CLIMATLANTIC CONSOLIDATED STRATEGIC DOCUMENT

Local and regional actions for carbon footprint reduction


European Union
European Regional
Development Fund

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Content

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1. Introduction

1.1 The European Atlantic Area: description and challenges.

The historical background

The decades of the fifties and the sixties of the past century were times of intense debate in Western Europe focused on the regional dimension of spatial planning as an instrument to foster economic development. In 1950, the Spatial National Plan was presented in France; in the words of the Reconstruction and Urbanism Minister, Claudius Petit, it aimed at "achieving a better allocation of men in terms of the business activity and natural resources". The first Regional Action Programmes began to be prepared and 15 Regional Development Societies were created. Later, in 1956, 22 Economic Programming Regions were launched. In 1964, already under the power of President De Gaulle, the Regional Development Commissions were created by a decree-law, transforming these Commissions into administrative regions. In 1965, the UK was divided into 11 economic planning regions: Scotland, Wales, Northern Ireland, Yorkshire, South West, East Midlands, West Midlands, South East, North West, North East and East Anglia. With the exception of Northern Ireland, Economic Planning Councils and Economic Planning Boards were created. In Spain and Portugal, the dictatorships and the centralizing nationalism delayed this emerging trend until the fall of both regimes. The Development Plans (Promotion Plans in Portugal) led by the technocratic bodies of both regimes represented a preliminary approach to the need for planning development at regional and territorial level. In Spain, the Constitution promulgated in 1978 defined a new decentralized territorial structure divided into 17 autonomous regions with relevant legal consequences as the administrative competences are distributed among local, regional and national governance levels.

Polycentrism was reinforced in the European peripheries, influencing the creation of the Conference of the Maritime Peripheral Regions (CMPR) in 1972, a pioneer initiative in promoting the concept of Atlantic Area, as a territorial unity with specific characteristics and shared future opportunities. The creation of the Atlantic Area in 1989, in the Portuguese city of Faro, was a natural extension of the CMPR initiative.

Challenges faced by the Atlantic regions

In reflecting on the future of European cohesion, four main challenges were identified that regions will have to face in the next decades[1]: adapting to globalisation, demographic change, climate change and the energy challenge.

Globalisation has stimulated increasing trade flows in recent years and is expected to continue to do so in the future. Although the economic crisis has slowed down this progress, the fastest-growing trade routes are those between the EU and the emerging countries. The rise of the emerging economies has had an important impact on transportation of goods between these countries and the EU and also has consequences on the evolution of passenger traffic through the development of the global economy (e.g. increase of low-cost travel facilities).

[1]REGIONS 2020: An Assessment of Future Challenges for EU Regions

Demographic change will transform the age and employment structures of our societies, raising important issues of both economic efficiency and inter-generational equity. Migratory pressure will have a particularly strong effect on Europe, due to its proximity to some of the world's poorest regions and those likely to be worst affected by climate change and natural resource constraints.

Climate change has become a major concern for the future of Europe. This applies both to efforts to mitigate climate change by tackling the growth in greenhouse gas emissions and the need for measures to adapt to the impacts of climate change.

The need for secure, sustainable and competitive energy represents one of society's main challenges. Limited supply, increased global demand and the imperative to cut emissions have led to a new realisation of the need to move towards a low-carbon economy in Europe.

Together these challenges will impact on the development of Europe's economies and societies over the coming years.

Regional disparities in economic output and income in the European Union are quite large although not so much in the Atlantic Area (AA) regions. However there is a wide diversity of productive structures across the Atlantic Area, more sectoral specialisations in the southern countries and more diversification in the northern part of the AA. Similarly the heterogeneity of the AA can be also detected in terms of the dynamism of regions, levels of production, productivity, employment, transport networks and accessibility, and territorial discontinuities.[2]

Atlantic Area Territorial Typologies

From the territorial structure point of view, the AA area integrates several regions with different urban typologies that in the coming years will not have the same objectives or position with regards to the major topics that influence both urban settlement and transport demand of passengers and goods, namely Demography, Urbanization and Economy.

Thus it would not appear reasonable to have identical recommendations or strategies for all the regions. However, it will not be possible to determine which strategy is optimal for each region or even sub-region. In this case, the approach has been to identify the most significant contexts in which each AA territory can recognize its own situation.

The recent ESPON projects (DEMIFER, FOCI and EDORA) clearly show the differences between AA regions regarding several criteria. The report on metropolitan areas in Europe[3] proposes a complementary approach on the functions performed by cities and agglomerations at the regional or local level in order to organise and control the various social systems that are represented in their territory. Six types of function may be identified:

- Living facilities: housing, shops, crafts, etc.
- Social facilities: transport, health, etc.
- Administration: politics, law& courts, police, etc.
- Innovation & prospective: research, education, innovation, etc.
- Culture: arts, sports, tourisme, etc.
- Economy: industries, services, etc.

[2]Atlantic Spatial Development Perspective
[3]Metropolitan areas in Europe, FRUS, BBSR-Online-PublikationNr. 01/2011

If these functions are combined with the demographic and economic parameters(especially employment), four main types of regions can be defined representing the various structural situations that can be found in the AA regions regarding both territorial organisation and mobility in terms of accessibility to the main centres for daily work or shopping .

1. **Predominantly urban**, dominated by a metropolitan area.
2. Group of equivalent medium sized cities grouped in a **polycentric network.**
3. Medium sized **city with smaller satellites.**
4. **Low density areas.**

Predominantly urban

Such an area is characterised by the existence of a large metropolitan relatively compact city, where urban sprawl is not very marked, which drives the flows both for passengers and goods. This City or Urban community has a high economic performance and attracts companies from several sectors of activity. It contains all the main functions associated with a metropolitan area, such as politics and administration, science and higher education, economics and culture. This corresponds to cities or metropolitan areas with population from 300,000 to 1,000,000 people associated with territories with more than 500,000 inhabitants and a high population density (more than 1000 inhabitants /km^2). Predominantly urban cities and regions in AA are, for instance:

- Bordeaux, Nantes and Le Havre/Rouen for France.
- Manchester, Liverpool, for UK.
- Dublin for Ireland.
- Bilbao for Spain.
- Porto in Portugal.

Polycentric networks

A polycentric area includes an urban network that presents complementarities among its cities, in order for the entire area to become more integrated (FOCI). Cities are of similar size with good communications or located relatively close to each other and low population dispersal in their proximities, although with a tendency to expand.

One key indicator is the travel time between those cities; this time should be short enough to allow a half-day work and back for the rest of the working hours in the origin city. Quite often, functions are dispersed among cities and citizens will go to one city or another to find specific facilities, shops or jobs.

According to the localisation in the AA, the size of the cities might be different. Some networks may group large cities, others smaller. One of the specific characteristics of such areas is the possibility to find jobs and main facilities very close to the living spot, which limits travel, especially commuting to work.

Several examples may be identified in AA such as:

- Poitou Charentes Region is a combination of 2 polycentric areas. The first along the coast (Charente Maritime mainly up to Niort) is located in a dense region and the other parts are in diffuse regions. In both areas, several networks could be identified like La Rochelle/ Rochefort, Poitiers /Chatellerault, Angouleme/Cognac/Saintes…
- Landes area is quite representative of diffuse polycentric; the population density is quite low, people are mainly working near the place where they live and several small cities (Mont de Marsan, Dax) group several functions although not fully developed (for instance no university, local administration, etc.)
- The Atlantic Axis of Galicia (Ferrol-A Coruña-Santiago de Compostela-Pontevedra-Vigo), with derivations to the interior (Ourense and Lugo) via high-capacity roads is an example of medium-sized polycentric network.

City and satellites

In some areas, a city or an urban community dominates smaller satellite cities and contains the majority of the functions. The "living facilities as well as limited social ones" are still in those smaller cities, but jobs, enterprises, hospitals, larger cultural buildings or sports equipment are concentrated in the leading city.

Quite often, smaller cities, characterized by a highly dispersed population, have mainly a residential role, with small shops, local services and crafts; then there is an important commuting flow, not time-consuming since the areas are not large nor very populated but rather intense due to the obligation to benefit from the majority of the functions in the leading city.

Several examples may be identified in AA such as:

- The pays de Loire Region (except the Nantes area) combines the 2 types of areas. In the east and south of the region, activities are organised around two cities: Angers and La Roche-Sur-Yon in a rather dense area. The northern part of the region is rather diffuse and activities are organised around Le Mans and Laval.
- The south of Aquitaine, with Bayonne near the coast and Pau at the east. This is a specific area since the two urban communities have strong links with other communities outside the administrative region, in the Spanish Basque country and with Tarbes in Midi Pyrennées.
- The urban area of Sousa-Baixo Tâmega, integrating several contiguous towns in a densely populated area that giving rise to an extensive sprawling area.

Low density areas

This level encompasses all the areas that are predominantly rural, outside the urban systems, and that are covered only by a network of local centres, mainly small towns or villages. They may be remote or play only a transitional role, and are characterised by a very low population density, low level of economic activity, and no agglomerations large enough as to be classified as medium-sized towns, although in some cases they may have a population of some thousands. These urban centres are here considered as component parts of these structural rural areas, in which they play a key role as central places.

These areas are characterizedby a highly dispersed suburban and rural population and high mobility in private vehicles associated to the difficultyto provide public transport. As they are not directly integrated into the influence of large cities, they suffer from a very marked accessibility deficit and have been unable to escape a process of gradual demographic and economic decline. Obvious examples of this are the Northern interior area of Portugal, inland Galicia and certain areas in the interior of France or Ireland.

The Atlantic Spatial Development Perspective and the territorial organization of the Atlantic Area

Following the conclusions of the Atlantic Spatial Development Perspective[4], the Atlantic Area was segmented into sub-areas facing different development issues as a result of their social, economic and territorial differences. Some sub-areas are considered "motor sub areas", the most dynamic areas with a high potential for development supported by the dynamic of some metropolitan systems and intermediate cities. Five "Motor sub-areas" were identified: Greater Dublin and the South East of Republic of Ireland, The Cardiff-Bristol-West Midlands-Liverpool-Manchester axis, the North-western part of the French Atlantic area, the cross-border area between the North-East of Spain and the South-West of France and, finally, the west Iberian Atlantic Area.

Between these five more developed areas there are large spaces with lower levels of development, lower population, intermediate and small cities with a low level of external connectivity. The reinforcement of the integration of these areas within the dynamic of the "Motor sub-areas" should be increased to achieve a better balance of the Atlantic territory.

Fig. 1.1 Number of challenges faced by each of the regions in the Atlantic Area.

Fig. 1.1 presents the number of challenges each regionin the Atlantic Area will face. They belong to the three groups that will be affected by three or more challenges at the same time. All European regions will be affected. However each of the challenges exhibits a distinct pattern. With the exception of energy[5], all challenges display strong sub-national variations.

The globalisation challenge concerns all the regions of the Atlantic Area. Their impacts on the different Atlantic sub-areas vary significantly considering the differences in the productive systems as mentioned already. Globally the way to respond to the challenge is to improve the productive sectors of the Atlantic Area, to

[4]CPMR/CPPM, AAC, November 2005

[5]The energy challenge is largely determined by national choices on the energy mix as well as national policies choices determining internal and external security of supply. These factors are strongly path dependent with a long term influence far beyond the time horizon of 2020. Distinct socio-economic factors determine thus regional disparities.

foster competitiveness and employment and to enhance the positive participation of Atlantic regions within the globalisation process. The Atlantic Area as a whole can benefit from its maritime dimension and from its specific geostrategic position as an interface between different continents - Europe, Africa, America and Asia. New opportunities appear with the new traffic conditions of the Panamá Canal. Fostering of Research and Development and marine and maritime innovation is a crucial factor to enhance the modernisation and competitiveness of the maritime economy. The development of the transport system, increasing the inter-operability within each mode, the inter-modality and the development of logistics, are keys to generate value from the geographical position of the Atlantic Area and its port systems. It is also a way to contribute to a more sustainable model of development and to fight against the greenhouse gas emission.

Climate change vulnerability

The Atlantic Area is likely to be more vulnerable to climate change than other European regions. Besides of the consequences of climate change, the transfer of population towards coastal zones, unemployment rates and economic issues will have direct relation with transport organisation and mobility demand. Southern regions of the Atlantic Area will obviously have a stronger challenge than those in Britain and Ireland. The range of the impacts on transport is quite large, directly or indirectly from the eventual reductions of land and increase of flood risks to the population moves and agricultural production changes. To face these challenges a two-fold strategy should be implemented: firstly a strategy that includes measures to reduce the emission of greenhouse gas emission from the transport system and from the productive sector, secondly a strategy for the adaptation of Atlantic regions to the short-term impacts of the climate change.

In spite of the diversity of the Atlantic Area, these regions will follow the same global trends that impact the whole EU; ageing people, increasing of immigrant flows, falling population in some regions. Nevertheless, since 2008, the demographic dynamics of some countries, such as Spain, Portugal and Ireland, reversed due to the sharp decrease in economic growth.

Concerning energy, Ireland appears quite vulnerable, more than Portugal and western Spain; France and most of England are less so. The Atlantic Area has good conditions to tackle the energy challenge by increasing the production of renewable energies, inland and offshore. Marine energies (wind, currents, waves, tide) are an important asset to be developed in the future in the Atlantic region, thus potentially contributing to reduce greenhouse gas emissions.

1.2 International and national policies to tackle climate change

Historical background

The earliest influence of European policies tackling climate change may be found in the Environment International Conference, held in Stockholm, in 1972 and in the meeting of the Presidents of State and Governments of Europe. The EEC Environment Action Plan (1973-1976) was the consequence of these initiatives. The sustainable development concept only emerged at the V Environment Action Plan, completed with the special focus on the environment (impacting economic sectors (transports, energy, industry, agriculture and tourism), in line with the conclusions of the Rio de Janeiro Earth Summit (1992).

The VI Environment Action Plan (2000-2010) already encompasses instruments targeted at tackling climate change, within the framework of the Kyoto agreement, which was ratified by the EU in May 2002.

