain, are very aware of the connection between the sustainability of their products and processes and their commercial and strategic potential.

It seems evident that the effort emitting activities and industries will make to adjust to the low carbon economy should produce business opportunities for entities capable of offering the technologies and products necessary for this adjustment.

In particular, an important demand is forecast regarding areas such as renewable energy, energy efficiency in the industrial sector (industrial process control, capital equipment, engineering services) and energy sector (generation, grids, auxiliary electric equipment), mobility and transport (automotive, naval, railway, aeronautical), and construction.

	VOLUME OF CLIMATE CHANGE ACTIVITY	COMPETITIVENESS	SUPPLY CHAIN SIZE IN THE BASQUE COUNTRY
Renewable energy	Very high	High	Medium-large
Automotive industry	High	High	Large
Marine	High	High	Medium-low
Railway	High	Medium-high	Medium-low
Aeronautical	Medium-high	Medium	Medium
Construction materials	High	Medium	Medium-low
Auxiliary electrical equipment	High	Medium	Medium-low
Energy process capital equipment	Medium-high	Medium	Medium-low
Industrial process control	High	Medium	Medium-low
Engineering services	Medium	Medium	Medium
Indoor	Very high	Medium	Medium

Table 3. Main areas of activity with business opportunities associated with climate change
Source: Compiled by the authors.

These activities are directly or indirectly present in the fields of action of many Basque industry supply chains and clusters.

- The renewable energy sector, which is highly present in the Autonomous Community, clearly has an important role in climate change. The International Energy Agency estimates that 50% of 2014's newly installed generation capacity came from renewable sources. The reduction in cost, particularly of photovoltaic energy, and the electricity network's improved intelligence and capacity to meet distributed generation needs will produce an important volume of demand for a wide group of Basque companies associated with this business.

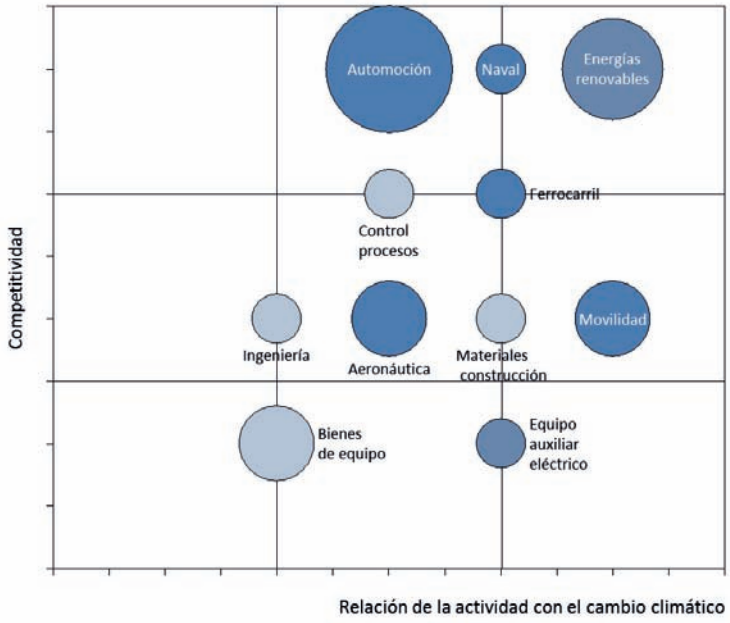


Illustration 25. Evaluation of opportunities vis-à-vis climate change.

- Mobility and transportation activities currently produce an important volume of emissions. The new vehicle emissions standards, the reductions demanded of sea and air transport, the need to improve mobility in urban environments, the growing demand for sustainability in freight transport, etc., place substantial pressure on improving the products of many of the most internationally known Basque companies, also involving a developed supply chain.
- Improved efficiency of electricity networks and industrial processes will be achieved thanks to control systems and equipment suppliers. It is expected that a substantial part of the improved efficiency will come from improvements to organisation and management, supported by better instrumentation and controls.
- Improvements to the energy efficiency of buildings should affect a large value chain, which in the Basque Country is related to very diverse sectors such as glass, cement, steel, home automation, engineering, design, appliances, etc.

The *BAC 2020 Science, Technology, and Innovation Plan* also highlights Basque industry's current level of specialisation in a series of sectors related to the technologies necessary to address climate change, such as machinery, electrical equipment, transport materials, energy, and telecommunications, as shown in Table 4.

	GVA specialisation index (EU 27 = 100)	Relative trade balance index		GVA specialisation index (EU 27 = 100)	Relative trade balance index
TOTAL	100	11	MARKET SERVICES	95	58
AGRICULTURE AND FISHERIES	43	-76	Commerce; vehicle repair	91	75
INDUSTRY	125	8	Transport and storage	104	71
Extractive industries	13	-99	Hospitality	148	-100
Food, drink, and tobacco industry	75	-4	Publishing, image, radio, and television	51	36
Textile, dressmaking, leather goods, and footwear	32	-39	**Telecommunications**	**123**	-100
Wood, paper, and graphic arts	129	19	Information technology	55	21
Coke and refined petroleum product manufacturing	85	40	Insurance and financial activities	110	63
Chemical Industry	60	-40	Consulting and technical activities	95	-100
Pharmaceutical products	14	-56	**Research and development**	**162**	53
Rubber, plastics and other non-metals	184	67	Other professional activities	77	85
Metallurgy and metal products	303	32	Auxiliary services	67	-66
Electronics and computer production	63	-33	Cultural and recreational activities	94	-100
Electrical equipment and material	**156**	22	Other services	56	0
Machinery and equipment	**133**	41	Household activities	196	0
Transportation materials	**122**	60	NON-MARKET SERVICES	89	36
Furniture and other manufacturing	74	-21	Real estate activities	94	-100
Steam, gas and electrical energy	**152**	-3	Public administration and defence	79	53
Sanitation and water supply	66	-59	Education	93	85
CONSTRUCTION	**131**	0	Health activities	104	-66
			Social services activities	46	-100

Table 4. Productive specialisation indexes and trade balances relating to the Basque Country in 2011
Source: Orkestra Institute, based on Eustat and Eurostat.

In addition, Basque industry's importance in terms of exports should be highlighted. As detailed in the Basque Government's strategic plans[23], Basque Country exports by sector are concentrated in traditional sectors such as equipment, semi-manufactured and automotive goods, which make up nearly 80% of all exports.

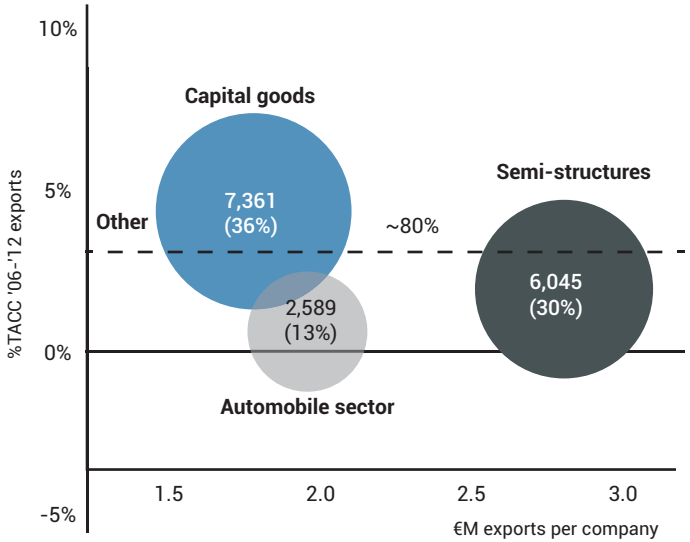


Illustration 26. Evaluation of 2006-2012 Basque Country exports by economic sector.
Source: 2014-2016 Business Internationalisation Plan. Basque Government.

In a global setting, these sectors face the challenge of increasing their added value (more innovation, more design, new services and solutions, new business models, etc.) in order to compete with low cost offerings, starting from the reality that our exports have a "medium" level of technology.

By geographical destination, the EU15 represent approximately 60% of exports, with France (17%) and Germany (14%) being the main absolute markets. Although the world's developing regions have grown in importance for Basque exports in recent years (with a 10% annual growth in BRIC exports between 2006 and 2012), Basque international activity continues to be highly concentrated in Europe. The Business Internationalisation Plan points out the need to continue focusing on diversifying exports, especially when taking into account the West's moderate expected growth in coming years.

These target markets for Basque company activity have more stringent requirements in terms of climate change. The current main target markets have their own comprehensive regulatory framework that combines emissions reduction measures, energy policy, and sectoral standards (e.g. building, transport, energy and industry) that, in general terms, exceed the basic requirements established by the EU. We

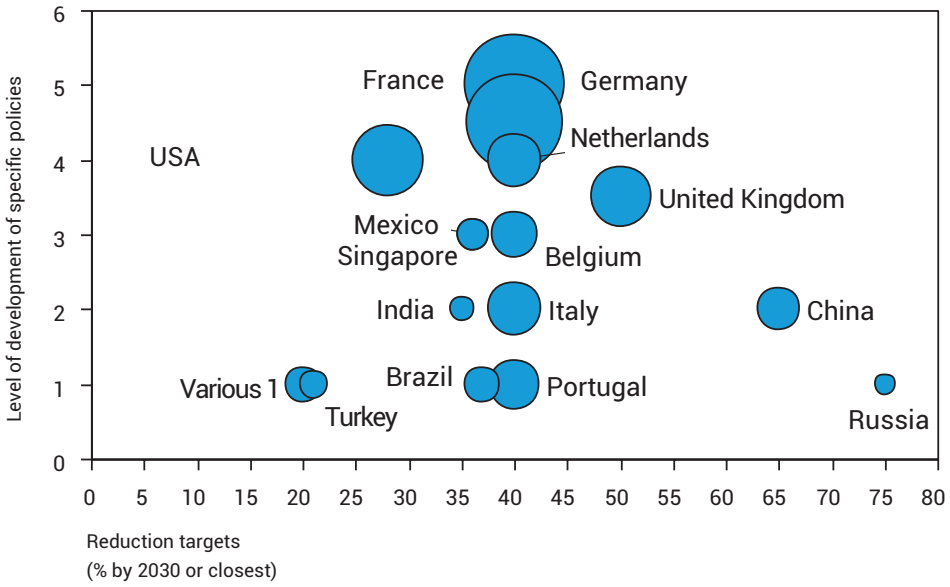


Illustration 27. Development of policies in the main target markets of Basque exports.
Source: World Resources Institute and compiled by the authors.

can use the planned level of investment for implementing the previously identified measures to estimate the opportunity and level of political commitment to the targets. As an example, India has produced preliminary estimates that suggest the need for an investment of at least USD 2.5 trillion to implement all of their climate change plans until 2030[24].

The effect that these more advanced regulations will introduce into the client sectors of Basque companies imply substantial changes in demand and new requirements and opportunities.

The combination of the effect of incorporating new political objectives, the development of regulations and the greater level of awareness (mainly with large global clients) multiplies the effect of the exposure of industrial activities to climate change.

Country	BC exports (2014 (p), thousands of €)	Carbon rights regulation type	Reduction targets	Specific policies	Specific policies directed towards the private sector and private initiatives
France	3,444,624	ETS	40% with respect to 1990 to 2030 60% for 2040	60% for 2040 Carbon Tax (2014 -) Reduce the nuclear share to 50% by 2025 Increase the share of renewable energy to 32% of final consumption, 40% of electricity, and 38% of heat consumption by 2030. Reduce final energy consumption by 50% by 2050.	Grenelle II Act: companies with more than 500 employees are required to calculate their carbon footprint. It is compulsory to report products' environmental impacts on labels. Carbon Index: CO_2 emissions labelling on off-brand products sold by the Casino supermarket chain.
Germany	3,142,191	ETS	40% with respect to 1990 to 2020 80-95% in 2050	20% savings in primary energy by 2020, and 50% savings by 2050. 20% reduction in primary energy consumption in buildings by 2020, and an 80% reduction by 2050. 18% of final consumption from renewable energy by 2020, and 60% of final consumption by 2050.	Stop Climate Change: certification system for GHGs emitted during food production and other business processes. WRAP (the Waste & Resources Action Programme): platform to quantify, communicate, and reduce the environmental impacts of food product life cycles and home improvements.
USA	1,705,707	ETS (according to States)	26-28% with respect to 2005 to 2025	Carbon Tax (according to States) The US government purchases 20% of the renewable energy.	CarbonFree Certified: label for products whose carbon footprint is offset. Carbon Neutral Certification: label issued to businesses that offset their Scope 1 and 2 emissions.
United Kingdom	1,339,361	ETS	50% with respect to 1990 to 2025 60% in 2030 80% in 2050.	Carbon price floor (2013 -) 2008 Climate Change Act 2009 Low Carbon Transition Plan Carbon Budgets Order 2011	Compulsory carbon emissions report for companies traded on the London Stock Exchange. Carbon reduction label on Tesco off-brand products.
Netherlands	1,037,905	ETS	EU ≥ 40% with respect to 1990 to 2030 25% to 2020	National climate agenda Dutch Energy Agreement for sustainable growth. Incentive Regulation for Sustainable Energy (SDE+) Delta Program Green Deals Court of Justice Requirement	Energy Investment Tax Deduction: direct deduction for companies that invest in sustainable energy and energy saving equipment.
Italy	1,012,639	ETS	EU ≥ 40% with respect to 1990 to 2030		Alleanza per il Clima: voluntary carbon labelling. White certificates: titles issued by the Electricity Market Managing Body that correspond to energy savings that have been verified and certified by the Gas and Electrical Energy Authority in order to promote interventions and improvements in final consumer energy efficiency.

Country	BC exports (2014 (p), thousands of €)	Carbon rights regulation type	Reduction targets	Specific policies	Specific policies directed towards the private sector and private initiatives
Portugal	902,506	ETS	EU ≥ 40% with respect to 1990 to 2030	Carbon tax (2015-)	
Belgium	794,795	ETS	EU ≥ 40% with respect to 1990 to 2030		Shared environmental policy charter - 10 pillars for the food chain: Initiative of the agro-food industry to reduce the environmental impact of its products in collaboration with the rest of the food chain.
China	635,758	ETS (according to cities) ETS under analysis on a national level	60-65% per unit of GDP with respect to 2005 to 2030	Nationwide cap-and-trade program in 2017 Cut carbon intensity by 40-45% by 2020. Increase the share of non-fossil fuels in its primary energy consumption to about 20% by 2030 Getting around 15% of its energy from clean sources by 2020	Emerging Industry Venture Capital Programme: supporting the growth of innovative companies in the area of energy conservation, environmental protection, and renewable energy. Low-carbon, renewable energy industrial parks. Guiding Catalogue for Industrial Restructuring and the Catalogue for Guidance of Foreign Investment Industries: restriction of high pollution, high energy, and resource consuming projects. Guiding Catalogue for Industrial Restructuring and the Catalogue for Guidance of Foreign Investment Industries: restriction of high pollution, high energy, and resource consuming projects. Council of State Decision to Accelerate the Promotion and Development of Emerging Strategic Industries: priority for the promotion and development of energy conservation and environmental protection.
Brazil	425,998	Under analysis	37% with respect to 2005 to 2025		Integrated Agriculture Production (IP Brazil): voluntary sustainability certification for agricultural products.
Algeria	403,401	--	7-22% by 2030		

Table 5. Examples of specific policies developed in the main target markets of Basque exports.
Source: Compiled by the authors.

2.4.1. Level of risk and opportunities

Concerns over sustainable energy and reducing carbon footprints are rooted in the business models of the most competitive Basque companies. Experience shows that leading companies, and those that make up their supply chain, are aware of the connection between the sustainability of their products and processes and their commercial and strategic potential.

These companies' proximity to their target markets mean that they are in a position to identify changes in demand early, and to direct their efforts to strengthen opportunities.

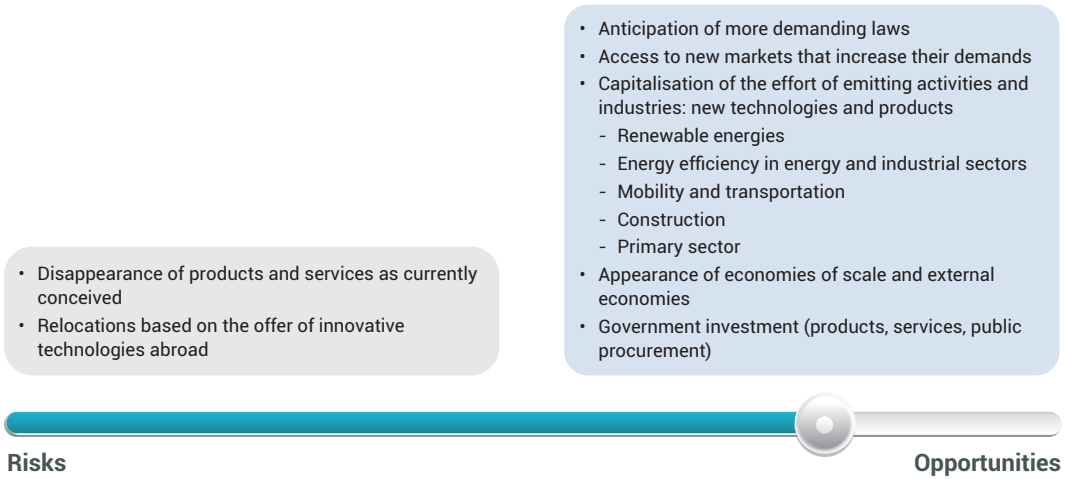


Illustration 28. Risks and opportunities related to market-derived impacts.
Source: Compiled by the authors.

3. COMPANY RESPONSES

The perception of risk and opportunity has an important element of subjectivity, where the company's own positioning and attitude towards the market have a high specific importance.

In any case, company competitiveness will be affected by the new carbon economy. Companies most active in climate change management on a global scale see both risk and opportunity.

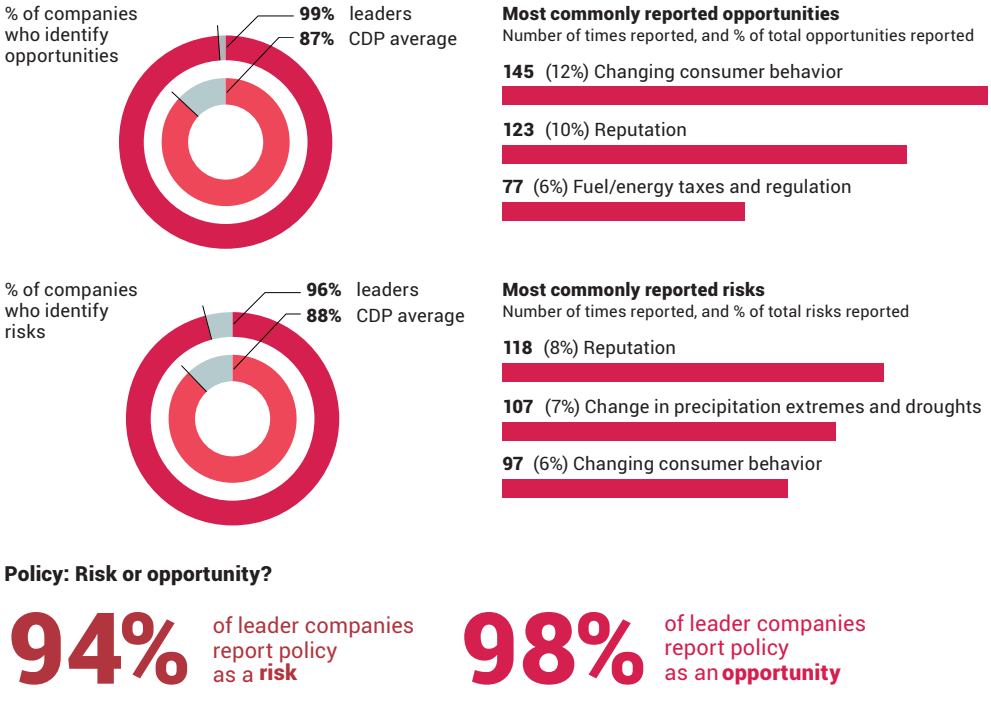


Illustration 29. Opportunity/risk level of the Low Carbon economy.
Source: CDP Climate performance leadership index 2014.

For Basque companies, this risk will play an increasingly important role in the future, and is already present in many industrial sectors.