Finally, on January2008, the Commission presented the Energy Plan for 2020, fostered by the emergence of climate as a concern of academia and media. Three key actions dominated the Plan: to reduce by 20% GHG emissions; to ensure that at least 20% of the energy consumed came from renewable sources, and to save 20% of energy through improved energy use efficiency.

Prospects

All countries in the Atlantic Area aim at reducing greenhouse gas emissions in response to the threat of climate change. This is evidenced by the position in policy, both across the individual countries and EU-wide, of measures to address man-made greenhouse gas emissions.

Key EU and International strategies developed to tackle climate change are:

- The United Nations Framework Convention on Climate Change[6];
- The EU's sustainable development strategy[7] (formerly the Gothenburg Agenda);
- Europe 2020[8] (the successor to the Lisbon Agenda).

The United Nations Framework Convention on Climate Change agreed that all members should take account of climate change considerations in social policy and actions, and that they would "promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation in this process, including that of non-governmental organisations."

The EU's sustainable development strategy set out the European vision for sustainable development principles across EU member states. Its overall goal was to "...support and promote actions to enable the European Union to achieve continuous improvement of quality of life for both current and future generations, through the creation of sustainable communities able to manage and use resources efficiently and to tap the ecological and social

[6] http://unfccc.int/resource/docs/convkp/conveng.pdf
[7] http://ec.europa.eu/environment/eussd/
[8] http://ec.europa.eu/europe2020/index_en.htm

innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion."

Europe 2020 was proposed by the EC in March 2010. It laid out a strategy to aid the recovery of Europe's economy, and to boost growth and employment. It has five headline targets, which are to:

- Raise the employment rate of 20-64 year olds.
- Achieve a 3% target of investment in R&D.
- Reduce greenhouse gas emissions by at least 20% compared to 1990 levels.
- Reduce the share of early school leavers and increase the share of the population completing tertiary education.
- Reduce the number of Europeans living below the poverty line.

Additionally, the open coordination method is still present in the Europe 2020 strategy. Each objective depends not only on EU policies but also on national policies, which are implemented through national climate change plans.

The UK Climate Change Act set a legally binding target in the UK of at least 34% cut in greenhouse gas emissions by 2020 and 80% cut in by 2050,both against a 1990 baseline.

The UK's Low Carbon Transition Plan, National Strategy for Climate and Energy, 2009[9] set out the country's strategy for achieving GHG emission reductions by 2020. It mandated that all departments should produce their own plan, showing how they would adhere to a carbon budget.

The Portuguese National Climate Change Strategy (PNAC)[10] set out the policy, measures and targets for responding to climate change challenges within the EU strategy. It set out predicted emissions to 2020 in both a high-emission and a low-emission scenario. Launched in 2004, revised in 2006 the PNAC incorporated additional measures to tackle the greenhouse gas emissions in the beginnings of 2008 in the fields of energy and transport. More ambitious targets were introduced concerning the increasing production of renewable energies and the development of biofuel in parallel with other measures to reduce the utilisation of transport by car. Each measure was to be monitored to assess the accomplishment of the objectives and to introduce any required adjustments.

In its National Climate Change Strategy 2007-12, the Irish Government set out its plans for GHG reduction up to 2020.Sectoral targets and measures were set out for energy supply (electricity 33% renewable, 30% biomass substitution in peat-fuelled power stations), transport (shift to public, biofuel substitution, public procurement), residential (tighter building regulations, energy rating certification), industry and commerce (bio-heat and CHP promotion)and agriculture (better manure management, increased afforestation). It charges the public sector to achieve a 33% improvement in energy use efficiency by 2020.

[9] http://www.decc.gov.uk/assets/decc/white%20papers/uk%20low%20carbon%20transition%20plan%20wp09/1_20090724153238_e_@@_lowcarbontransitionplan.pdf
[10] http://www.apambiente.pt/POLITICASAMBIENTE/ALTERACOESCLIMATICAS/PNAC/Paginas/default.aspx

France has set out a strategy to deal with global climate change in the Climate Plan[11], which represents a global agreement involving the State, local authorities, trade unions, professionals and environment-focused associations. France is one of the industrial economies with low GHG emissions. In fact, it is with Portugal significantly below the EU average. The Climate Plan goal aims at reducing by 22% the GHG emissions between 2005 and 2020.The reduction will be implemented through the following policies:

- Residential sector: there is a target of 56% reduction, involving the generalisation of low-consumption buildings in 2012 and in 2020 all the new buildings should be positive energy based, that is to say, the energy generated in the building should be higher than the spent primary energy by means of (i) a 38% reduction of the consumption of the existing buildings, (ii) creating eco-credits inclusively with zero interests rate and (iii) renovating public and social buildings.
- Energy industries: there is a goal of 42% reduction by closing one half of heat coal units, energy efficiency and renewals energy development.
- Transport: 11% reduction, (i) investing in new infrastructures based on railway, river and maritime transports, (ii) a bonus-malus system concerning the acquisition of new vehicles, (iii) eco-tax perkm for trucks on highways.

The Spanish Climate Change and Clean Energy Strategy[12], completed with the regional plans and the measures adopted by the Network of Spanish Cities, sets out the national commitment to reduce GHG emissions. Spain is slightly above the EU GHG emissions average. The strategy is targeted at stabilizing the growth of GHG emissions balancing the environmental commitments with the economic development of the country. According to the strategy, a 37% increase in GHG emissions is expected in 2012 with respect to 1990 values (20% in buying carbon credits). The adoption in 2006 of a Building Technical Code was the principal measure that has been implemented, determining the installation of solar heating and photovoltaic panels aiming to save 40% in energy consumption. The increase of the forest area as a carbon sink, the fight against forest fires, the fostering of organic agriculture and reduction of traditional agriculture are additional measures. The interventions targeted at sectors presenting higher levels of GHG emissions:

- Transport: Increased integration of spatial planning and transport; modal change focused on railways (48% of the investments), maritime transports, public transport and non motorised ways of urban mobility; demand management programmes targeted at reducing congestion in cities and rationalisation of the public transport system in the low density places.
- Residential sector: application of the Building Technical Code, grants and other aids to adapt buildings to the new environmental norms; full replacement of the Community Coal Boilers in 2012; citizen awareness campaigns focused on saving energy consumption.

The Covenant of Mayors initiative, a movement involving local and regional authorities that commit themselves to increase energy efficiency and use renewable energy on their territories aims at contributing to the European Union 20% CO2 reduction objective by 2020.

[11] http://www.developpement-durable.gouv.fr/Le-plan-climat-de-la-France.html
[12] http://www.mma.es/secciones/cambio_climatico/documentacion_cc/estrategia_cc/pdf/cle_ene_pla_urg_mea.pdf

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1.3 Climate change as a basis for a common strategy for the Atlantic Area.

The emerging role of macro-regions in allocating EU funds and in contributing to the design of new programming periods strategies should be taken into consideration in every EU policy. The Climatlantic project is a good opportunity to implement this guideline within the framework of the EU climate change strategy. The Atlantic Area Cities' experiences should be understood as a valuable heritage to build a strategy for a new European macro-region targeted at organizing and enhancing the Atlantic Area. This macro-region should integrate not only Atlantic continental territories, but also Great Britain and Ireland as well as the islands representing the Macaronesia territory (Azores, Canarias, Cabo Verde, Madeira and Ilhas Selvagens) and involve regions and national governments in a coherent action plan.

The policies targeted at tackling climate change, when they are seen from the perspective of the Atlantic Area and of the development priorities of an emerging macro-region, are beyond the simple status of a climate change policy tool. Climate change should be a focus of policy intervention in the Atlantic Area in similar terms to those of the European space as a whole. In fact, the phenomena and trends that climate chance strategy wants to tackle affect the European territory as a whole, independent of regional and local diversities.

For the Atlantic Area, climate change strategy and policies represent a true opportunity to design and implement a new growth and development model for these territories. The new Atlantic macro-region strategy needs to go beyond a simple maritime strategy. Notwithstanding the relevance of maritime issues for the future of the Atlantic Area, the competitiveness challenges faced by the Atlantic regions need to be approached and solved through a new development model. Traditionally, the Atlantic regions are oriented to establish solid links with the central and continental territories of Europe. The orientation towards the core of the European space is predominant, and naturally flows with this core territory tend to be more relevant than those that they are developed between the Atlantic regions themselves along the Atlantic façade. But one cannot ignore that historically Europe has a tradition of international vocation and projection. The future of Europe is linked to America and Asia. Today, with the enlargement of the Panama Canal, the Atlantic is the obvious intermediation space of the European links with these territories.

So, the Atlantic regions cannot be vulnerable and strictly dependent on the flows with the core and more developed territory of the European Union. The Atlantic regions should be seen as a new growth space, combining maritime and territorial policies. In this approach climate change policies provide an opportunity to create new avenues for growth, transforming the competitive advantages of these territories.

To achieve these ambitious goals, the dominant productive clusters prevailing in the economic fabric of the Atlantic regions should be considered. Agro-food activities, forest, fishing and aquaculture, textiles, apparel and shoes, tourism, shipbuilding and aerospace industries are good examples of the resilience of the industrial tradition of these territories. The best indicator of this resilience is the magnitude of industrial employment represented by these clusters, despite the loss of jobs generated by the structural adjustment of them to the new globalization perspectives.

The climate change approach is a good opportunity to simultaneously increase innovation performance of the more traditional clusters and foster emergent knowledge-based activities.

Climate change policies require the incorporation of higher intensity levels of knowledge, a key topic for the Atlantic Area in order to involve more traditional clusters and emergent activities in the same approach.

The interpretation of the potential role of climate change approach in the Atlantic Area fits well with recent analytical surveys about this territory. Crucial threats and negative impacts of the globalization trends have been identified. But there is a vast set of opportunities (one of them is the good value for money of its diversity) that are still waiting to be discovered by entrepreneurs and policy agents.

The climate change approach is also an instrument to help building an Atlantic macro-region with a double vocation, maritime and territorial. GHG emission reduction, dissemination of renewable energies, new patterns of mobility and accessibility targeted at reducing the carbon footprint all require the combination of maritime and land interventions, exploring the close proximity of the maritime façade and the excellence of inland territories. A new competitiveness model for the Atlantic Area can be built, without replying in a mimetic way the priorities and innovation trends and the core European regions. Climate change policies are then a key instrument to prevent diversity in Europe and transforming it into a growth factor.

1.4. Aims of the Climatlantic project

The overall aim of the CLIMATLANTIC project is to foster the development of strategies at regional and local level aimed at reducing the carbon footprint in the European Atlantic Area. Initially this is to be achieved by setting up think-tanks drawn from participating regions to develop a list of proposals for strategic actions and policy changes and to draw up a list of pilot projects to be planned, executed and evaluated in one or more regions. The strategic analyses delivered by the Climatlantic Think Tanks are mainly conceived as helpful instruments for key decision makers at the local, regional and European levels.

The CLIMATLANTIC project set up four thematic think-tanks addressing key topics where substantial reductions of the carbon footprint of the European Atlantic Area are envisaged: Energy and Mobility, both of them focussed directly on ways of reducing their associated GHC emissions and Spatial Planning and Social Behaviour, where it is examined how urban development plans, transport systems and public attitudes might be modified in ways that would lead to GHG reductions. Additionally, a fifth think-tank aims at developing a strategy for the reduction of the carbon footprint of the European Atlantic Area from the diagnosis and recommendations defined in the four thematic think tanks. We are aware that the series of actions and recommendations emerging from the four main topics addressed by Climatlantic should be complemented by further initiatives related to the role of information communication technologies in the reduction of the carbon footprint of the Atlantic Area. Nevertheless, we believe that the sources of GHG emissions considered in this report are likely to contribute to a large fraction of the total carbon footprint of the European Region under study.

Each of the five think-tanks was coordinated by experts in the field and fed by the corresponding pillar working groups formed by experts nominated by the different organizations acting as partners in this Project. A limitation of the strategy adopted for the elaboration of the present strategic document is that a certain degree of heterogeneity is likely

to emerge in the final product. Nevertheless, although being well aware of this potential shortcoming, we believe that the high level of expertise needed to tackle each of the considered topics in depth, justifies the option finally chosen.

All the pillars have an interest in GHG emissions from transport. Possibilities for abatement of GHG emissions from the transport sector by reduction of fuel use are a direct concern of the Mobility Pillar. From an Energy Pillar perspective, increases in the supply of transport biofuels and in the use of electric cars charged by renewable electricity are of interest. The horizontal pillars are also concerned with the ways in which spatial development and public attitudes affect transport patterns and the resulting emissions.

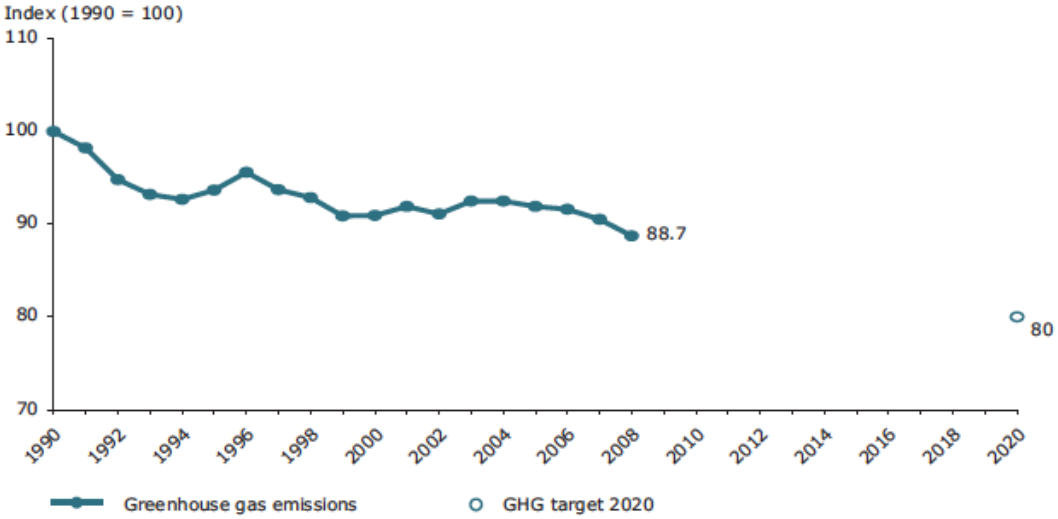
In the commercial and residential sectors, space and water heating are important energy uses; so more energy-efficient building construction and operation along with an increase in the use of biomass fuels and solar water heating are possibilities for GHG abatement. For public authorities, operations such as refuse processing and water pumping are significant energy consumers with potential for GHG abatement.

2. The carbon footprint of the Atlantic Area

The carbon footprint refers to the total amount of greenhouse gases produced in a given territory to support human activities either directly or indirectly. It is usually expressed in equivalent tons of carbon dioxide (CO_2).

2.1. GHG emissions in Europe: global magnitudes and shares among sectors.

The Annual European Union greenhouse gas inventory 1990–2008 and inventory report 2010 published by the European Environmental Agency shows that the Total GHG emissions, without LULUCF, in the EU-27 decreased by 11.3 % between 1990 and 2008 (627 million tonnes CO2-equivalents)(Fig.2.1).



Note: GHG emission data for the EU-27 as a whole, refer to domestic emissions (i.e. within its territory) and do not include emissions and removals from LULUCF; nor do they include emissions from international aviation and international maritime transport. CO_2 emissions from biomass with energy recovery are reported as a Memorandum item according to UNFCCC Guidelines and not included in national totals. In addition, no adjustments for temperature variations or electricity trade are considered. The global warming potentials are those from the 1996 revised IPCC Guidelines for National Greenhouse Gas Inventories.

Figure 2.1. EU-27 GHG emissions 1990–2008 (excluding LULUCF)

In the EU-15, total GHG emissions in 2008, without LULUCF, were 6.5% (274 million tonnes CO2-equivalents) below 1990. Emissions decreased by 1.9% (76 million tonnes CO_2-equivalents) between 2007 and 2008.

By far the most important sector responsible for EU-27 GHG emissions in the 1990–2008 period is energy (i.e. combustion and fugitive emissions) accounting for 79.1% of total EU-27 emissions in 2008. The second largest sector is Agriculture (9.6 %), followed by Industrial Processes (8.3 %).

[1]European Environment Agency, Annual European Union greenhouse gas inventory 1990–2008 and inventory report 2010. Submission to the UNFCCC Secretariat. EEA Technical Report No 6/2010. www.eea.europa.eu.

By contrast, three areas show a large positive trend in EU27 CO2 emissions[13] . These are:

- International maritime transport;
- International aviation;
- Land surface transport.

This sectoral information is summarised in the chart below[14]

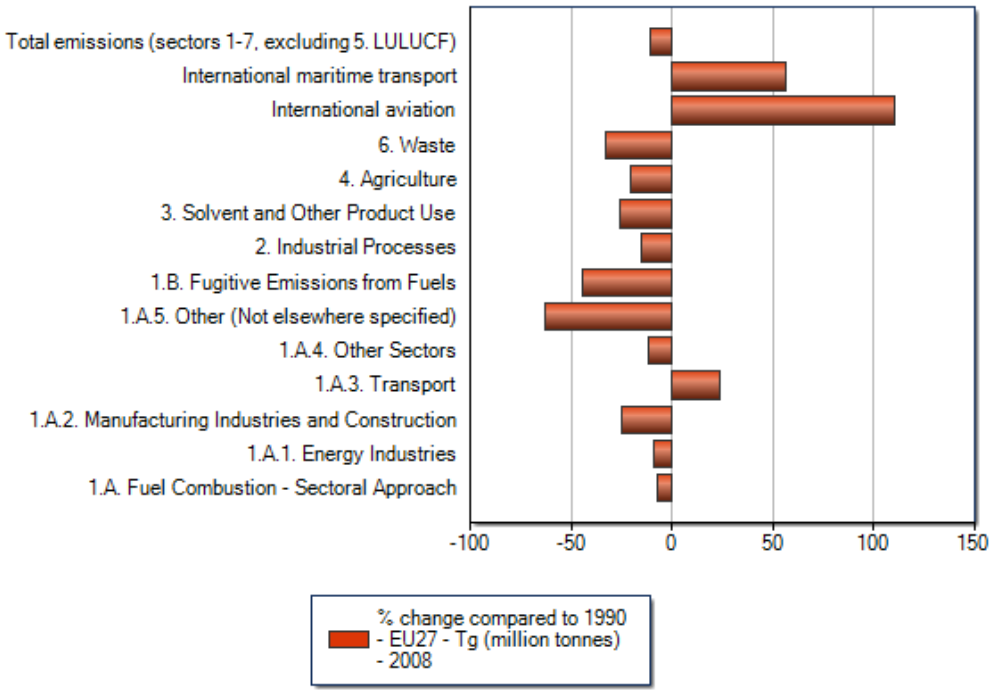


Fig. 2.2. 2008 GHG emissions by area compared to 1990.

2.2. GHG emissions in the Atlantic Area.

Of the five countries with regional participants in the project, greenhouse gas emissions per person in 2008 were highest in Ireland, mainly due to its land use practices (Fig. 2.3). The UK, with the highest population density, had the highest emissions per unit area.

A breakdown by sector of the primary sources of greenhouse gas emissions in 2008 in the member states of the five participating regions has been extracted from the European Environment Agency's greenhouse gas inventory[15]; a summary is shown in Fig. 2.4. There are considerable differences between countries.

In the UK, their large energy industry sector accounts for over 40% of their emissions. In France, the transport sector is their biggest emitter. In Ireland, agriculture is responsible for

[13] http://dataservice.eea.europa.eu/
[14] Source: http://dataservice.eea.europa.eu/
[15] European Environment Agency, 2010. Greenhouse gas inventory 1990-2007 and inventory report for 2008. www.eea.europa.eu.

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almost one-third of GHG emissions, due largely to its high cattle numbers, low afforested area and large peat-land area. In Spain and Portugal, energy, other industries and transport account for most of the emissions (Fig. 2.4).

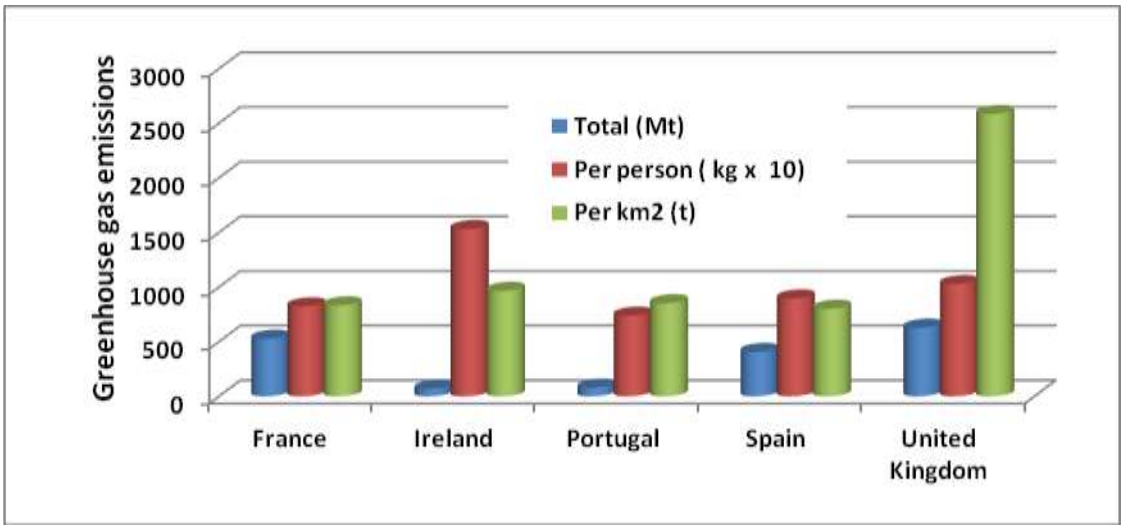

Fig. 2.3: Greenhouse gas emissions in 2008 per head of population and per unit area of the countries of the five participating regions.

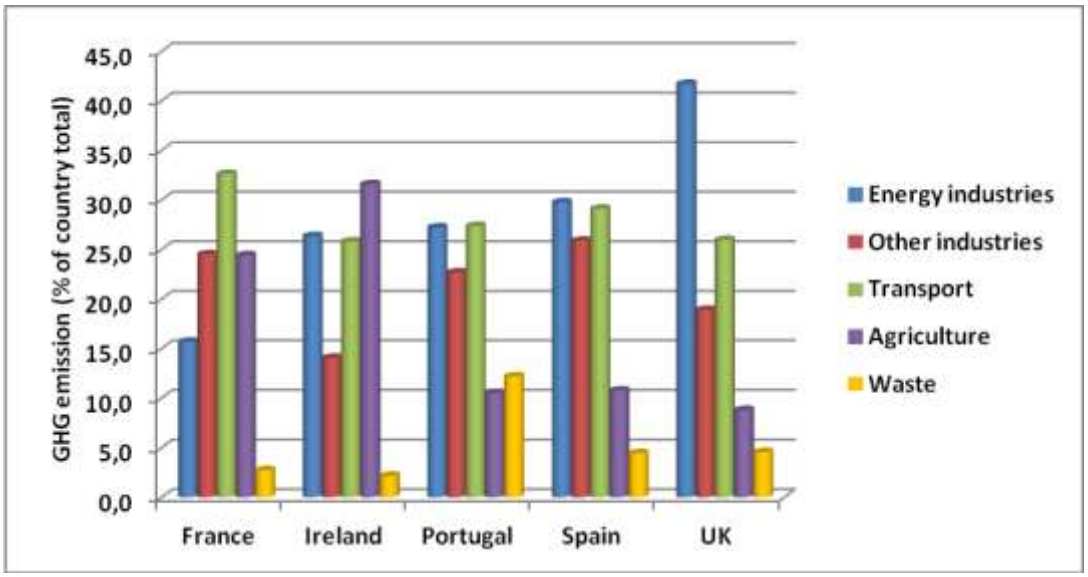

Fig. 2.4: A breakdown by source of the greenhouse gas emissions from the countries of the five participating regions.

Available details of GHG emissions in the various regions are generally broken down by user rather than by primary source. Nevertheless, they give some indication of differences between national and regional trends.

France, Quimper Communaute, COMAGA: In comparison with all of France, Brittany with its large agricultural area has higher emissions from transport and agriculture; but Greater Quimper, being mainly urban, has low emissions from agriculture and almost half its total emissions from passenger and freight transport (Fig. 2.5). Brittany, with its large rural area, is concerned to increase the production and use of biofuels both for transport (from arable

crops) and heating (biogas, wood residues, energy recovery from waste). In Quimperthe focus is in three areas:

- *Transport*: Increasing the use of public transport, driver training etc.
- *Public buildings:* Survey of energy efficiency, assessment of solar thermal potential.
- *Residential housing stock:* Promotion of thermal renovation, assessment of aerial thermal imaging.

Both region and municipality also share a concern to improve the security of the electricity supply by shedding load in an orderly way in peak-demand periods.

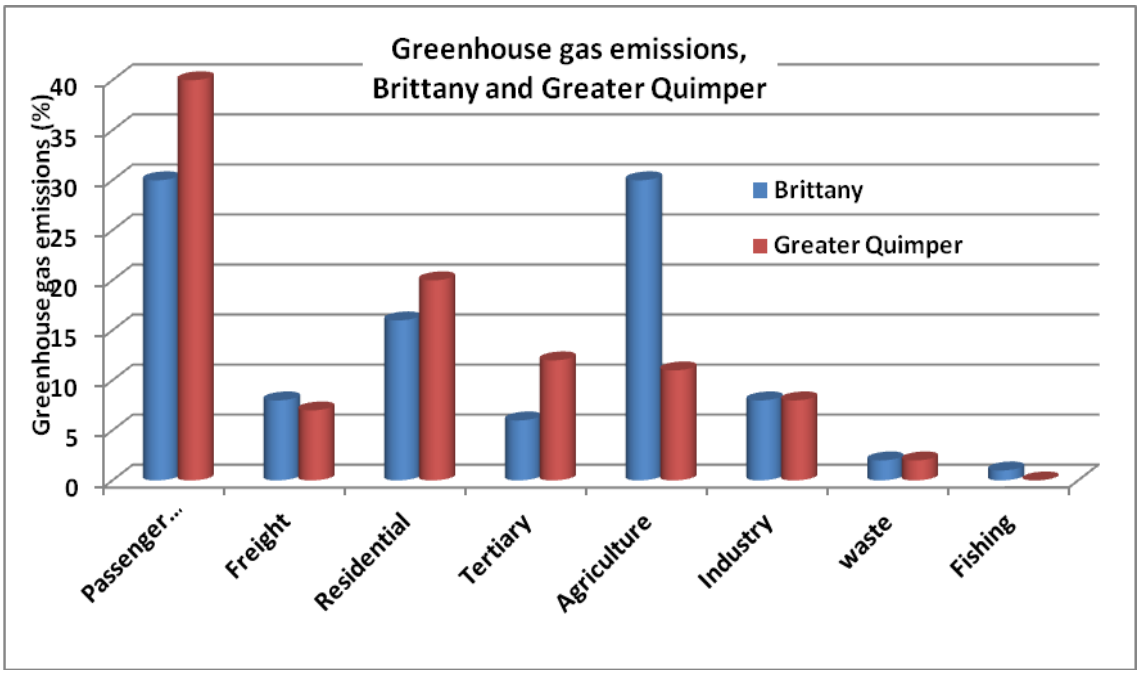

Fig. 2.5: Greenhouse gas emissions, Brittany and Greater Quimper

Similarly in Grand Angouleme, if one excludes five major energy industries that operate within a national emission trading scheme and are therefore not amenable to local intervention, transport accounts for half the total emissions, residential use for 21%, and agriculture is insignificant (Fig. 2.6). So here again, although their regional plans include many aspects of renewable energy and efficiency measures, it is reasonable that reduction of the emissions arising from transport should be the main focus.