The identification of opportunities will vary depending on the company's profile. Companies considered as leaders[25] address the risks and opportunities from a perspective that is radically different to that of

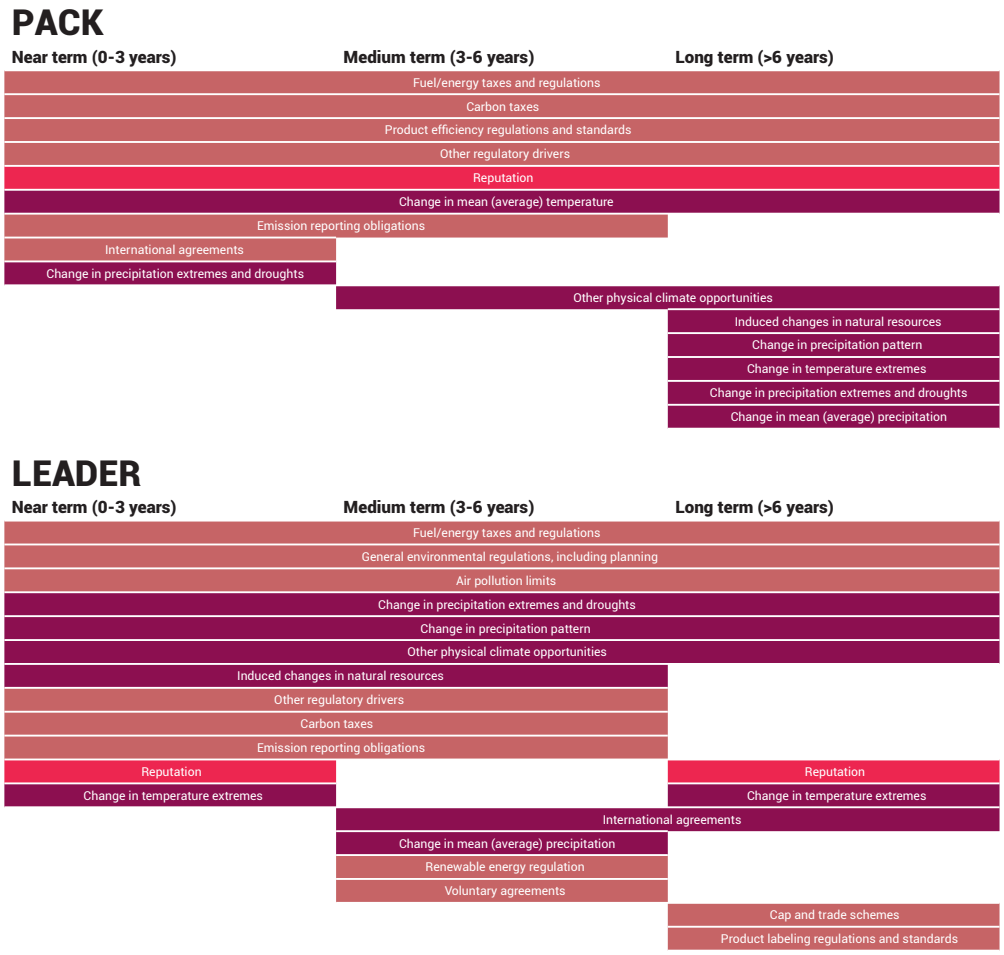


Illustration 30. Opportunity timeline of the Low Carbon economy.
Source: CDP 2014 UK Corporate Environmental Report.

the rest. They take a greater number of the low carbon economy's effects into account, and anticipate the impact's timeframe, which therefore affects the decision-making in their companies.

Nevertheless, a study conducted by McKinsey notes that 60% of executives consider climate change to be a strategically important factor, and the majority consider it relevant to the development of products, investment plans, and the brand's image. However, few of these companies act in line with this perception.

Therefore, whether the low carbon economy's impact will be positive or negative will depend in large part on the decisions adopted by each company. Company responses can be addressed from all aspects of the company's management, transforming climate change risk into a factor of competitiveness that strengthens new business opportunities:

- Strategic planning.
- Cost optimisation.
- Innovation promotion and application.
- Comprehensive internationalisation management.
- Staff training.
- Branding and reputation.

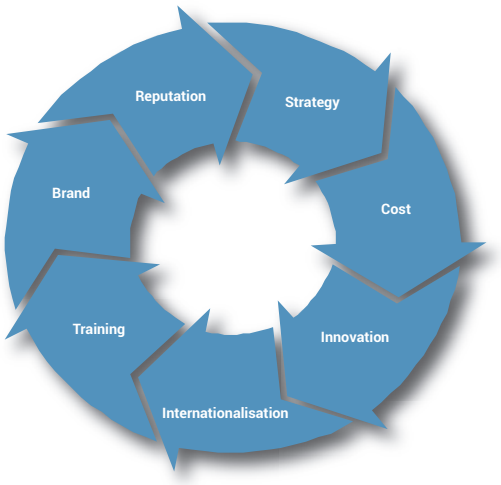


Illustration 31. Management components to address the low carbon economy.
Source: Compiled by the authors.

3.1. Strategy

The incorporation of the low carbon economy into the decision-making process is the key to staying ahead and achieving solid positioning to respond to the opportunities.

The perception of the role that they must play regarding climate change is growing within companies[26]. In the decision-making process it is noticeable that there is an increase in the inclusion of measures such as moving responsibility to the company's highest decision-making body, developing incentives linked to climate change, and strengthening relationships with Public Administrations.

Some of the main Basque companies have already incorporated the principle into their business strategies. Nevertheless, a still significant number of companies address the issue with a vision based on environmental and social responsibility. As many as 40% do not yet include this issue as a company value, with the number falling to 30% among companies that make up *Izaite* (Association of Basque Companies for Sustainability).

More than 50% of *Izaite* companies already offer products and services associated with the low carbon economy.

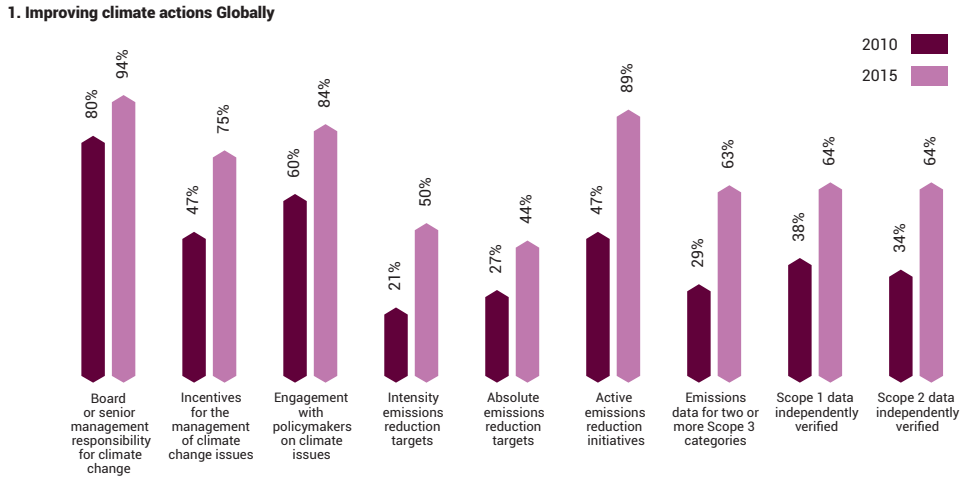


Illustration 32. Progress of actions for the transition of leading companies to the low carbon economy.
Source: CDP Global Climate Change Report 2015.

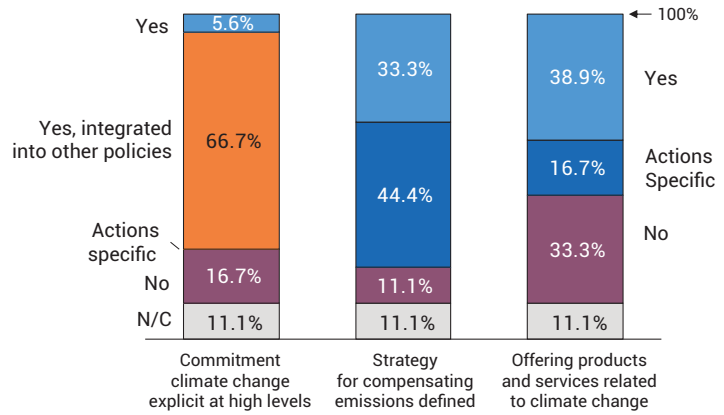


Illustration 33. Level of Incorporation of Climate Change in company decision-making.
Source: 2012 IZAITE survey (Association of Basque Companies for Sustainability).

The largest companies in the Basque Country demonstrate activity in different strategic decision profiles in which the low carbon economy plays an important role. It is possible to identify concrete business decisions that are clearly related to climate change.

- Making the highest level of corporate governance responsible
- Defining the range of products and services
- Prioritising attributes of the value proposal
- Client positioning
- Selection of target markets (regions, sectors, etc.)
- Identification of lines of innovation
- Location of facilities
- Mechanisms for increased efficiency
- Relationships with Public Administrations
- Access to sources of financing
- Selection of strategic partners
- Acceso a fuentes de financiación
- Selección de aliados estratégicos

DECISIONS PROFILE	COMPANY	MAIN ACTIONS
Defining the range of products and services	Arcelor Mittal Vidrala	"Sustainable steel" Lighter bottle
Prioritising attributes of the value chain	Befesa Zinc Aser Gamesa	Carbon footprint of supplier activity
Client positioning	Iberdrola CAF	"Green Energy" Eco CAF
Selection of target markets (regions, sectors, etc.)	Eroski	Sustainability and environmental focal point
Identification of lines of innovation	Irizar A&B Lab. biotechnology	Electric bus Bio detergents
Location of facilities	Idom Vicinay	Facility vulnerability analysis
Mechanisms for increased efficiency	ITP Bridgestone	Low emissions turbines in the aeronautical sector Product efficiency R&D
Access to sources of financing	Gamesa Iberdrola	Investment Funds Dow Jones of sustainability
Selection of strategic partners	FLOTTEK consortium	Floating concrete wind turbine platforms

Table 6. Examples of Basque company actions related to strategic decisions.
Source: Compiled by the authors.

More complex, and less developed, is the analysis of business activity development for opportunities associated with products and services linked to reducing emissions. There are no studies that rigorously analyse and quantify this effect on production activity.

In any case, it is evident that business opportunities exist and are growing. According to financial reports published[27], Siemens, for example, quantifies its environmental portfolio's earnings at €32.3 billion (43% of its 2013 business volume), which are mainly focused on combined cycle power plants and intelligent construction technologies, renewable energy (steam and wind turbines for thermal solar energy plants) and water and air cleaning technologies. The use of these efficient technologies contributed to their clients releasing 377 million fewer tonnes of CO_2 into the atmosphere.

At Philips, the sale of products relating to sustainability was €11.815 billion in 2013, with annual growth of 7.6%. This figure makes up 50.6% of the group's total income. The company earmarked €509 million for sustainable innovation, equal to 29% of its total R&D. General Electric generated "green" income of USD 28 billion in 2013, being 12% more than the previous year, and 19% of its total turnover. R&D investment reached 1.6 billion for projects relating to the efficiency of power plants, wind turbines, etc.