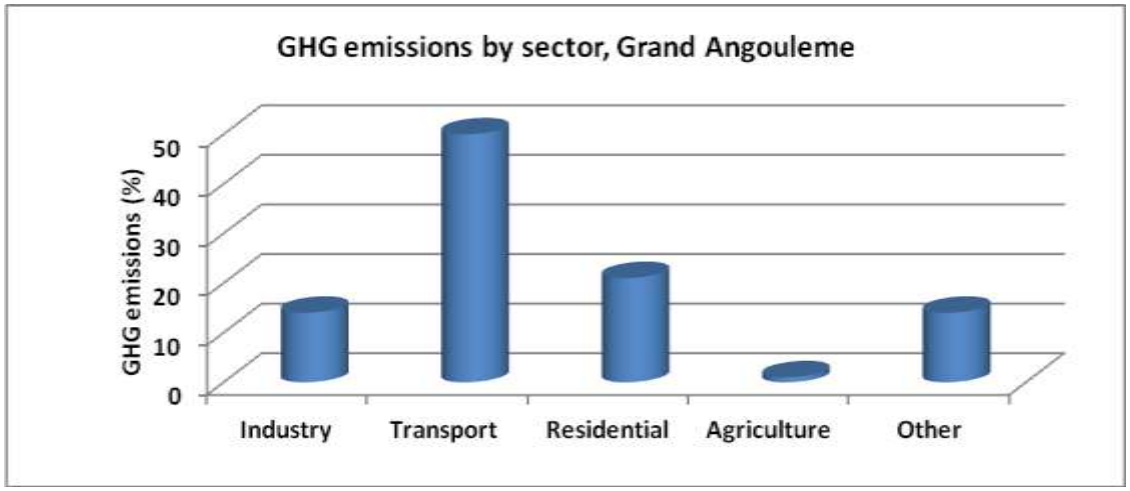

Fig. 2.6: Greenhouse gas emissions, Grand Angouleme

Spain-Portugal (Galicia-Northern Portugal): In the Eixo Atlantico cities of Galicia-N.Portugal transport is the biggest GHG producer, more so than in all of either Spain or Portugal (Fig. 2.7). Energy production is also a substantial GHG producer, due mainly to the production of electricity for export in a number of coal-burning plants in Galicia.

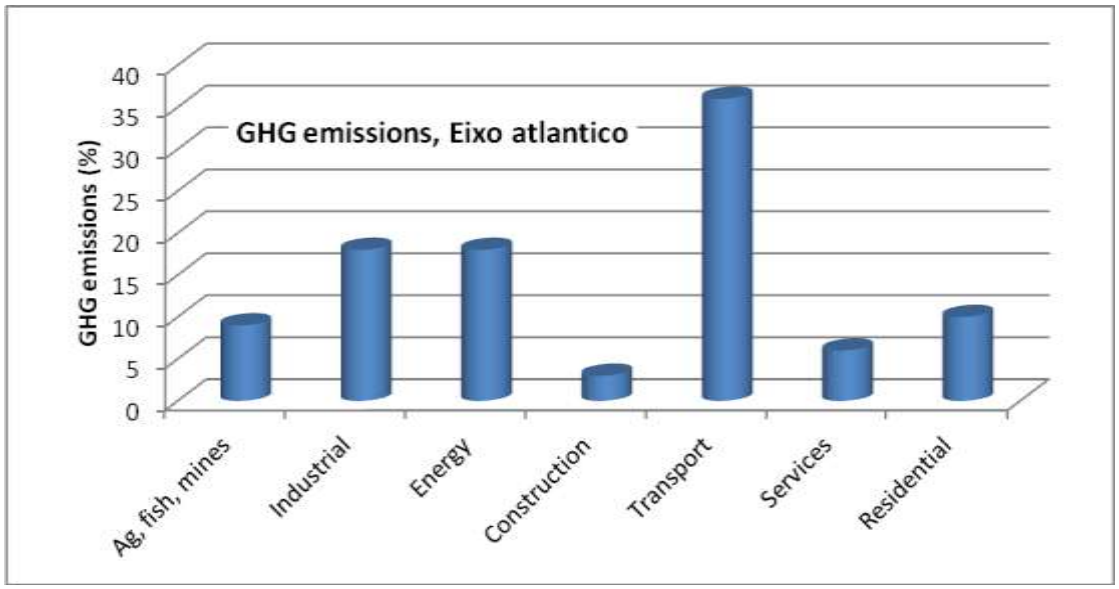

Fig. 2.7: GHG production by sector, Eixo Atlantico area.

UK, North-West Region, Merseytravel: In the North-West of England, GHG emissions by user fall mainly into three categories: industrial/public/commercial (44%), residential (29%) and road transport (26%). The transport energy contribution is similar to the rest of the UK; although not as dominant as in the French regions, it is still a substantial contributor to GHG emissions and is of particular interest to Merseytravel.

Ireland, South-East Region: There are no official GHG statistics available for the South-East Region of Ireland. However, it is reasonable to assume that the breakdown is similar to that for the whole of Ireland, with the probability of agriculture contributing an even greater proportion in the South-East Region. On this basis it may be assumed that agriculture, transport and energy industries are the main primary sources of GHG emissions in the region.

In view of these trends, it would be appropriate if SERA were to propose strategic initiatives or initiate a pilot action aimed at reducing GHG emissions from the agricultural sector. But the prospects for replication of such a project in other regions would be low. Also it is difficult to devise a strategy to reduce emissions from this sector while still maintaining its economic viability; this problem was highlighted at a recent Irish conference[16]. Finally, emissions from agriculture are mainly in the form of methane and N_2O, and are not closely related to energy use.

[16]Teagasc + Association of Applied Biologists, 2010: Proc. Conf. "A climate for change: opportunities for carbon-efficient farming". Dublin, May 24-5, 2010.

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3. Energy policies for the reduction of the carbon footprint at the local and regional level

3.1. Energy in the European Atlantic countries involved in CLIMATLANTIC

All the member states in the project are dependent to some extent on imported energy (Fig. 9). UK, with its North Sea hydrocarbon reserves and France, with its nuclear industry, are nearest to self-sufficiency (Fig. 3.1). The others depend very heavily on imports of oil, gas, coal or electricity.

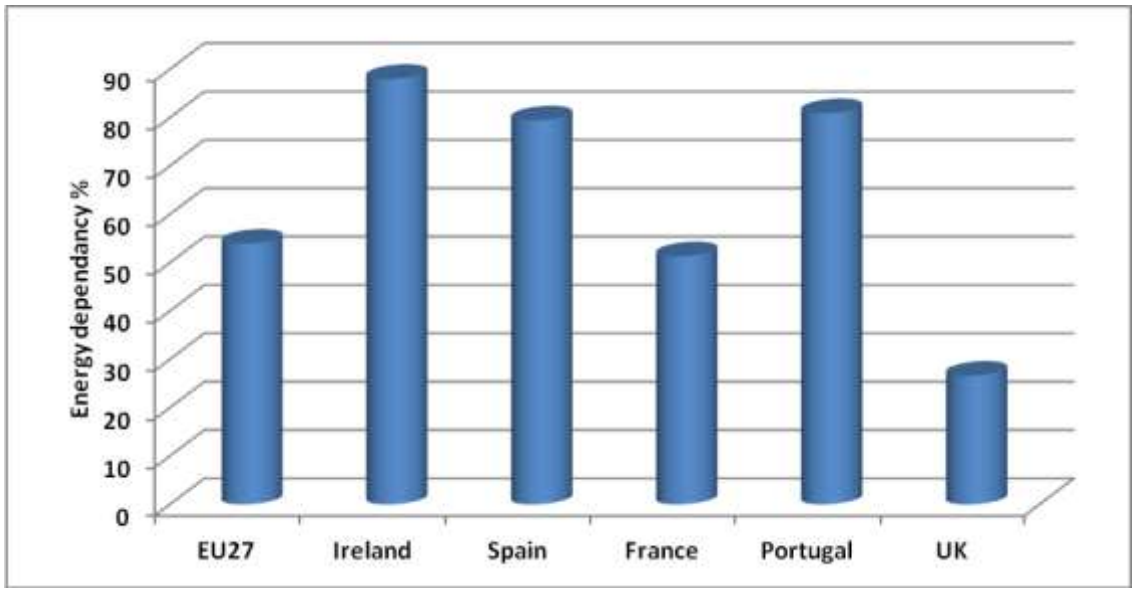

Fig.3.1. Energy dependency of EU27 and five member states, 2009 (Source: Eurostat)

Oil, gas and to a lesser extent coal are the main fuels used in all countries. Over 40% of French energy supply is from nuclear; only Portugal has a proportion of renewable use over 10% (Fig.3.2).

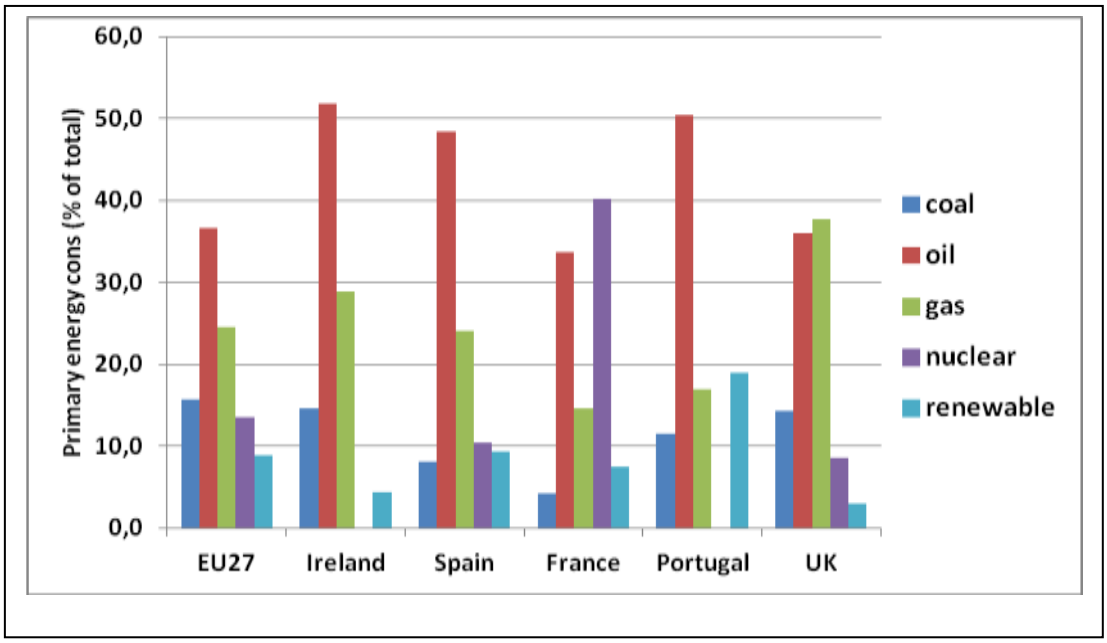

Fig. 3.2: Primary energy consumption by source, 2009 (Source: Eurostat)

Biomass (mainly wood) is currently by far the greatest contributor of renewable energy in each country (Fig. 3.3). Wind is more important in the partner countries than in the EU27, and has great scope for expansion in most AA countries. Hydro and geo-thermal make some contribution, but with less potential for expansion. Solar energies contribute very little at present, but could play a much bigger role in the future especially in southern AA countries.

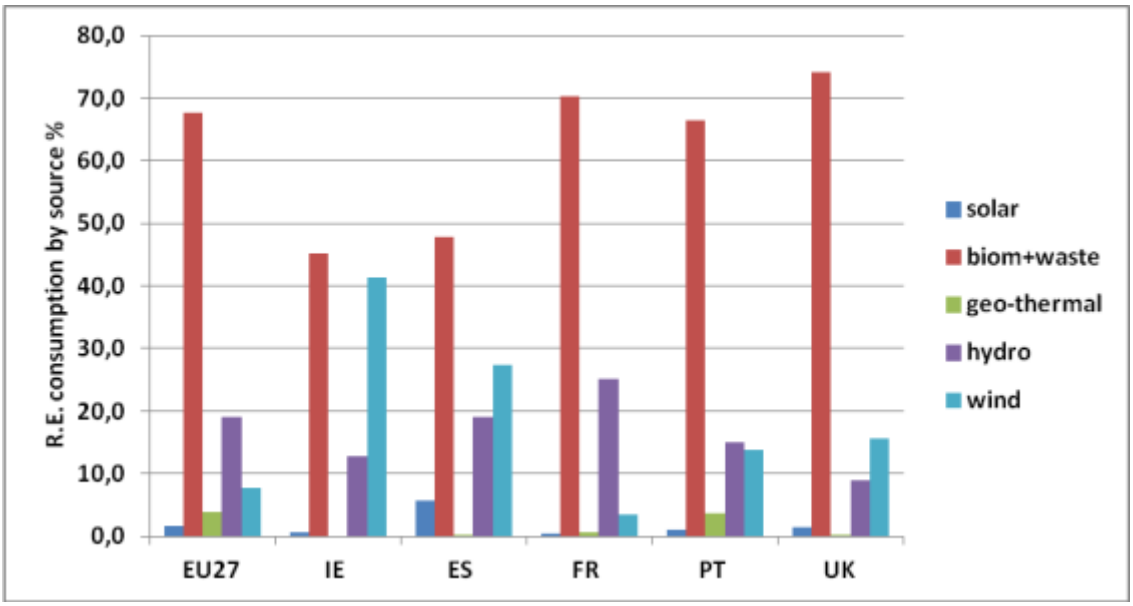

Fig. 3.3: Renewable energy consumption by source (source Eurostat)

3.2. Renewable energy action plans

Each EU Member State is obliged to submit an Action Plan for the achievement of 2020 renewable energy targets as set out in the Renewable Energy Directive of 2009[17]. It is important that any policy recommendation or pilot action emanating from the current project should take these National Action Plans into account. Summaries of each Member State's plans are on the European Environment Agency's website[18].

The Action Plans are required to specify the amounts of renewable energy each country proposes to supply as electricity, transport energy and heating/cooling. Of the five countries with participating regions, all except France propose to supply about half their 2020 target as renewable electricity (Fig. 3.4). France and Portugal have set the highest targets for heat production. The 10% substitution target for transport energy is mandatory, so the differences between countries reflect mainly differences in the amounts of fossil transport fuels used in those countries.

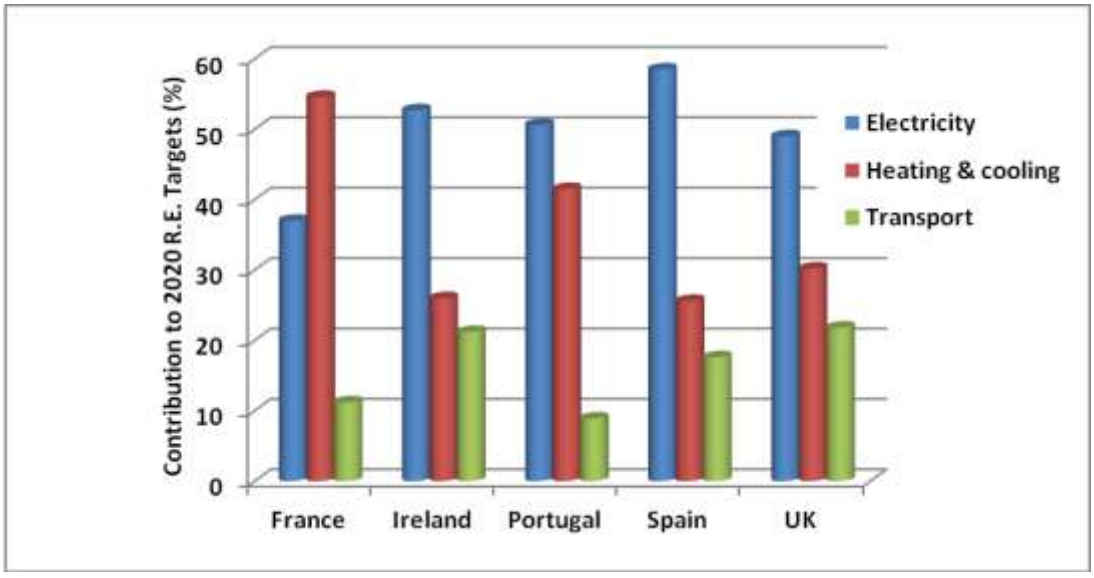

Fig. 3.4: Relative contributions of renewable energy forms to the 2020 Action Plan targets

The Plans also specify the technologies to be used for the production of the renewable energy. As might be expected, wind energy is destined to become an important source of renewable electricity in all Atlantic-facing countries (Fig. 3.5), but especially in Ireland and the UK with their high wind speeds (Fig. 3.6). Most of this increase is seen as coming initially from on-shore installations, with off-shore increasing in the longer term. Hydro generation is already significant in three countries but has little scope for further expansion; only Portugal is proposing a substantial expansion of this resource. Solar (in the more southerly countries) and biomass are also intended to make significant contributions; geo-thermal and wave/tidal are seen as longer-term options that will make little contribution by 2020.

[17]Commission of European Communities, 2009.Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources.
[18]European Environment Agency, 2010.Taking a closer look at Europe's renewable energy plans for 2020. www.eea.europa.eu.

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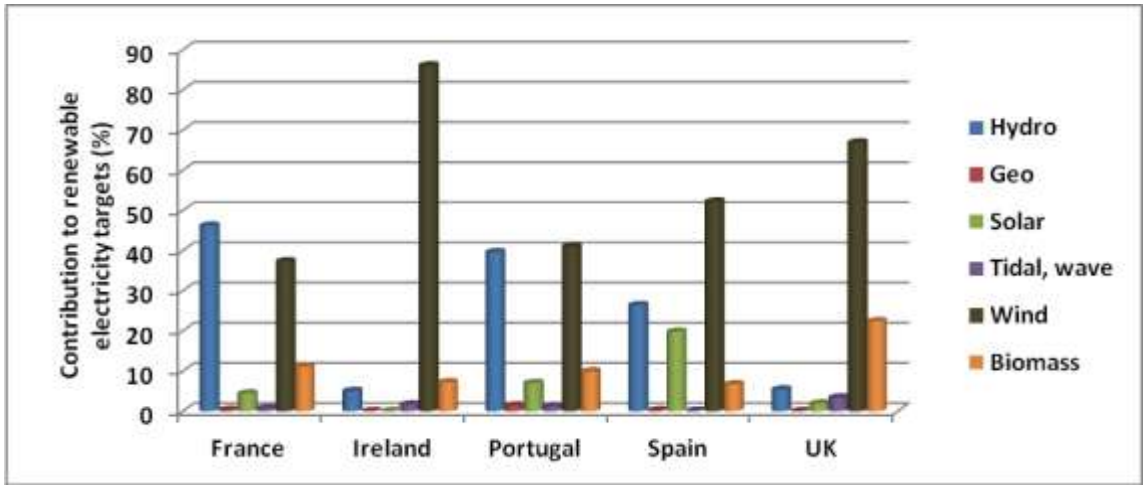
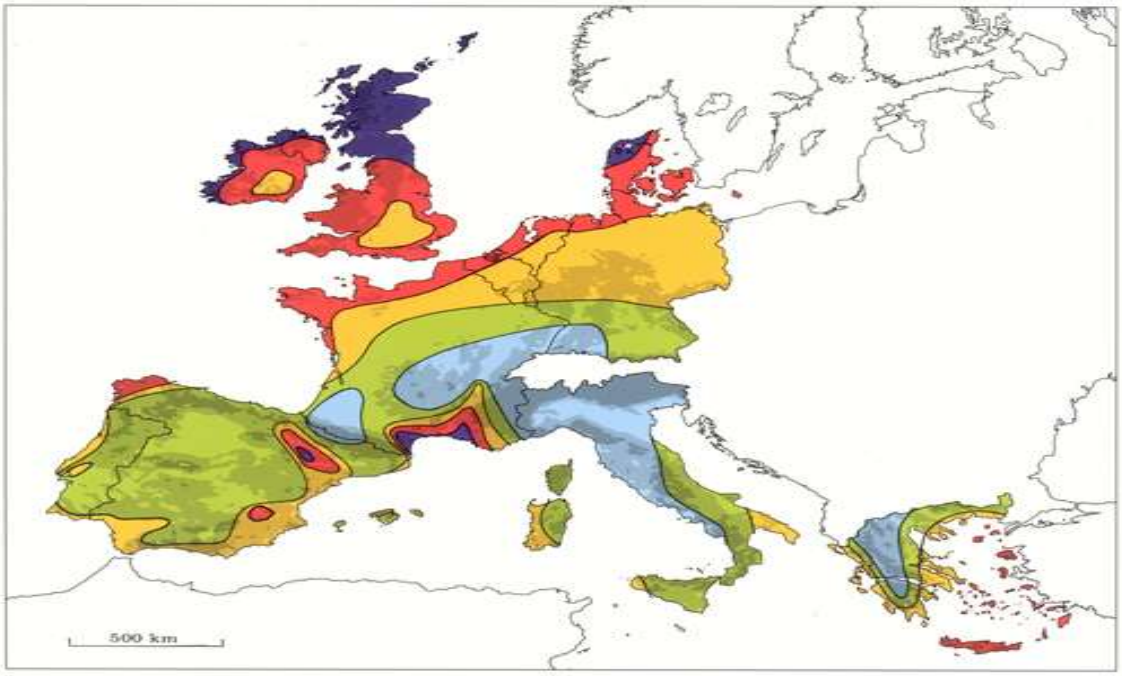


Fig 3.5: Sectoral contributions to 2020 renewable electricity production in National Action Plans



Wind resources[1] at 50 metres above ground level for five different topographic conditions

	Sheltered terrain[2]		Open plain[3]		At a sea coast[4]		Open sea[5]		Hills and ridges[6]	
	$m\,s^{-1}$	Wm^{-2}	$m\,s^{-1}$	Wm^{-2}	$m\,s^{-1}$	Wm^{-2}	$m\,s^{-1}$	Wm^{-2}	$m\,s^{-1}$	Wm^{-2}
	> 6.0	> 250	> 7.5	> 500	> 8.5	> 700	> 9.0	> 800	> 11.5	> 1800
	5.0-6.0	150-250	6.5-7.5	300-500	7.0-8.5	400-700	8.0-9.0	600-800	10.0-11.5	1200-1800
	4.5-5.0	100-150	5.5-6.5	200-300	6.0-7.0	250-400	7.0-8.0	400-600	8.5-10.0	700-1200
	3.5-4.5	50-100	4.5-5.5	100-200	5.0-6.0	150-250	5.5-7.0	200-400	7.0- 8.5	400- 700
	< 3.5	< 50	< 4.5	< 100	< 5.0	< 150	< 5.5	< 200	< 7.0	< 400

Fig. 3.6: The European wind energy resource

Most of the renewable heat target is planned to come from biomass in all countries (Fig. 3.7). This will be mainly wood residues, but with a significant requirement for short-term energy crops as well. Renewable energy from heat pumps and solar thermal installations will contribute in some countries.

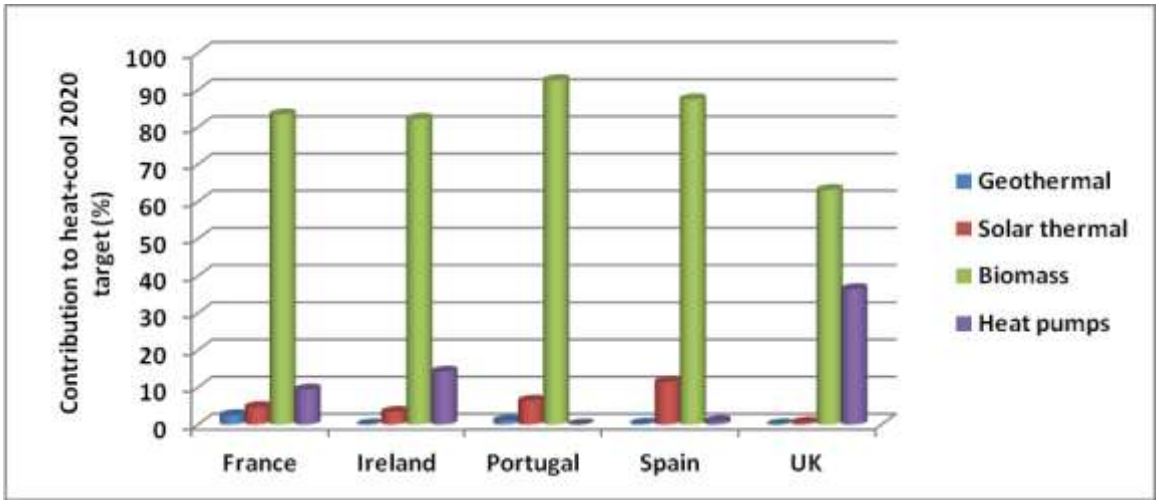


Fig. 3.7: Proposed sources of renewable heating and cooling 2020 energy targets

Partner countries plan to keep their transport biofuel use close to the minimum needed to meet their 10% substitution target. They are relying heavily on biodiesel to meet their targets, with a much lower adoption of bio-ethanol (Fig.3.8). This trend is repeated throughout the EU27, with biodiesel expected to provide 75% of the mandatory 10% target and with 80% of all biofuels coming from 1st-generation technologies. Given that much of the required biofuel will be imported from outside the EU, the availability, price, quality and sustainability (environmental and social) of imports may well become significant issues. Electric vehicles, which would nicely complement the expansion in wind energy by re-charging in off-peak hours, are seen as making only a small contribution by 2020. Renewable hydrogen is not seen as making a contribution by any country.

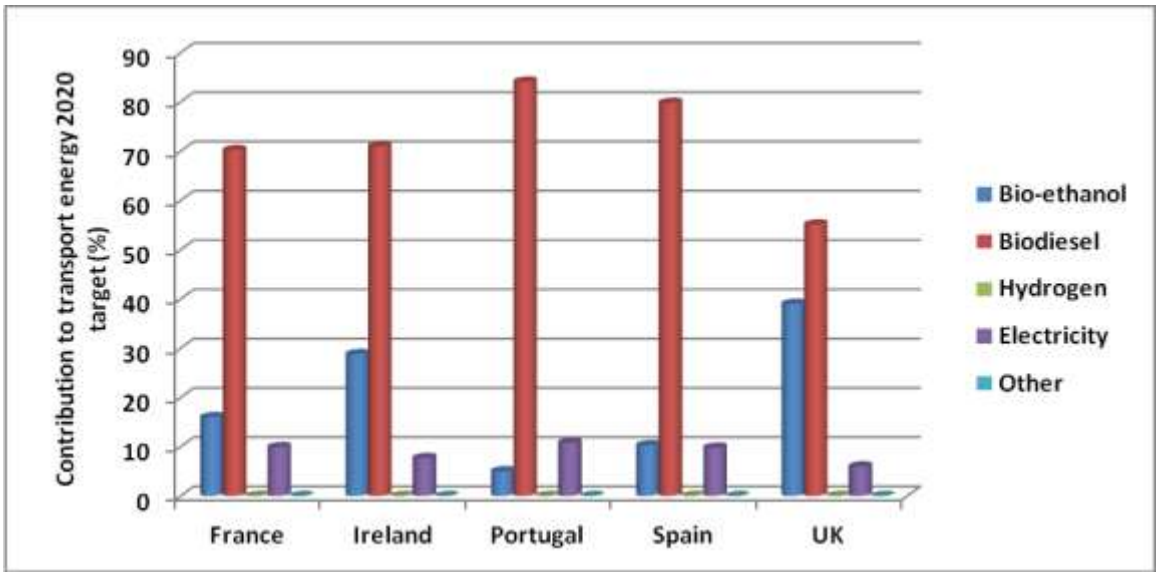


Fig. 3.8: Sectorial contributions to renewable transport energy 2020 targets

In summary, the Action Plans suggest a big increase in wind generated electricity throughout Europe, in particular in the northern AA countries, and an increased exploitation of solar thermal and photovoltaic in the south. Biomass will be the predominant supplier of renewable heat, and biodiesel will be the main source of renewable transport energy.