3.2. Cost

With respect to company competitiveness, a significant proportion of the studies published[28] focus mainly on the increase in costs associated with the internalisation of emissions costs, and the risk that greater relative costs could cause energy intensive industries to move to countries with more lenient regulations (offshoring known as *carbon leakage*).

In general, the studies predict a moderate company relocation effect, with it being understood that, for the majority of companies, the emissions reduction costs are low when compared to factors such as relocation, market conditions, and labour force quality. The impact could be significant for the most energy intensive sectors and those most exposed to international competition, such as metal, cement, paper, and chemicals, if there is no standardised carbon cost regulation on a global level.

However, pioneering companies in the application of mitigation measures have demonstrated that investments in energy efficiency and the use of renewable energy has a positive impact in the medium-term (lower energy bill and advanced levels of technology) that improve competitiveness and the positioning of the company in the face of markets and competitors with lower energy costs.

The levels of return for each type of investment vary in each business sector. Just as investments in energy efficient processes have an important multiplying effect on annual savings and the reduction in industrial sector emissions, other sectors such as telecommunications and ICT show greater returns on investment relating to energy efficiency in buildings.

Forty percent of Basque companies subject to the carbon market present emissions levels in line with the target set by the European Union. A large number of facilities have already reached an efficiency of around 80% of their sector's BAT, notably steelworks (94.2%), cement plants (91.9%), and paper mills (some reaching 200%), even if few Basque companies stand out in the latest CDP reports[29].

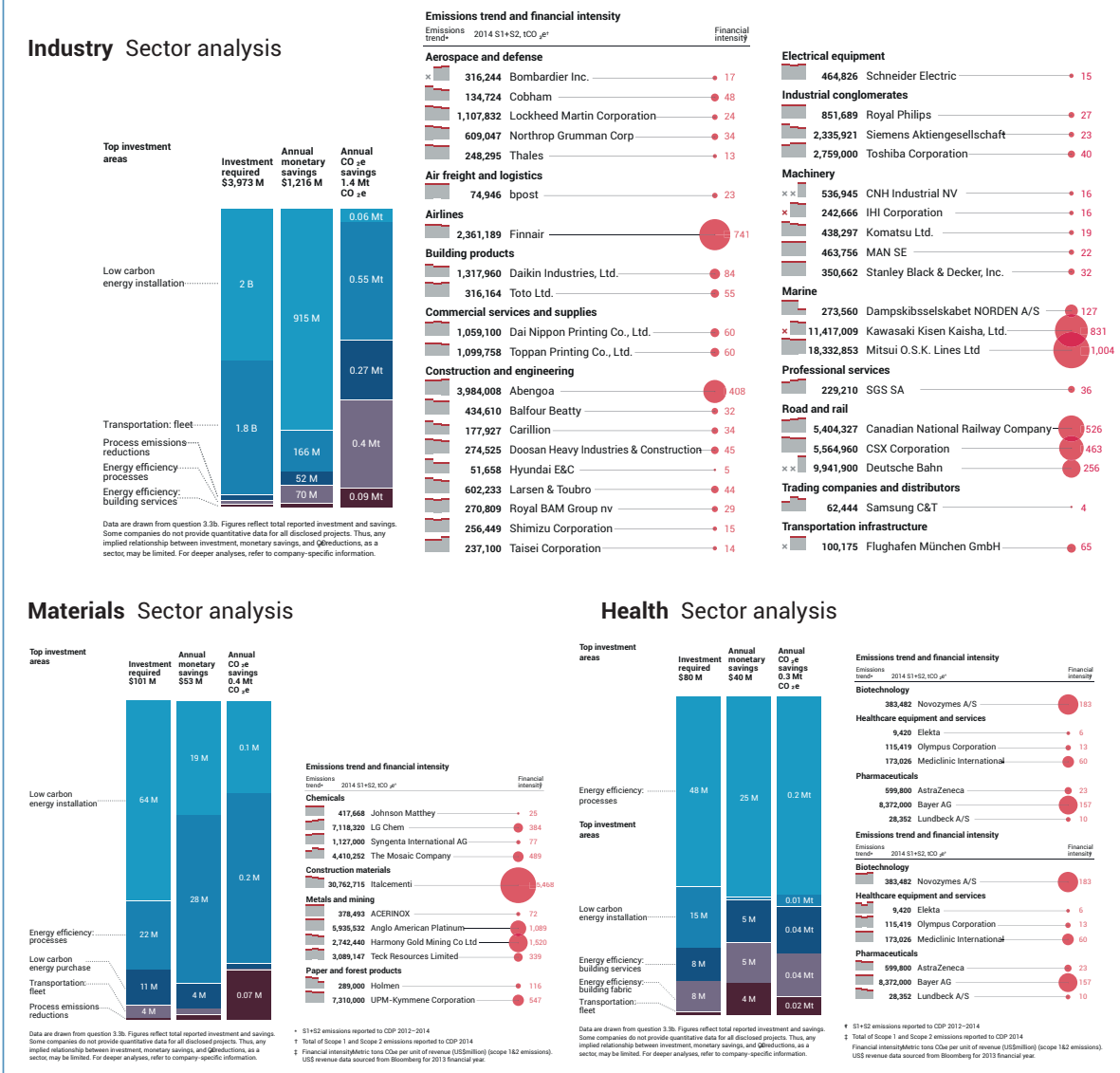


Illustration 34a. Investment related to climate change and expected results by sector.
Source: CDP Climate performance leadership index 2014.

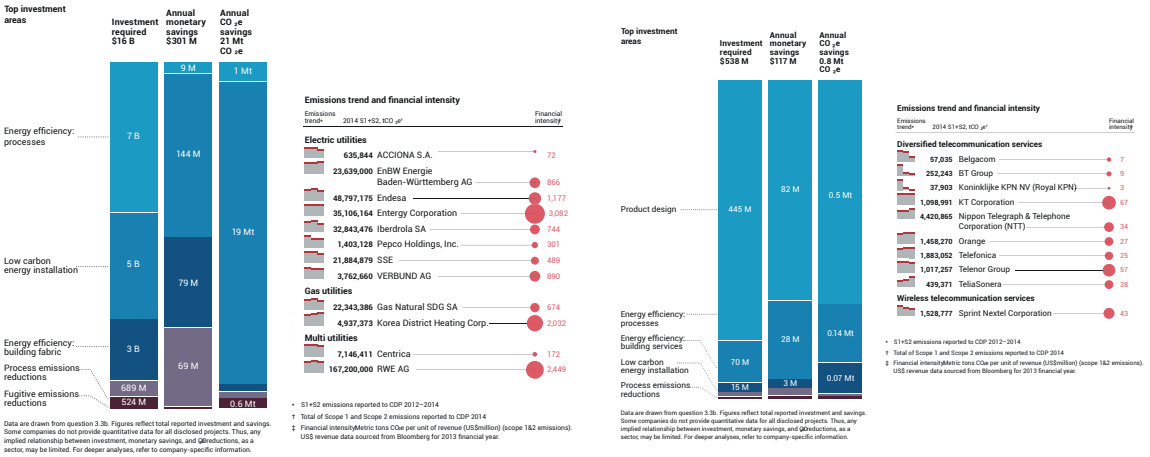


Illustration 34b. Investment related to climate change and expected results by sector.
Source: CDP Climate performance leadership index 2014.

As an example, the BAC's increased investment in the environment can be cited. This involves the Petronor Fuel-Oil Reduction Unit:

- €1 billion in investments.
- Energy self-sufficiency (cogeneration) (equal to 25% of the Garoña nuclear power plant).
- 440,000 tonne reduction in CO_2 annually (woodland equivalent equal to 46% of Vizcaya's surface area).
- 160,000 t/year reduction in SO_2.
- 80% reduction in waste produced.

Illustration 35. Examples of large-scale climate change investments in the Basque Country and returns obtained.
Source: Compiled by the authors.

3.3. Innovation

The low carbon economy is a catalyst for innovation. The emissions reduction targets involve a strong demand for innovative technologies, products and processes that allow for qualitative leaps forward in the state of the art.

The Basque Government is providing clear support for specialisation in two sectors that are closely linked to the low carbon economy: advanced manufacturing and energy, with a priority focus on exploiting potential innovation and transferring that to the market.

The emissions reduction targets involve a strong demand for innovative technologies, products, and processes.

It is estimated that the generalised implementation of the best techniques (*Best Available Techniques*, BAT) will contribute to industrial sector emissions being reduced by approximately 20%[30]. Based on the application of BATs and improved processes, energy efficiency measures would achieve 49% of

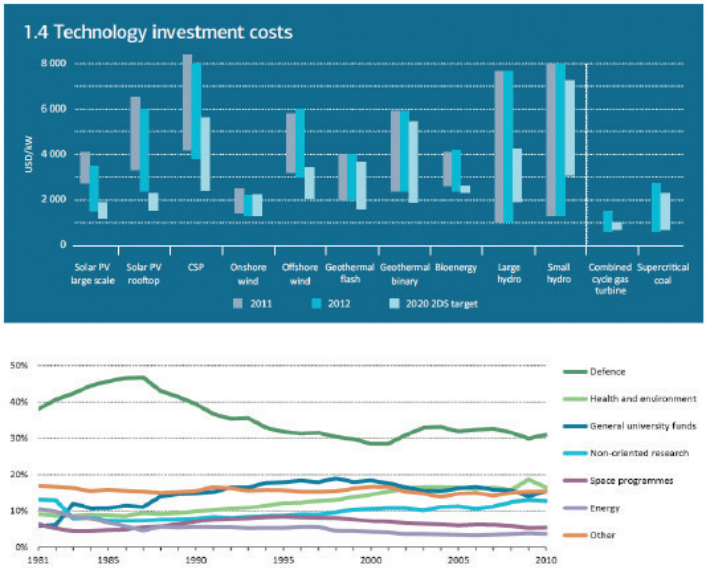


Illustration 35. Sectoral R&D expenditure distribution in OECD countries.
Source: IEA. International Energy Agency.

the reductions necessary in this sector. The rest must be derived from technologies that are not yet developed.

The International Energy Agency (IEA) analyses indicate clear potential for innovation. For example, they point out that electricity generation processes present an average primary energy loss of 60%, and that only 20% of energy consumed by cars with a combustion motor is transformed into mobility. In 2011, OECD countries subsidised fossil fuels (mainly coal) by USD 532 billion, while renewable energies received subsidies of only USD 88 billion. Although renewable energy technologies are increasingly competitive, they continue to be more costly than conventional sources, and have not yet reached the cost levels necessary to meet the targets.