While the Action Plans focus mainly on renewable energy production, member states must also make projections of energy use efficiency advances in estimating their total energy use for each year up to 2020. The Energy Plan for 2020presented by the Commission in January 2008 contained a target to save 20% of energy use through improved efficiency. In Ireland, a 2007 White Paper requires local authorities to achieve a 33% saving[19]. So the challenge to achieve the required improvements will be just as daunting as the renewable energy targets, especially for local and regional authorities. It follows that strategies and actions to achieve energy savings in the regional authorities' own operations and to promote increased efficiency in the industrial, commercial and residential sectors in their regions are an essential part of the output from this project.

In Ireland, the SERA is committed to developing a Climate Change Action Plan for the region as provided in Regional Planning Guidelines for the region in 2010. All regional/local development plans will be required to identify the areas within which renewable energy proposals of a particular type will be given favourable consideration[20]. The Energy Pillar Pilot Action "Assessment and demonstration of measures to reduce electricity consumption by municipal authorities" will play a valuable role in identifying the energy use sectors where savings can be achieved, the attainable levels of energy reduction, and the actions and strategies that will be needed if the targets are to be achieved.

3.3. Energy related indicators and their impact on GHG emission reduction

Member States' Renewable Energy Action Plans (as discussed in Chapter 3.2) require the recording of total annual energy use for electricity production, heating/cooling, and transport. These figures are to be presented as ktoe (thousands of tonnes of oil equivalent) per annum. Records of renewable energy production are required to be further broken down by source as follows:

- Electricity: Hydro, geothermal, solar, tide wave and ocean, wind, and biomass.
- Heating, cooling: Geothermal, solar, biomass (solid/liquid/gas), heat pump.
- Transport: Bioethanol (+ETBE), biodiesel, hydrogen, renewable electricity, others.

Data in this format will be required on an annual basis for the Action Plans at national level, so wherever possible it would make sense to collect it in the same format and frequency at regional level. This information would then provide a comprehensive set of indicators of developments at regional level and their likely impact on GHG emissions. In this section indicators deal mainly with energy production trends from each energy source; the impact of these changes on GHG emissions is also discussed.

The GHG saving achieved by any switch from fossil to renewable energy or by improved energy use efficiency depends on the efficiencies of the new and replaced technologies and would require life-cycle analysis for accurate determination. However the following are preliminary guidelines as to their likely potential contribution:

[19]Department of Communications, Energy and Natural Resources, 2007. White Paper "Delivering a sustainable energy future for Ireland: the energy policy framework, 2007-2020." www.dcenr.gov.ie.
[20]Regional Planning Guidelines for the South-East Region 2010-2022: Volume 1. Made by the South-East Regional Authority on 26th July 2010.

- *Bio-energy:* While the world-wide CO_2 reduction from existing ethanol plants has been estimated at 1.18 kg/litre[21], ethanol produced from wheat in a modern plant should reduce emissions by at least 2 kg per litre of petrol displaced. The world reduction from biodiesel from all feedstocks has been estimated at 2.19 kg/litre[2]. Rape methyl ester should achieve 1.5-2 kg per litre of diesel displaced, pure plant oil over 2 kg/litre, and biodiesel from RVO or animal fat over 2.5 kg/litre[22]. In preparing its Climate Change Strategy, the Irish government assumed a mean CO_2 reduction of 1.65 kg/litre for all transport biofuels over a range of feedstocks and conversion technologies[23].

  Appendix V of the Renewable Energies Directive[24] presents typical values for the GHG reduction to be expected (omitting any effect of land use change) from the use of various biofuels, as a percentage of the emissions from the equivalent fossil fuel. A summary of the range of values presented is as follows:

  - Ethanol from crops: 32-71%, depending on feedstock and source of plant energy.
  - Biodiesel: 36-88% depending on feedstock.
  - Pure rape-seed oil: 58%
  - Hydro treated oil: 40-68%, depending on feedstock.
  - Biogas from wastes: 80-88%
  - Ethanol from ligno-cellulose: 80-88%
  - Fischer Tropsch diesel: 93-95%

  The wide range of values highlights the importance of achieving the optimum combination of technology and feedstock. The use of by-products and residues as feedstocks, and of technologies that convert ligno-cellulose to transport fuel, should be promoted where possible.

- *Wind, hydro, wave/tidal, solar, energy efficiency measures:* The carbon intensity of Ireland's electricity production in 2006, mainly from a fossil fuel oil-gas-coal mix, was about 0.6 kg CO_2 per kW hr supplied. Assuming that about 3 kW hr is produced per kg of fuel, the average emission reduction would be about 2 kg of CO_2 per kg of displaced fossil fuel. In practice the introduction of renewable electricity or improved efficiencies is more likely to displace the more polluting fuels such as coal, in which case the reduction of emissions would be higher (4 kg or more per kg of displaced fuel). This figure would apply to all renewables with no direct associated fuel use, and also to energy use efficiency measures, though life-cycle analysis would be needed to examine any indirect energy use, e.g. in plant construction or building modification.

[21] S&T Consultants, 2009. GHG emission reduction from world biofuel production and use. Prepared for Global Renewable Fuels Alliance, 2 St. Clair Avenue West, Toronto ON M4V 1L5, Canada.
[22] Sustainable Energy Ireland, 2004. Liquid biofuels strategy for Ireland. Study co-ordinated by Ecofys Netherlands. www.sei.ie.
[23] Department of Environment, Heritage and Local Government, 2007.Climate Change Strategy, 200712.www.environ.ie
[24] Commission of European Communities, 2009.Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources.

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3.4. Measures to reduce energy-based GHG emissions

Methods of reducing energy-related carbon footprint can be grouped as follows:

- Improve the production efficiency of existing generating capacity.
- Increase production of renewable energies, in particular those that feature in national and regional action plans.
- Improve energy use efficiency (e.g. promote district/community heating and electricity where feasible).

Raising the efficiency of existing large-scale fossil-fuel or nuclear generating plants is considered to be outside the scope of the current project. Renewable electricity generating plants may be no more than photo-voltaic panels part-supplying residential demands; in general renewable plants will have small to medium capacity, and will be located to facilitate access to a resource e.g. high wind speeds or locally-produced biomass. This type of distributed generation facilitates local use of surplus heat in CHP applications, and presents fewer problems for the electricity grid. It should be encouraged wherever it is economically viable

Within the Merseytravel area, the Liverpool City Region is currently developing a Sustainable Energy Action Plan to bring together the broad range of expertise and knowledge that will be required to upscale low carbon activities within the city region. When completed, this could provide a useful blueprint for other Climatlantic cities.

Reduction of the fossil energy used in residential, public and commercial buildings and operations is well worth exploring. It is particularly important that buildings and operations within the control of local authorities should set an example in terms of energy management.

Most of the energy used by regional/local authorities is in the form of electricity; transport fuel is also significant, followed by office heating. Of the electrical demand, the main uses are for public lighting, pumping of water and effluents, and building services (IT, light and heat). So the efforts of the authorities to meet their energy saving targets should focus on these areas.

The concept of carbon neutral buildings, i.e. buildings with a net zero contribution to GHG emissions from their construction and use, is gaining momentum. With regard to the construction phase, regional authorities need to ensure that their building regulations are regularly updated to require the use of low-energy materials and high insulation standards while also keeping building costs in mind. Where building regulations are set at national level, regional authorities should lobby to ensure that a move to carbon neutral construction is facilitated as building materials, technologies and costs allow.

While improved housing standards will make a significant long-term impact, upgrading of the existing housing stock will be needed to achieve short-term GHG reduction. National or regional incentives to stimulate retro-fitting of insulation and replacement of inefficient combustion units and electric appliances will continue to be required.

Ways of increasing the production and use of renewable energy in each region is an important part of the study, as achievement of the 20% substitution target in the Renewable Energy Directive will present a major challenge. However, each region will have its own preferences

depending on climate, available biomass materials, etc. The range of renewable technologies that should be considered includes the following:

- *Bio-energy:* Three biomass conversion technologies are now well-developed. First, oil- or starch-producing crops or residues can be used to produce transport biofuels. With a mandatory 10% substitution target, and the likelihood of an EU deficit and imports from remote countries at fluctuating prices as 2020 approaches, it would be prudent for each region to maximise its home production. Second, low-moisture biomass can be used as fuel for boilers (and to a lesser extent in CHP plants) in residential, commercial or industrial applications. Finally, animal manures, farm crops, food wastes and other organic residues can be digested to produce methane for use as boiler, CHP or transport fuel. These uses are already well established, but there is room for expansion in most countries and the factors holding up their more wide-spread production and use should be examined so that 2020 targets can be delivered.

  Merseytravel led an EU project called BIONIC, which addressed the issues of biofuel supply and use in transport specifically from the perspective of Local Authorities. Its aim was to promote developments in the regional production and use of transport biofuels. Project information including best practice guidelines can be found at: http://www.bionic-project.eu/

  SERA produced a Bioenergy Implementation Plan for its region in 2007[25]. It set an overall target for the supply of 17% of the region's energy from biomass by 2020. It was envisaged that 30% of heat needs, 14% of electricity and 10% of transport fuel would be in the form of bioenergy.

  In another INTERREG-funded project (BioMara), Irish and Scottish research agencies are examining the possibilities of marine biomass (seaweed and micro-algae) for energy production. This is another topic of particular relevance to Atlantic-facing countries. The project was launched in 2009, and it is unlikely that results will emerge in time to be evaluated in the Climatlantic project. Seaweed is unlikely to become a major source of renewable energy in the foreseeable future; micro-algae production may find occasional niches where the right combination of high temperature, high light level and effluent substrate requiring treatment is available, but significant commercial development is unlikely.

- *Wind:* A common feature of each Atlantic seaboard region is the availability of a wind resource suitable for electricity production. Each region will need to exploit this resource as much as possible in the run-up to 2020. Frequently-cited development-limiting factors include grid connection difficulties and costs, delays in the planning process, finance procurement and long-term uncertainty about renewable electricity prices. For on-shore wind, a review and evaluation of planning regulations in the regions with a view to producing guidelines for supportive regional planning would be a useful exercise. Figures 13 and 14 show that wind can and will play a major role in meeting 2020 electricity targets. Accordingly, areas of high potential should be zoned for wind-energy-related developments. In regions with off-shore potential, additional issues such as foreshore leasing and interaction with other marine users and the marine environment would have to be addressed in advance of commercial development, and this process needs to be expedited. The European Wind Association

[25]South-East Region Authority, 2008. BioEnergy Implementation Plan 2008-13. SERA, 1 Gladstone Street, Clonmel, Co. Tipperary.

has estimated that off-shore turbines with a capacity of about 3 GW have already been installed, and that a further 16 GW is at some stage of planning.

- *Hydro:* Opportunities for new large hydro plants are very few in any region at this stage. Some regions may have a possibility for further development of small hydro units.

- *Wave, tidal, ocean:* This is another area where the AA regions should lead the way. Wave technology is seen in Ireland as eventually providing a significant amount of renewable electricity, but it is still some years away from commercial exploitation and little contribution to meeting the 2020 targets is expected. A draft development plan containing a resource assessment for the sector has just been published[26].

  A joint submission by France, Ireland, Portugal and Spain[27] on the EU Strategy for The Atlantic Area included the following comment on renewable ocean energy:

  "The Atlantic Area is one of the world's richest areas in terms of wind, wave and tidal energy. It is currently estimated that by 2050, up to 50% of Europe's electricity supply could be provided by renewable ocean energy generated off the Atlantic coast. This would have huge advantages for the region in terms of job creation and internationally traded products and services, for the Union as a whole in terms of energy security, and in terms of a reduction in the EU's reliance on fossil fuels and CO_2 emissions."

  The recently-established MAREN project[28], with a range of national representation similar to the present project, aims to investigate the marine energy potential (wind and ocean) of the Atlantic seaboard and the many technical, environmental, socio-economic and policy issues that need to be resolved in advance of major exploitation of the resource.

  It is clear that the AA has prime access to a massive marine energy resource. Even though it will be some years before the technologies to exploit that resource are available, in the meantime it is incumbent on each AA region to initiate actions to facilitate marine energy development in their adjoining oceans. These actions should include R&D to quantify the resource and identify and develop technologies for its development, as well as the resolution of planning and grid-connection issues.

- *Solar thermal:* This could provide a useful amount of hot water at residential level, especially in the lower-latitude regions (Fig. 3.9). It is expected to supply 3% of the 2020 renewable heating/cooling target in Ireland, rising to about 10% in Spain. Given that the main uptake is likely to be at residential level, methods to incentivise householders to install solar thermal units need to be examined and policies to incorporate this into current and future housing stock introduced.