OECD country energy sector participation in R&D expenditure has dropped significantly in relative terms. While defence innovation receives 30% of the public budget, innovation in energy has fallen from 11% in 1981 to 3-4% in 2010. The IEA estimates that an increase of between 3 and 6 times the current energy innovation budget is needed to reach the targets.

The transition to the low carbon economy must be supported by important innovation incentives from a national and international perspective. In fact, some relevant initiatives already exist[31].

ENERGY	ADVANCED MANUFACTURING
Renewable energy Smart electricity networks Power storage	Resource sustainability and efficiency Competitive, eco-efficient manufacturing Integration of new materials and complex structures Distributed, collaborative, and smart manufacturing Innovation in management - New business models and services with high added value Safe and smart means of production

Table 7. R&D lines in strategic priorities related to the low carbon economy in the Basque Country.
Source: 2020 STIP, Advanced Manufacturing Strategy, EnergiBasque Strategy.

Innovation in this area requires support from the public sector, – and not just economic support – which at times may be critical. For example, energy efficiency in construction will be discouraged by the fragmented agents participating in the process, and due to the fact that users rarely take the opportunity to impose their preference and specifications, despite the important economic advantages that they may obtain. Regulation and inspection is essential in these cases. Occasionally, the efficiency and cost of innovation are related to the existence of a network of users (e.g. charging networks for electric vehicles, smart meters, etc.) with a sufficient critical mass, which the government must ensure through its role as the regulator of technical standards. On the other hand, in the case of urban transport sustainability and efficiency, the role of public purchasing is the main factor for advancement. There are innovations relating to basic developments that are difficult to protect, but which may be highly effective and must be assumed through public initiative (historically, this has been the case with the development of certain photovoltaic techniques, transistors, and the internet).

Measures are being implemented in the Basque Country to promote research and related innovation in the energy sector, as well as various industrial activities that are part of the low carbon economy. In the energy sector, for example, there are specific lines of action for research relating to renewable energy, smart electricity networks and power storage, fundamental aspects of smart electricity network development, and the electrification of transport. Likewise, mechanisms focused on industrial activities have been developed to encourage and support R&D related to efficiency and sustainability, eco-efficient manufacturing, smart and safe means of production, smart manufacturing, etc.

The necessary improvements to innovation mechanisms do not only involve developing new products and services, but also institutional and social innovation, and new methods of business organisation, marketing and distribution. An example of this concept is the reuse of materials and components (the so-called "circular economy" and "remanufacturing"), where the successful cases of Renault and Caterpillar are well-known[32].

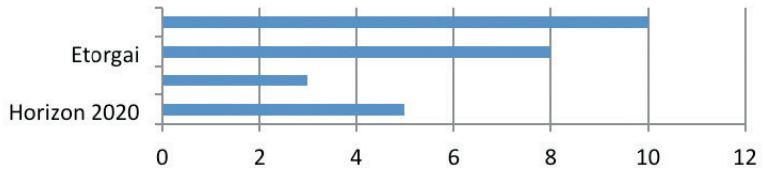


Illustration 36. R&D activity related to the low carbon economy in the Basque Country (No. projects).
Source: Compiled by the authors.

Society's attitude towards adopting measures against climate change depends on its expectations. Individuals are more prone to accepting the low carbon economy if they understand its benefits, and if they wait for other agents to implement changes simultaneously. When a sufficient number of decision makers announce their intentions, shared expectations cause change: the costs lower as a result of the experience curve, and institutions and groups opposed to change can be left behind in terms of competitiveness. A domino effect is produced. In contrast, if the other agents' expectations for change are reduced, a perception of risk and expense will increase among all agents involved.

For this reason, many business leaders are asking the government to send the appropriate signals and adopt a carbon price that is believable and predictable in the long-term, so that investment can be planned and innovation can be put into practice. As has recently occurred in Spain with renewable energy, government inconsistency and hesitation when it comes to applying these policies causes difficulties and set-backs for the necessary investments.

As an example, different innovation initiatives can be cited that have succeeded in positioning products and services for the low carbon economy in new markets:

- **Irizar i2e - electric city bus:**
  - Autonomy between 200 and 250 km / 14-16 hours of city driving.
  - CO2 emissions reduction: 88 t/year. 33,000 litres of fuel saved.
  - Noise reduction.
  - Zero emissions.
- **CAF-ECO:**
  - Highly efficient traction equipment.
  - Energy recovery during breaking.
  - Light materials.
  - Reduction in auxiliary consumption.
  - Efficient driving.
  - Reduced journey times.

Illustration 37. Examples of innovation related to the low carbon economy in the Basque Country.
Source: Compiled by the authors.

3.4. Internationalisation

Internationalisation is one of the key components of any economic activity's competitiveness, especially industrial activities. Basque exports are focused on developed markets that will show a high level of demand for the low carbon economy.

In this context of increasingly demanding markets of opportunity, Basque companies face economic, human resource, and information barriers linked to international activity, and barriers associated with the culture of the countries they address. In addition, companies that do not export do not do so because of business size, and because they carry out activities that they consider not very exportable.

The Basque clusters are instruments that strengthen the presence of Basque businesses in the most demanding international markets, and facilitate the introduction of products that are adapted to the new requirements of the low carbon economy in sophisticated geographical markets.

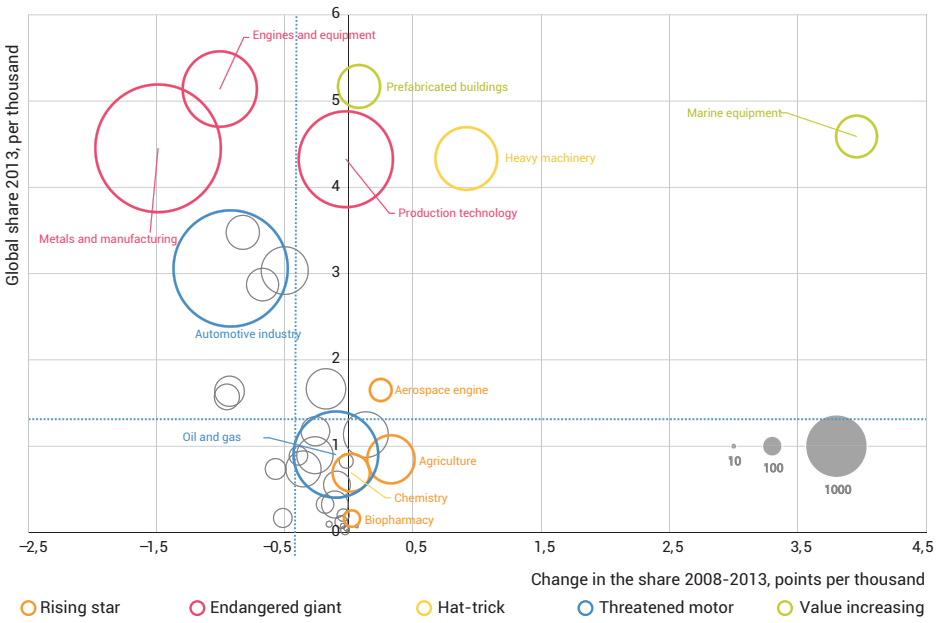


Illustration 38. Map of BAC cluster exporters.
Source: Orkestra Institute, based on data from the Tax Agency and United Nations, Comtrade.

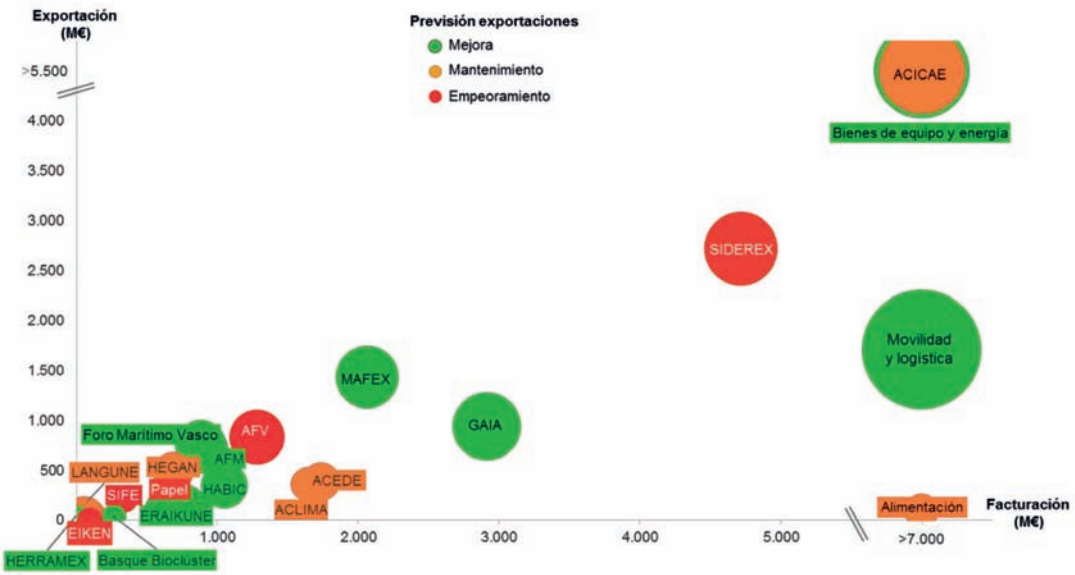


Illustration 39. 2011 Basque cluster employment, export and turnover.
Source: 2014-2016 Business Internationalisation Plan. Basque Government.

A map of exporting clusters produced by the *Orkestra-Basque Institute of Competitiveness*[33] shows the Basque exporters with the greatest market share and best growth dynamics in their respective markets. Among these are some of the areas of opportunity highlighted previously: marine equipment, heavy machinery, prefabricated buildings, engines and equipment, production technology, automation, and aerospace engines, etc.

The *2014-2016 Business Internationalisation Plan*, which establishes specific measures to support internationalisation, points out how clusters relating to automation, energy and capital equipment, and steelmaking have a high volume of exports. Included among the sectors with export growth forecasts are mobility and logistics, automation and control (GAIA), railway, shipyards, construction, and utilities.

Likewise, Basque Country institutions have planned to establish specific aid measures in target markets. A large part of these countries that are targets for export growth (Internationalisation Strategy) will be implementing more restrictive regulations in the future:

- **Priority 1:** Germany, China, India, Mexico, USA.
- **Priority 2:** Brazil, Russia, Turkey.
- **Priority 3:** Australia, Colombia, Indonesia, Malaysia, Peru, Singapore, South Africa, Vietnam.