[26]Department of Communications, Energy and Natural Resources.Draft Offshore Renewable Energy Development Plan (OREDP) Version 1.3, November 2010. www.dcenr.gov.ie.
[27]EU Strategy for the Atlantic Area.Common contribution from France, Ireland, Portugal and Spain. https://webgate.ec.europa.eu/maritimeforum/system/files/Common%20Contribution%20Atlantic%20Strategy%20FINAL%20EN.pdf
[28]Cardiff University (co-ordinator), 2010. Marine Renewable Energy–Energy Extraction and Hydro-environmental Aspects. Interreg IVB Atlantic Area programme. www.marenproject.eu

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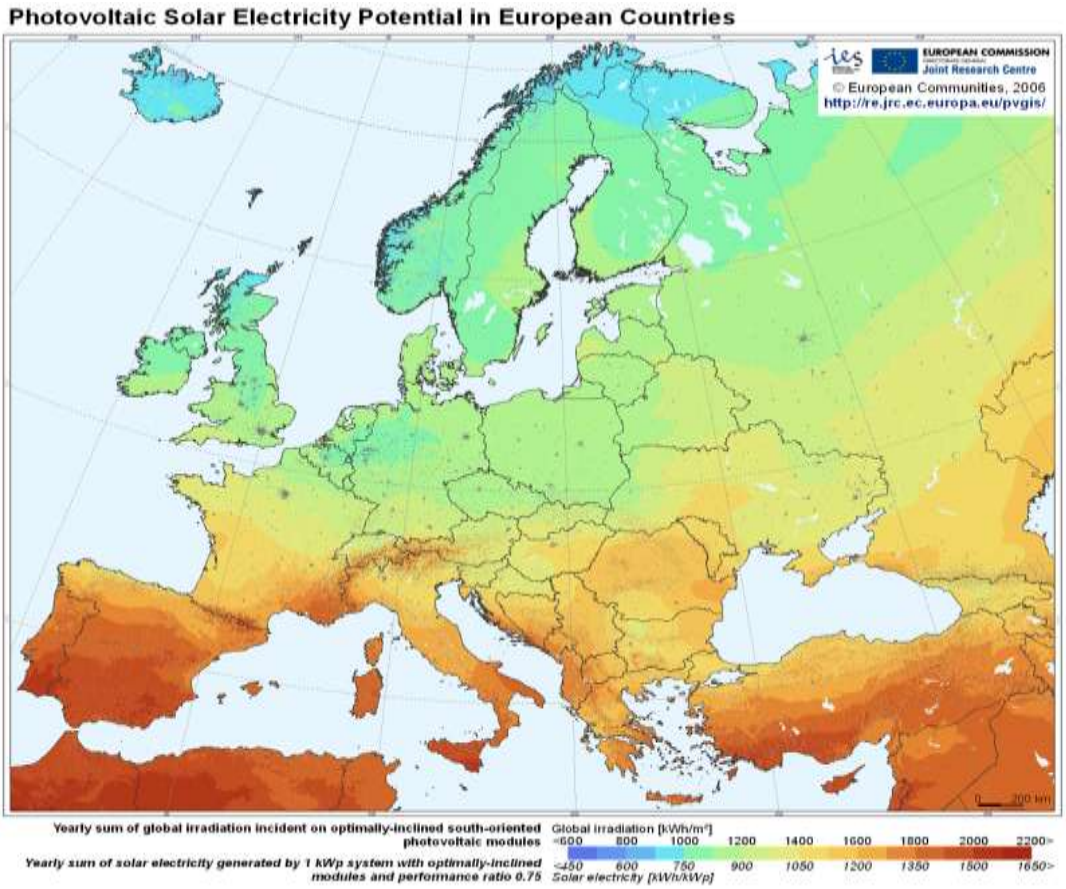

Fig. 3.9: The solar energy resource (thermal and PV) in the Climatlantic regions

- *Heat pumps and geothermal:* There are very few high-temperature deep geothermal resources in the regions involved in this project, so little opportunity for the direct use of geothermal energy for heating or electricity production. A feasibility assessment involving Portugal and Ireland was included in the Thermie programme in the late 1990s*;* its findings were inconclusive[29]. However, there are opportunities for the use of heat pumps to extract heat from water, earth and ambient air. Switzerland, Sweden, Germany and Austria already have significant heating capacity based on earth-source heat pumps. UK, and to a lesser extent Ireland and France plan to produce significant amounts of their 2020 heat targets from these sources. Modern heat pumps have an improved ability to provide water at temperatures adequate for room heating while still retaining a high COP. In urban areas where space is limited, air-source units are most likely to find application. Yet UK is the only member state to target a substantially increased use of heat pumps in its 2020 Action Plan. All public authorities should examine the potential of these units in their climates, and promote their increased use in their own office buildings and in other residential and commercial premises.
- *Solar photo-voltaic*: This has limited short-term potential in more northerly countries. Nevertheless a resource assessment similar to that suggested for the solar thermal and geo-thermal may be useful, especially in Galicia or N. Portugal, where their National Action Plans propose significant electricity production from this source (Fig. 3.9). Other

[29]Thermie programme 1996-8. To promote the use of geothermal energy from proven aquifers and to match this energy to existing potential heat users. Project nº DIS-1038-96-IR.

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countries Action Plans suggest little commercial activity before 2020, but longer-term development may take place if the cost of panels can be reduced.

- *Electric vehicles*: The outputs from renewable energy sources such as wind, solar, tidal and wave are inherently variable over time. The generating capacity from wind must be expected to increase rapidly in the immediate future in all Atlantic sea-board countries; solar photovoltaic will develop more slowly in southern countries and marine technologies in the north. As these technologies continue to expand, management of the electricity grid to match supply and demand, and in particular to utilise renewable electricity in off-peak demand periods, will become increasingly problematic. Possibilities for the storage of electrical energy are being researched and this work should continue, but a positive outcome is unlikely in the short term.

  An alternative approach to this problem is to create new demands for electricity in off-peak periods. Electric vehicles (EV) re-charging their batteries overnight from renewable electricity would help to provide this demand; in operation they would also reduce urban air pollution and traffic noise and allow the use of an alternative source of renewable transport energy.

  To promote a rational development of EV technology, and to ensure standardisation of battery charging facilities between countries and vehicle manufacturers, the EU has recently launched its Green eMotion EU Project as part of the FP7 Transport programme (www.greenemotion-project.eu). The project has a total of 42 partners: car manufacturers, energy utilities, universities, and technology and research institutions across Europe including all the Climatlantic partner. The project may be expected to make a major contribution to a rational development of an electric vehicle industry. The Grand Angouleme Pilot Action within the Climatlantic project dealing with the development of electric vehicle infrastructure may also be expected to provide useful guidance for regional authorities.

  To allow EVs to achieve large-scale commercial acceptance, further progress is needed on the cost, size and capacity of electric batteries. It is apparent from the review of Action Plans that member states expect little commercial penetration before 2020. However, the EU's transport biofuel production capacity will continue to be limited by the availability of indigenous feedstocks, and wind will become a major source of renewable electricity. So substantial development of EVs may be expected in the post-2020 period, and regions should ensure that they develop the infrastructure to allow this to happen.

  A successful roll-out of electric car use requires the installation of public charging points to proceed in parallel with car sales. Public authorities should play a key role in site selection for these units; they need to ensure they are at locations that will continue to be freely accessible to motorists and will not lead to traffic congestion problems if/when electric car use becomes widespread. They should have an active, positive role in this process, not just via planning permission decisions.

3.5. Energy Pillar summary and conclusions

Within the Energy Pillar of the Climatlantic project, two methods of reducing greenhouse gas (GHG) emissions have been examined: improved energy use efficiency and increased use of renewable energy.

The Renewable Energy Action Plans drawn up by the Member States of the project partners have identified the technologies that will be of most significance in the achievement of their targets:

- To meet their national renewable electricity targets, wind will be the predominant resource to be developed, with some expansion of solar PV in the southern regions.
- Biomass combustion will be the predominant resource to meet the heating targets, with a small contribution from solar thermal and heat pumps.
- Biodiesel produced from vegetable oil is to be the dominant renewable transport fuel; a smaller contribution will come from ethanol, initially from arable crops and later from ligno-cellulose. Electric vehicles will make a contribution as 2020 approaches.
- Although they deal primarily with renewable energies, the Action Plans of each member state contain inbuilt assumptions of substantial improvements in energy use efficiency. Also the Commission's Energy Plan for 2020has a target to save 20% of energy use through improved efficiency, and some countries and regions have set themselves even higher targets for public bodies. Regional authorities will face several challenges if these targets are to be met in their regions. In their own operations, the biggest energy users are likely to be public lighting, water and waste pumping, vehicle fuel, and office services.

In general, the main producer of GHG emissions in the participating regions is the transport infrastructure. Energy use in homes, commercial/public buildings and industries is also significant; emissions from agricultural operations are small except in some rural regions and they are not closely related to energy use.

With regard to regional actions and strategy development, regional and local authorities have a central role, both directly and indirectly in the use and promotion of renewable energies and energy efficiency measures in their areas of influence. They have direct responsibility for energy use in public buildings, transport fleets, water and waste treatment services, public lighting etc. and for any opportunities to generate renewable electricity on public sites. They also have direct responsibility for the enforcement, and perhaps the drafting, of planning guidelines and regulations that can facilitate (or impede) the development of renewable energy production activities and the construction of low-energy or carbon-neutral buildings. Indirectly they can promote by demonstration the public adoption of low-GHG practices, and they can lobby national government agencies for the introduction of measures that support renewables and energy use efficiency. They should also play a part in ensuring the conduct of resource assessments of the more promising renewable energy technologies in their territory. A summary of the actions and strategies that should be considered by regional authorities adjacent to the Atlantic is given in Table 1.

Given the predominance of GHG emissions from the transport sector, it is logical that the reduction of these emissions should be the main focus of this project. The use of increased amounts of biofuel would bring about an immediate improvement and would present few technical problems; this should be implemented quickly in public transport fleets, and any necessary fiscal or financial support measures should be introduced. However, given the limited range of currently-available transport biofuel options, the preponderance of biodiesel use in the National Action Plans, and the relatively small amount of biodiesel produced in the EU, regions need to start examining potential sources of supply and in particular any possibility to increase indigenous production.

Another short-term priority for regional bodies should be to maximise the efficiency of energy use in the buildings, installations and fleets under their control. This would entail a programme of energy use monitoring in every aspect of their operations, followed by the planning, implementation and evaluation of energy efficiency measures. A SERA Pilot Action to install and evaluate several energy-efficiency initiatives in a local authority area will be available as a template for this programme.

The authorities' longer-term strategy should be to increase their use of renewable energies for heat and electricity production. This needs to be planned carefully to ensure that the most environmentally beneficial technologies are selected and that their installation makes economic sense and would serve as a basis for a demonstration programme.

Authorities should also examine the possibility of using land sites and buildings under their control for the generation of renewable energy for their own or other use. This may require the development of new structures such as public-private partnerships where authorities' existing mandates preclude such activity or where financial constraints would be a limitation. An exchange of views and experiences between regional authorities on this topic would be useful. With regard to specific renewable technologies that require planning permission, the authorities should examine whether in their role as planners they could further streamline planning and zoning processes to facilitate the development of these technologies. This applies in particular to on-shore and off-shore wind farms, and will also become an issue for ocean technologies when they reach the stage of commercial development. Biomass combustion units also raise issues in relation to controls and limits on their emissions. These technologies are, or will become, important in all Atlantic regions. The Climatlantic partners should give consideration to:

- Examination of the planning processes, regulations and guidelines for these technologies in their regions
- Recommendations for the streamlining and simplification of these processes.

Finally, regional authorities should consider whether there is a need for any further studies of the potential for development of specific renewable resources in their region. Much information is already available, but themes such as wave and tidal energy, geo-thermal and solar are reaching a stage of development that may justify further resource evaluation. Where there is a positive outcome, such studies would form a basis for future resource development plans.

Sector/ actions	Transport	Public buildings/sites/operations	Residential	Renewable energy (RE) production and use
Short-term direct actions by regional authorities	Increase 1st gen biofuel use in public vehicle fleets (fiscal/financial/other incentives)	Examine RE use options (e.g. solar/biomass/PV/wind); instaland demonstrate bestoptions. Monitor energy use efficiency. Research and cost efficiency measures (lighting, pumping, other services)	Re-examine building regulations to enhance energy efficiency of new residential buildings	Quantify region's resources for RE production, especially on wind in N. Europe, solar PV and thermal in S. Europe, biomass + biodiesel + marine in all regions. Examine regulatory framework effects on RE development, esp. for wind & ocean. Simplify regulatory process where possible.
Short-term actions co-ordinated by regional authorities	Incentivise 1st gen biofuel use in private vehicles (e.g. adjust car taxes, congestion charges, parking rights etc). Co-ordinate EV re-charging facility development.	Explore public/private funding arrangements for RE use in public buildings (solar, biomass boilers etc). Implement energy efficiency measures.	Promote RE use and energy efficiency; use public buildings as demonstration sites	Examine public/private sources of finance for RE feasibility assessment and development. Identify barriers (technical, environmental, economic) to RE development in region.
Long-term strategies	Promote EV use. Maximise biofuel use. Lobby for national policy measures to promote biofuel use (e.g.an effective obligation system).	All new public buildings to be carbon neutral and suitable for use as demonstration sites; examine policies needed and cost implications. Public land/sites to be used for RE production where possible.	All new residential units to be carbon neutral; examine policy requirements and cost and other implications	Monitor regional potential of emerging 2nd gen biofuel production technologies Lobby for national policy measures to support 2nd gen biofuel production (e.g. effective obligation system). Promote development of transnational policies dealing with off-shore energy development.

Table 1: Actions and strategies for consideration by regional authority

4. Mobility policies for the reduction of carbon footprint at local and regional level

4.1 Terms of Reference

The aim of the CLIMATLANTIC project is to develop strategies at regional and local levels to reduce the carbon footprint in the European Atlantic Area. This section concentrates on the mobility contribution to this aim. The future prosperity of our continent will depend on the ability of all of its regions to remain fully and competitively integrated in the world economy. Efficient transport is vital in making this happen (European White Paper, Roadmap to a Single European Transport Area). As the Atlantic Area is the interface between Europe and a large part of the world, transport represents a challenge which concerns more than the AA regions.

The EU-27's greenhouse gas (GHG) emissions from transport have been increasing and this trend is projected to continue. The rate of growth of transport's GHG emissions has the potential to undermine the EU's efforts to meet its long-term GHG emission reduction targets if no action is taken to reduce these emissions.

Between 2000 and 2050, it is estimated that GHG emissions from domestic transport in the EU-27 will increase by 24%; emissions from road transport are projected to increase by 19% and those from domestic aviation by 45% (JRC 2008).

The latest version of the EU White Paper published in March 2011 (Roadmap to a single European transport area – towards a competitive and resource-efficient transport system) provided clear objectives at the European level to reduce carbon footprint (60% reduction of emissions) and proposed several types of actions to meet these objectives by 2050.

Numerous studies completed or under way across Europe have evaluated the options available to reduce carbon emissions. The European Commission study, 'Routes to 2050', is one example. It centres on developing visions of the future, setting a baseline and targets upon which reductions can be monitored, with an exploration of the options available to meet those targets (DG ENV, 2009).

Several other surveys have been conducted, both on the evolution of key factors regarding mobility of passengers and freight, and on the GHG impacts. These approaches are focused on the situation in 2050 and the various scenarios describe the possible outcomes from a global point of view in the European regions.