Priority	Country	Carbon rights regulation type	Reduction targets	Specific policies
P1	Germany	ETS	40% with respect to 1990 to 2020 80-95% in 2050	20% savings in primary energy by 2020, and 50% savings by 2050. 20% reduction in primary energy consumption in buildings by 2020, and an 80% reduction by 2050. 18% of final consumption from renewable energy by 2020, and 60% of final consumption by 2050.
P1	USA	ETS (according to States)	26-28% with respect to 2005 to 2025	Carbon Tax (according to States) The US government purchases 20% of the renewable energy.
P1	China	ETS (according to cities) ETS under analysis on a national level	60-65% per unit of GDP with respect to 2005 to 2030	nationwide cap-and-trade program in 2017 cut carbon intensity by 40-45% by 2020. Increase the share of non-fossil fuels in its primary energy consumption to about 20% by 2030 Getting around 15% of its energy from clean sources by 2020
P2	Brazil	Under analysis	37% with respect to 2005 to 2025	
P1	Mexico	ETS under analysis on a national level	22-36% with respect to BAU to 2030	Carbon Tax (2014 -) National Climate Change Strategy and Special Climate Change Programmes every 5 years Climate Change Law (national) State Climate Change Programmes National Emissions Registry (RENE) 35% of electricity generation from clean energy sources in 2024 50% GHG emissions reduction in 2050 with respect to 2000 emissions
P3	Singapore	--	36% GHG per unit of GDP by 2030	
P2	Turkey	Under analysis	21% with respect to BAU to 2030	Climate Change Strategy 2010-2020 Climate Change Action Plan 2023 Sectoral targets
P1	India	--	33 - 35% per unit of GDP with respect to 2005 to 2025 25% by 2020	40% of its electricity from non-fossil fuel sources National Action Plan on Climate Change
P2	Russia	--	25-30% with respect to 1990 to 2030	
P3	Various 1	Remaining: --	South Africa: emissions between 398 and 614 Mt CO by 2025 Australia: 26-28% with respect to 2005 to 2025 Indonesia: 29% with respect to BAU to 2030 Colombia: 20% with respect to BAU to 2030	South Africa: Carbon tax (2017 -)

Table 8. Examples of specific policies developed in Basque priority target markets.
Source: Compiled by the authors.

3.5. Training

Despite there being no empirical evidence regarding the effect of applying carbon prices on employment, the demand for professionals will grow significantly in activities related to the low carbon economy (renewable energies, transportation services).

The models[34] predict a moderate or neutral global effect for employment in the medium-term[35], especially if income from carbon rights is used to encourage employment. Unsurprisingly, carbon restrictions will cause unemployment in some sectors, although they will also generate employment in others.

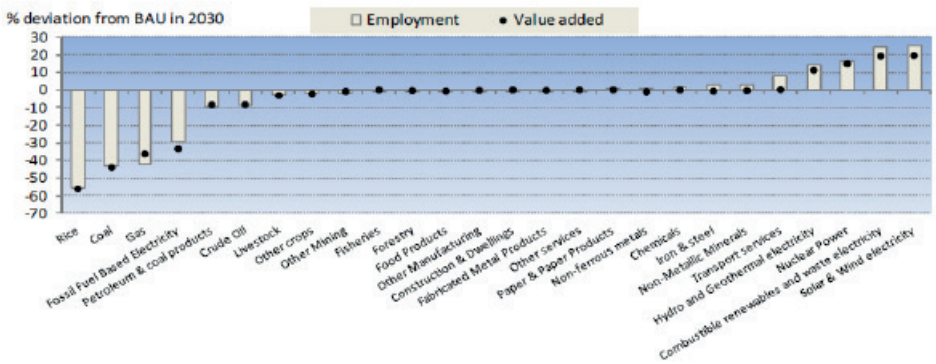


Illustration 40. Changes to the sectoral composition of forecast employment in Europe.
Source: OECD.

On a sectoral level, the negative impact could be significant in energy intensive sectors or those that are highly polluting, at least during the transition period[36] . Analysts recommend that labour policies be adopted to favour flexibility, together with geographic and sectoral mobility, in order to facilitate personnel adaptation and reorientation towards the new, expanding sectors. Impacts are more likely to be produced between regions of a single country rather than between countries given the reduced cost of relocation.

The Basque Country has the knowledge and the mechanisms to transfer this to companies that are committed to the low carbon economy as a factor of competitiveness at all levels of training: univer-

sity (university plan, industrial doctorates, etc.), professional training (Basque PT plan), and research (RIS3 Science and Technology Plan).

The Basque Country University Plan[37] proposes an emphasis on training in RIS3 priority areas (advanced manufacturing, energy, health and urban planning) that incorporate the basic components to promote competitiveness associated with climate change. In addition, it plans to strengthen the incorporation of PhDs into the business landscape through the company doctorate training programme, and the development of professional doctorates with companies, technology centres and clusters.

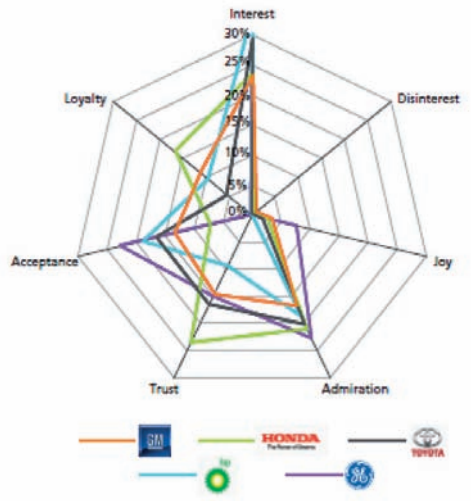
- **First internationally recognised centre for climate change: BC3.**
- **More than 200 expert climate change researchers in the Basque Science, Technology and Innovation Network.**
- **More than 100 projects completed in the eco-design room (60% with companies).**

Illustration 41. Examples of training in activities relating to the low carbon economy.
Source: Compiled by the authors.

Meanwhile, the professional training plan[38] establishes a new Basque framework for professional specialisations and qualifications that cover company specialisation needs, incorporating new knowledge and capacities, and establishing set specialisation areas in emerging sectors and social challenges, with Climate Change playing a predominant role.

3.6. Branding and reputation

Consumers have a positive opinion of a company's commitment to the low carbon economy. The perception of value and a brand's attractiveness grows by establishing a Company-Low Carbon Economy relationship, although notable differences exist between geographic regions both in terms of the perception of leadership and the sectors considered as leaders in the low carbon economy. As an example, a greater sense of leadership is perceived in sectors such as distribution and energy in the UK, and manufacturing brands in the United States and China[39].



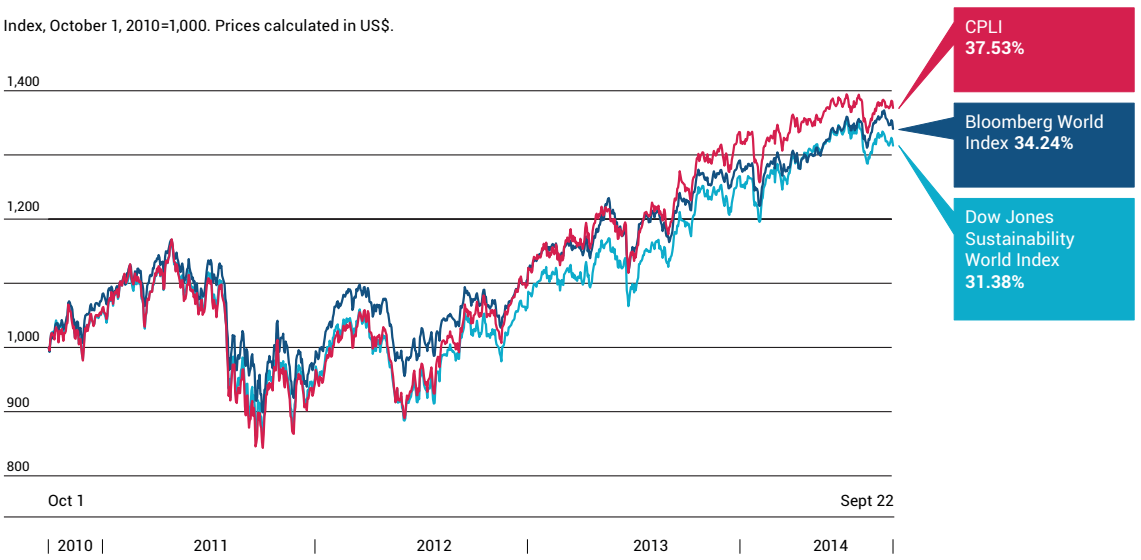
"Select up to three emotions from the following list that most closely describe how you feel when you hear about the company you have chosen is acting on climate change"

Illustration 42. Emotions associated with the low carbon economy in the United States.
Source: Consumers, Brands and Climate Change. The Climate Group.

COMPANIES with best Reputation

2012	RECOR 2014			
1º	1º	IBERDROLA	=	11º VICINAY
2º	2º	SENER	=	12º EUSKALTEL
6º	3º	IDOM	↑	13º CIE AUTOMOTIVE
3º	4º	CAF	↓	14º GESTAMP
11º	5º	PETRONOR	↑	15º EROSKI
15º	6º	GAMESA	↑	16º TECNALIA
4º	7º	KUTXABANK	↓	17º TUBACEX
> 20º	8º	ITP	↑	18º BBVA
> 20º	9º	MERCEDES	↑	19º TUBOS REUNIDOS
19º	10º	ARTECHE	↑	20º INGETEAM

Despite there being no specific study, it can be said that among the Basque Country companies with the best reputation[40], a number of those that have integrated the low carbon economy into their business model to the greatest extent are outstanding. Initiatives such as *Iberdrola's 'Green Energy'* and *Km. 0 from Kaiku*, and *Irizar's zero-emissions bus* are a reflection of Basque companies committing to strengthening competitiveness associated with Climate Change.



Source: data in US$ from 1/10/2010 to 22/9/2014, source ECPI based on data by Thomson Reuters Datastream and Bloomberg.

Illustration 43. Leading CDP company financial performance.
Source: CDP Climate-performance-leadership-index-2014 .

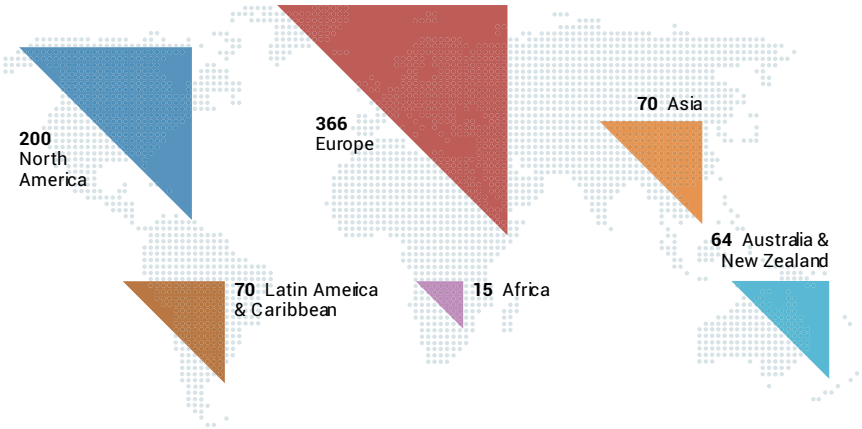
On the international stage, the companies that most stand out on sustainability stock indexes show better returns than the rest of the stock exchange. The 2014 *Carbon Disclosure Project (CDP)* report shows better stock index performance set by companies considered as leaders when compared with other indexes.

Pioneering companies in the application of Net Positive principles:

- **BT, Capgemini, Coca-Cola Enterprises, The Crown Estate, IKEA Group, Kingfisher, SKF.**

Illustration 44. Pioneering companies in the application of Net Positive principles.
Source: Compiled by the authors.

Where are the signatory investors located?*



CDP investor base continues to grow*

Investors by type

312 Asset managers

256 Asset owners

152 Banks

38 Insurance

27 Other

Illustration 45. CDP investor base

Source: CDP Climate-performance-leadership-index-2014 .

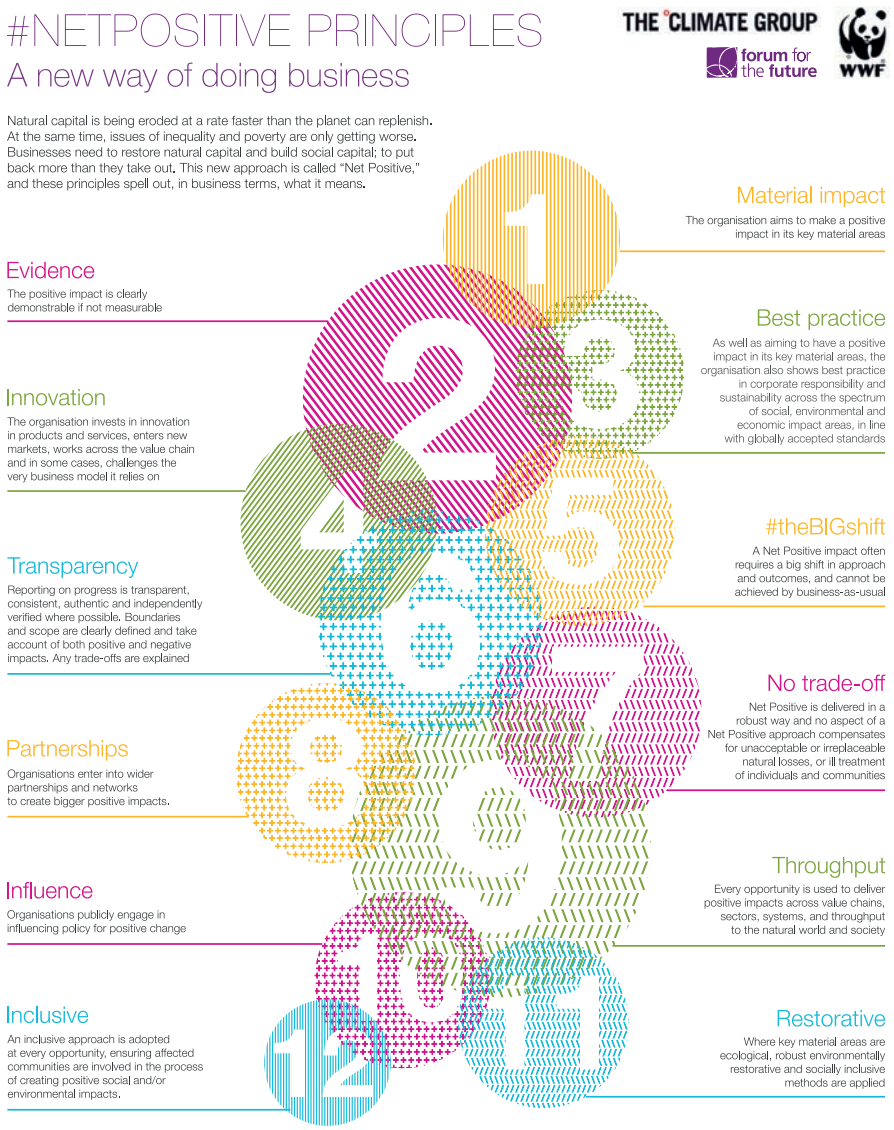


Illustration 46. Net Positive Principles.
Source: The Climate Group .

Apart from the company's own performance, the low carbon economy's importance for competitiveness is reflected in the growing number of investment funds investing with sustainable criteria. Reports such as those published by the CDP[41] and *SIF Foundation*[42] indicate that, for example, responsible investment (SRI - sustainable, responsible, and impact investing) has increased by 76% between 2012-2014, and that the assets currently managed make up approximately one sixth of all professionally managed funds in the United States.

The low carbon economy is a step forward for companies; a new business model that returns more resources than it consumes to society, the environment and the economy. The *Net Positive*[43] focus enhances reputation, increases sales, reduces costs, and enhances individual involvement in the business project.

4. KEYS

Is the low carbon economy related to business competitiveness?

What is the current perception of climate change?

- There is increasing agreement about the diagnosis internationally at all levels; the effect appears to be undeniable, and the difficulties of compensating for it are great.
- The level of awareness and social, institutional, and business involvement is growing.
- Explicit commitments to reduce emissions continue to grow, both on a State level and from specific companies, although their compliance is complicated by the difficulties of implementing "fair" instruments on a global level.
- There are different quantifications for existing opportunities. In any case, it is acknowledged that the Low Carbon Economy will draw large investment (infrastructure, industrial, technology, social).
- The Paris Summit should mean a significant change in the way Climate Change is addressed.

What factors will be most influential?

- The Low Carbon Economy's relevance varies by geographic area and business sector.
- The Basque Country's main industrial sectors are among those with the greatest level of impact and opportunity.

There are three fundamental factors to take into consideration:

- Impact on the physical environment:
  - Damages derived from phenomena related to climate change have increased by 50%.
  - For every euro invested in flood protection, €6 are saved on reconstruction costs.
  - As a whole, these types of impact present a greater level of risk than opportunity in the Basque Country.

- Impact derived from mitigation policies:
  - Important efforts have been made, especially those relating to processes and energy efficiency.
  - The industrial sector still has the potential to improve efficiency by 60%.
  - Investments made have economic returns on investment, not just in relation to reducing emissions.
  - Future international agreements will expand the scope of regulation.
  - These types of impact mean both risks and opportunities for companies.
- Impact derived from the market:
  - More than 80% of BAC exports are to countries with strict regulatory requirements.
  - Some of the sectors of activity most relevant to the Basque economy (both because of their size and competitiveness) are highly exposed to changes in the market related to the low carbon economy.
  - Although there are risks, the market will produce important opportunities for all business activities.

How can we take advantage of the low carbon economy's opportunities? How do we face the challenges?

- The perception of risk and opportunity is largely subjective, and depends fundamentally on the company's attitude.
- Turning climate change uncertainty into opportunity with the low carbon economy depends largely on business decisions.
- 60% of leading executives on an international level consider climate change to be a strategic factor.

Opportunities can be managed at all levels of business:

- **Strategy**
  - On an international level, the low carbon economy is increasingly present in business decision-making processes.
  - 60% of large Basque companies have introduced them into their strategies to varying degrees.
- **Cost**
  - Cost improvement investments (energy efficiency, process improvement, transport, etc.) are economically beneficial in addition to reducing CO_2.

  - Existing studies indicate that each type of business activity receives a greater return on investment in different types of activities and investments.
  - On average, every dollar invested in energy efficiency and clean energy will generate between 2 and 4 dollars over the course of the investment's lifespan.

- **Innovation**
  - 50% of the greenhouse gas reductions necessary to meet current requirements must be derived from technologies that have not yet been developed.
  - The Basque Country has instruments to support innovative activity related to the low carbon economy.

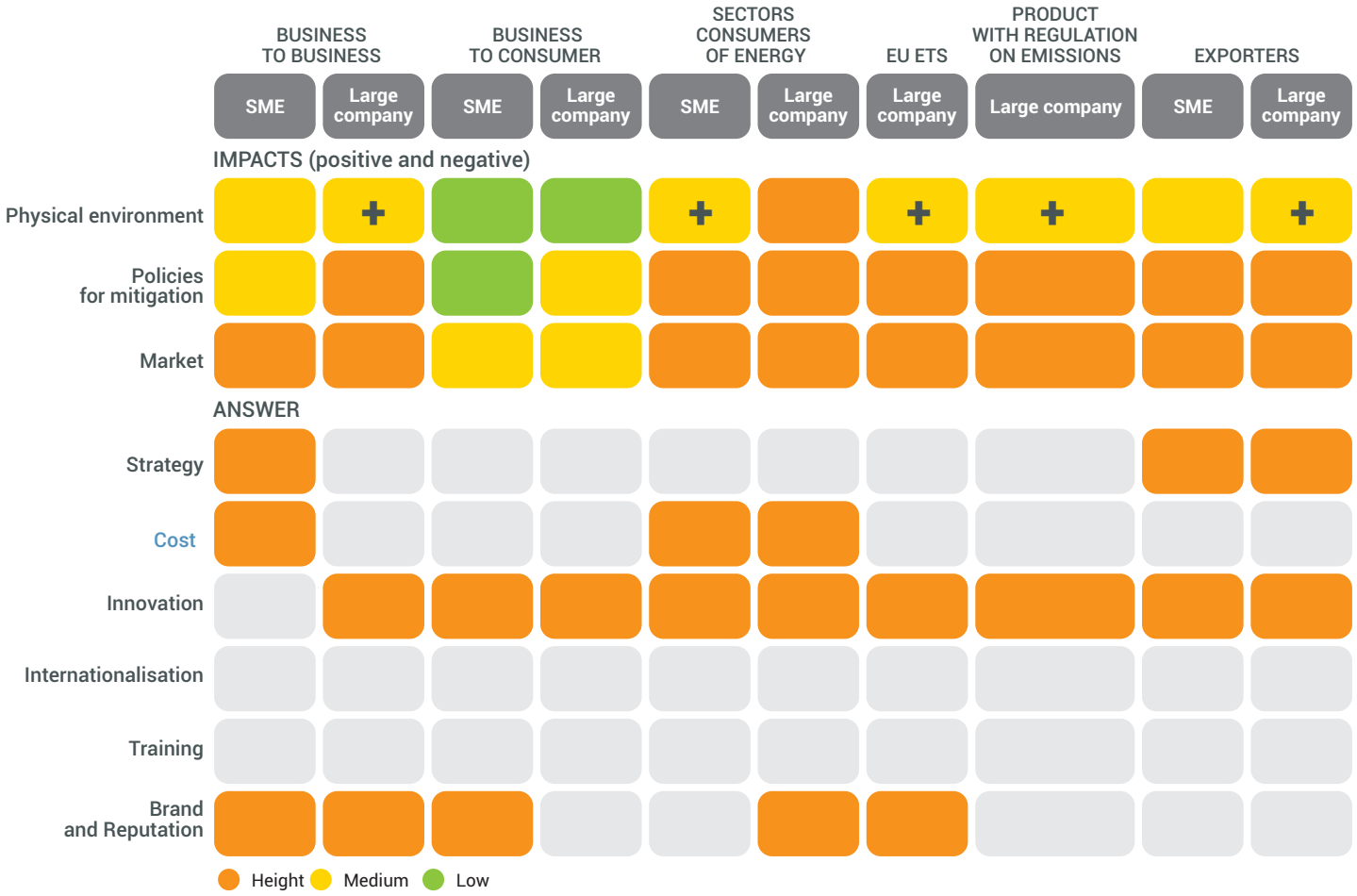
- **Internationalisation**
  - The most exported products, and those identified as having greater potential, are related to the low carbon economy.
  - A large number of export growth target countries will be implementing more restrictive regulations.
  - Business clusters can become an instrument that reinforces the presence of Basque businesses in more advanced activities and markets.

- **Training**
  - The sectors that will require more professionals in the future are those relating to low carbon economy activities.

- **Branding and Reputation**
  - A company's brand being associated with the low carbon economy is a valuable asset on the market.
  - Large investors are increasing their activity in activities related to climate change.
  - The business results of current leading companies support their commitment to the Low Carbon Economy.

The previous analysis cannot be applied homogeneously to all organisations. In order for each organisation to be able to focus their strategy and actions, it is necessary to identify the specifics relating to their activity and the sector to which it belongs. An initial approximation is included in the following figure in function of the organisation's size and sector.

SECTIONING OF IMPACTS AND RESPONSES



EXAMPLE RESPONSE PROFILE	EXAMPLE ACTION	EXAMPLE BUSINESS
Locationof facilities	Facility vulnerability analysis	Idom Vicinay
Mechanisms for increased efficiency	Low emissions turbines in the aeronautical sector. Efficiency of products	ITP Bridgestone
Defining the range of products and services	Sustainable steel, lighter bottle, electric bus, bio-detergents	Arcelor Mital, Vidrala, Irizar, A&B Lab
Selection of strategic partners	Floating concrete wind turbine platforms	Consorcio FLOTTEK
Prioritising attributes of the value chain	Carbon footprint of supplier activity	Befesa Zinc Aser, Gamesa
Client positioning	Green energy Eco CAF	Iberdrola, CAF

5. ANNEXES

5.1. List of interviews

1. ACLIMA
2. Basquetour
3. CAF
4. Cementos LEMONA
5. Basque Country Logistics and Mobility Cluster (pending)
6. 2015 Basque Country Competitiveness Conference: Orkestra, Iberdrola, Petronor
7. DEBEGESA / GARAPEN
8. ERAIKUNE, Construction Cluster
9. Factor CO_2
10. Basque Maritime Forum
11. GAMESA
12. GERDAU Basauri
13. Ihobe Public Company
14. Orkestra Institute. Energy Chair
15. Ormazábal
16. Tecnalia

5.2. Glossary

In addition to all of the sources consulted, to produce this report personal interviews were carried out with leaders of the following companies and institutions:

- **PAs** – Public Administrations
- **ACLIMA** – Cluster Association of Environmental Industries
- **IEA** – International Energy Agency
- **BASQUETOUR** – Turismoaren Euskal Agentzia. Basque Tourism Agency
- **BAT** – Best Available Technologies
- **BC3** – Basque Centre for Climate Change
- **BRICs** – Brazil, Russia, India and China
- **BAC** – Basque Autonomous Community
- **CDP** – Carbon Disclosure Project
- **COP21** – 21st Conference of Parties
- **ETS** – Emission Trading System
- **EU ETS** – European Union Emission Trading System
- **EVCC2050** – 2050 Basque Climate Change Strategy
- **GAIA** – Basque Association of Industries for Electronic and Information Technologies
- **GHG** – Greenhouse Gases
- **IEA** – International Energy Agency
- **Ihobe** – Public Environmental Management Company of the Basque Government
- **INDCs** – Intended Nationally Determined Contributions
- **IPCC** – Intergovernmental Panel on Climate Change
- **MAGRAMA** – Ministry of Agriculture, Food and the Environment
- **NatCatSERVICE**
- **OECD** – Organisation for Economic Cooperation and Development
- **GDP** – Gross Domestic Product
- **RIS3** – Regional Research and Innovation Strategies for Smart Specialization
- **URA** – Basque Water Agency

5.3. Index of tables and illustrations

Table index

Index of Illustrations

5.4. Bibliographical notes

[1] International Energy Agency. **"Energy and Climate Change"**. OECD/IEA, 2015.

[2] International Energy Agency, same source.

[3] **"Business proposals in view of a 2015 international climate change agreement at COP 21 in Paris"**. BusinessEurope, 2015.

[4] The World Bank, 2014. **State and trends of carbon pricing 2014**. Washington, DC. Available at: **https://openknowledge.worldbank.org/handle/10986/18415**. The World Bank requested that companies, organisations and countries that apply some form of carbon price sign a resolution to this effect in order to demonstrate consensus in the run-up to September 2014's Climate Change Summit in New York. Among the signatories were energy intensive companies (such as BP and Exxon-Mobil), as well as Google, Microsoft, Disney, Walmart and Delta Airlines.

[5] For example, see the companies referenced in the main international sustainability reference indexes: **FTSE4Good, Ethibel Excellence**, Cleantech index, **Global Challenges index,** etc. According to the newspaper "**El País" (12 July 2015)**, "*in recent years we have seen a flurry of announcements from businesses and funds that are disassociating themselves from investments related to fossil fuels. Examples include the announcements from the Norwegian Sovereign Wealth Fund, the Rockefeller Foundation, the AXA insurance company, and the Fourth Swedish National Pension Fund (AP4). This movement is also occurring in other institutions that handle large investment funds, such as the University of Oxford, Stanford, and the Church of England. Meanwhile, there is rapid growth in the so-called 'green bonds', instruments that attempt to attract financing for investments that benefit the environment.*"

[6] World Bank. **State and trends of carbon pricing 2014**.

[7] Organisation for Economic Co-operation and Development (OECD), 2013. **Effective Carbon Prices**, OECD Paris.

[8] Independent advisory entity promoted by the Governments of Colombia, South Korea, Ethiopia, Indonesia, Norway, the United Kingdom and Sweden. For the development of their main project, **The New Climate Economy**, the group collaborated with eight research centres that are international leaders in this field. The panel of economic experts is presided over by Sir Nicholas Stern, author on the first report on the impact of the **Climate Change Economy** in 2006.

[9] The Global Commission on the Economy and Climate, same source.

[10] Mikel González-Eguino and Iñaki Arto (BC3): **Economic impact of the first period of the 2050 Basque Country Climate Change Strategy's implementation**. BC3, 2015.

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[18] IEA, 2014. **Capturing the Multiple Benefits of Energy Efficiency.**

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[20] **http://ec.europa.eu/clima/policies/effort/index_en.htm**, accessed on 5 August, 2015.

[21] Ihobe. **BAC GHG inventory**.

[22] For example, in its **"Competitiveness of the EU Metalworking and Metal Articles Industries" (2009)** report, the DG Enterprise & Industry describes metal-mechanic industry as "nearly invisible", but highly relevant in terms of volume, with 10% value added and 20% of European industrial companies, structurally composed of small companies with little negotiating power to use with clients and suppliers.

[23] **2014-2016 Business Internationalisation Plan**. Basque Government. **https://www.euskadi.eus/contenidos/informacion/planes_programas_2010/es_planes/adjuntos/Plan_de_Inter_Emp_es.pdf**

[24] India INDC to UNFCCC. **India's intended nationally determined contribution**. 2015.

[25] CDP **2014 UK Corporate Environmental Report**.

[26] CDP **Global Climate Change Report 2015**.

[27] Expansión newspaper, 17 July 2015: **"Green products, the business of General Electric, Siemens, and Philips"**.

[28] **"The impacts of environmental regulations on competitiveness"** report (Antoine Dechezleprêtre and Misato Sato), published by the Grantham Research Institute at the London School of Economics, and the Global Green Growth Institute in Seoul, exhaustively reviews the literature published up to 2014 on the subject.

[29] CDP **"2014 Iberia Climate Change Report 125"**. The following companies with connection to the Basque Country appear: Arcelor Mital, BBVA, Gamesa, Iberdrola.

[30] IEA **Tracing Clean Energy Progress** 2013.

[31] The EU's **"Secure, Clean and Efficient Energy"** programme proposes to allocate €5.931 billion between 2014 and 2020 to reduce energy consumption and the carbon footprint, alternative fuels, smart networks, etc. The **"Smart, Green and Integrated Transport"** programme plans to earmark €6.399 billion for the development of efficient, safe and sustainable transportation systems. It is forecast that expenditure related to climate change will exceed 35% of the total 2020 Horizon budget.

[32] See references at **http://www.caterpillar.com/es/company/sustainability/remanufacturing.html**, **http://media.renault.com/global/en-gb/renaultgroup/Media/PressRelease.aspx?mediaid=59603**

[33] Orkestra-Basque Institute of Competitiveness. **2015 Basque Country Competitiveness Report**.

[34] Analysis on the economic impact of climate change generally uses hybrid models (Integrated Assessment Models, IAM) that integrate scientific climate change models with economic growth models.

[35] Château, J., A. Saint-Martin and T. Manfredi (2011), **"Employment Impacts of Climate Change Mitigation Policies in OECD: A General-Equilibrium Perspective"**, **OECD Environment Working Papers**, No. 32, OECD Publishing. Publishing. **http://dx.doi.org/10.1787/5kg0ps847h8q-en**

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