Considering the diversity of these possible scenarios and of the ways which lead to them, as well as the large number of uncertainties and involved hazards which will probably modify these alternatives, we followed the recommendations of ESPON which suggests developing and implementing policy instruments in the domain of Mobility:

- To have a global approach. The larger the GHG reduction that is required, the wider the range of options that need to be taken up, thus requiring a broader range of policy instruments.
- To be adaptive and flexible to the evolutions since the options to achieve this objective and the policy instruments required could vary according to the place and the time.

- To determine appropriate metrics and clear indicators to understand the evolution and measure the impacts of the measures.
- Not to forget that transport is a derived demand, therefore policies and other developments in other sectors have the potential to increase or decrease the amount of travel that is undertaken, and thus the level of GHG emissions that are emitted from the transport sector.

Accordingly, our objective is to identify and analyse, on the basis of the above-mentioned surveys, the policy instruments which could improve transportation and be adapted to various territorial situations encountered in the AA and that are related to the reduction of the carbon footprint. In a holistic approach to transport they should be combined with instruments and measures dealing with other transport issues like safety, security, etc.

To achieve this goal the methodology which has been adopted is as follows:

- Identify the overall situation of AA regions and the challenges which need a quick response;
- Determine the most significant land use patterns in AA;
- Specify the mobility domains that are linked to GHG emissions and on which local authorities decisions may have direct or indirect influences ; this leads to the definition of the main indicators to assessing any changes in these domains;
- Analyse the relevance of the different types of policy instruments on each of the land use organisations and their impact on GHG emissions;
- Provide guidance recommendations on the development of these instruments.

The general framework of the study and derived recommendations takes into account 3 main axes which provide guidelines and hypotheses for the main factors influencing transport and mobility of passengers and goods in Europe over the 50 next years:

- The first concerns the political choices and orientations that have been, are or are envisaged regarding mobility. Several institutions launched projects or took decisions whose impacts on the Atlantic Area have to be considered;
- The second is a link to the challenges facing Europe and the AA for the future; for several reasons, transport is at the very heart of these. All the answers to these challenges require an efficient and eco-friendly mobility system for passengers and goods as the support of increased well-being of the citizens and economy;
- The third stems from the lifestyle choices made by European citizens and their effect on the coastal regions which constitute the AA. Societal evolution and urban sprawl are intrinsically linked with mobility. Each type of mobility places certain constraints on the type of urban form that is possible and vice versa.

4.2 Present situation of transport in the Atlantic Area

Considering the importance of transport in the general economy and its high impact on carbon footprint, all the political decision-making bodies in Europe have taken strong positions and developed actions to reduce these impacts as much as possible. From the European

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Commission to local authorities, several organizations have expressed their positions and given some orientations for the future of transport in the AA.

Political Orientations

European Commission

The position of the European Commission on transport and mobility policies has been clearly identified from the first version of the White Paper and spelled out in more detail since then through several documents, actions and research or demonstration programs. Some of the most relevant among the recent *prises de position* are:

1. Activities on Alternative Fuels

- Communication on alternative fuels (11/2001) Biofuels, natural gas, hydrogen.
- Directive on the market share of biofuels (5/2003) market share 2% in 2005, rising to 5.75% in 2010.
- Directive on the taxation of energy products (10/2003) lower taxation of alternative fuels enabled.
- Renewable Energy Directive Binding target: 10% share by 2020 (April 2009).
- Technology Platforms, Joint Technology Initiatives.
- Hydrogen/fuel cells (TP: 2004; JTI: 2008), Transport (2004), Biofuels (2005).
- Green Cars Initiative of European Economic Recovery Plan Electromobility projects (selection by July 2010).

2. Market Regulation

- Regulation of pollutant emissions: Reduction of pollutant emissions through EURO standards.
- Regulation of CO_2 emissions: Cars: 130g/km by 2015; 95g/km by 2020, Light Duty Vehicles: 175 g/km by 2017.
- Renewable energy Directive: 10% share of renewable energy sources in motor fuels by 2020.
- Fuel quality Directive: Reduction of CO_2 intensity of fuels by 6 % by 2020.
- Promotion of clean and energy efficient vehicles in public procurement: Directive requiring inclusion of energy consumption, CO_2, and pollutant emissions in the purchase decision.
- Urban mobility actions: CIVITAS programme; Urban Mobility Action Plan.

3. Near Term Actions

- White Paper on Transport: Adopted in March 2011, givers a broad set of objectives and recommendations for all types of transport modes.

- Expert Group on Alternative Fuels: Provides advice to the Commission on the development of a comprehensive fuel strategy and concrete measures for substituting oil.
- Strategic Transport Technology Plan: Strategy for European transport research and innovation based on policy needs. The STTP will address all transport modes and cover the full innovation cycle.
- Competitiveness and CARS 21: Follow-up of the strategy on clean and energy efficient vehicles.
- Clean Transport Systems Initiative: Main objective is the substitution of fossil fuels by alternative fuels as major energy sources for all modes of transport.

Committee of Regions (CoR)

In its Cancun resolution the CoR reaffirms its call for an international climate change agreement limiting global warming to no more than 2 degrees Celsius by 2012. "National leaders have a responsibility to the planet to sign an internationally binding agreement on the reduction of greenhouse gas emissions in Cancun." CoR President Mercedes Bresso said.

The CoR reminds regions and local authorities that they have a major role to play when it comes to achieving better resource efficiency and a more climate-friendly economy on the ground. They must raise public awareness, mobilise public political support, business investment and funding sources and motivate producers and consumers to change their behaviour, according to the resolution.

To fully unlock regional and local potential in the fight against climate change, the CoR recommends organizing training for local and regional authorities on how to tackle climate change at grassroots level as well as running climate change awareness campaigns for citizens. The CoR also recommends strategic public-private partnerships, such as alliances between small- and medium-sized enterprises and local and regional authorities, with a view to further developing and applying low carbon technologies.

Regions and cities should conclude local climate action pacts between public and private partners setting out concrete climate action measures to reach the 20-20-20 goal.

Atlantic Area Institutions and orientations

The Atlantic Commission of CPMR (Conference of Peripheral and Maritime Regions of Europe) updated recently the general strategy proposed in 2005[30] . Several of these strategies are linked to transport:

- The Atlantic corridor ;
- The inclusion of metropolitan areas in the central network;
- The ports;
- The connections between AA and the rest of Europe;

[30] SCHEMA DE DEVELOPPEMENT DE L'ESPACE ATLANTIQUE, Porto Juin 2005 CRPM

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The CAAC (Conference of Atlantic Area Cities) adopted a more local approach[31] and listed five trans-national topics where improvements were needed, of which two are "Environment and Climate Change" and "Transport and Accessibility"[32].

From these 2 complementary approaches, the main objectives for the external flows coming in the different regions of the Area may be identified as:

1. Promote a clean and safe multimodal interlinked network:

- Complete Atlantic priority projects under TEN-T policy, and especially the North-South connection along the Atlantic seaboard.
- Promote a West-East link to connect with the centre of Europe.
- Increase the number of short sea shipping routes and motorways of the sea.
- Develop an Atlantic network of logistics platforms by encouraging multi-modality.
- Coordinate maritime safety: itineraries, refuge areas and emergency response plans.

2. Encourage the building of innovative vessels specialised in short-sea shipping and yachting

3. Develop port development strategy: Logistics platforms, modernisation of infrastructures in accordance with sustainable urban planning

4. Promote of the yachting sector, a major reservoir for jobs for Atlantic territories

5. Governance of TEN-Ts by geographic area (macro-areas) based on a strong political commitment

The two above mentioned institutions proposed a series of actions to be promoted at the Spatial Planning level[33]:

- The short distance economy which facilitates exchanges between producers and consumers within the same territory; obviously the development of such short-distance commercial relationships influences directly the transport system.
- The knowledge society to reinforce the economy in general and to improve the quality of life potential ; this knowledge economy is considered at European level as one of the main factors to avoid the desertification of rural areas. The impacts on transport are double-sided, decreasing traffic of everyday commuters to work and increasing links with external areas. It has also several implications for Spatial Planning.
- Accessibility between and within cities which must be mobility nodes facilitating the fluidness of passengers and goods within a multimodal urban mobility system.

[31] Proposed Guidelines for an integrated strategy for the Atlantic Area (2010)
[32] "Research, Innovation and Training" constituted another topic which will be detailed among the instruments for implementing new strategies (cf §5)
[33] Réponse de la Conférence des Villes de l'Arc Atlantique à la Consultation publique de la Commission européen sur une politique maritime intégrée pour le bassin de l'Océan Atlantique

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Local Authorities

All across the AA, several Urban Communities have designed and implemented their own action plans regarding the consequences of transport on GHG emissions. For instance the third Local Transport Plan for Merseyside aims to *"Provide and promote a clean, low emission transport system which is resilient to changes to climate and oil availability"*. Several have designed and implemented SUMPs (Sustainable Urban Mobility Plans[34]). SUMPS include measure to reduce GHG emissions.

From Inverness to Sevilla, many cities of AA have been involved in CIVITAS or Interreg programs on transport and mobility either at European or national /regional level which offered them possibilities to develop various actions and to experiment and deploy advanced transport systems. Several significant good practices and case studies, set up by large and smaller cities have been developed on all urban mobility topics and on relations between cities, by road, rail or sea concerning technologies like clean vehicles, alternative transport modes, integrated & real-time information systems, transport management and organisation (pricing, parking or public transport strategies) as well as urban and inter-urban logistics

Local authorities and the stakeholders of the Atlantic territory are the basis to ensure an integrated development approach. As can be seen in the Covenant of Mayors, the local European authorities have become involved in sustainable urban policies that are energetically efficient and that promote the use of public transportation.

Transport and Mobility Situation

Roads, railway lines, inland waterways, seaports, airports and railway stations form the backbone of the transport infrastructure in Europe. Modern transport infrastructure of a high standard is the basic means of moving goods and passengers and, as such, essential both for regional economic development and for creating an internal European market.

The global situation of European transport is described in the several projects and studies which have been mentioned already. Few of them are detailed at the regional level (NUTS3).In the same way, the level of GHG transport emissions at regional AA level is not clearly determined.

In general in Europe, the highest motorway density is found around European capitals and other big cities. However there are big differences within the AA since two of the regions where this density is highest are[35] Greater Manchester (138km/1000km$^{2)}$ and Merseyside (100 km/1000 km^2). Coastal regions with a thriving tourism industry have noticeably denser motorway networks than other peripheral regions. Except for the UK, the railway density in km^2 is low in all AA. However, when the density is calculated versus the number of inhabitants, the position of the AA regions tends to increase due to the demography mentioned previously. Compared to regional or national flows, international freight is of little importance to the AA road freight sector.

Apart from Northern Ireland and UK, the tonnage ratio between international and national is around 1/5 (Eurostat). Even on the north/south corridor, less than 25% of the transiting freight is international. For the remaining goods transported by road, the majority of them (around

[34]For more information www.mobilityplans.eu/
[35]Eurostat regional yearbook 2010

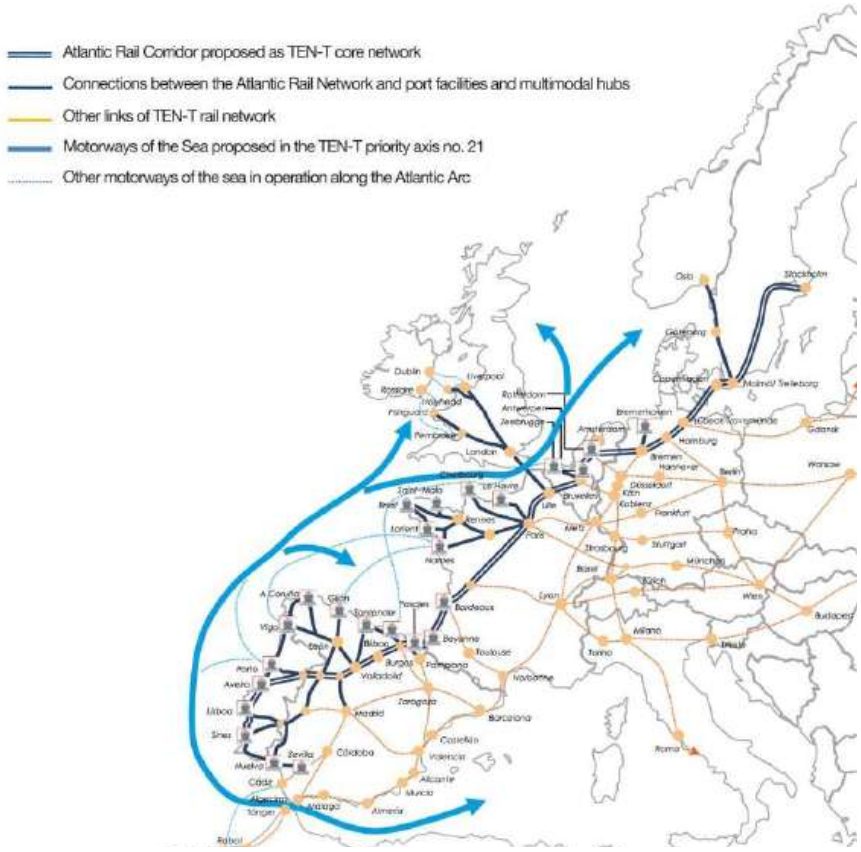
60%) do not travel more than 500 km , which means they rarely cross over a region, they have a tendency to remain in the same region (departure and arrival).

Regions with better accessibility to raw materials, suppliers and markets enjoy generally more competitive market positions. The majority of the AA regions are under the average level of accessibility in Europe (*ESPON Polyc)*

As in many regions, progress in transport has largely concentrated on the transport of goods, the needs for which are largely different from those of passenger transport.

Considering Maritime transport, the number of passengers in AA ports is very low. For the freight, slightly more than 90 M tons went through Le Havre harbour in 2009 which is double the amount of freight going through Portugal, Nord west Spain or NW UK or Ireland. And the total of those five regions matches the South Nederland tonnage (Rotterdam)[36].

Fig. 4.1*. Network of Roads, railway lines, seaports and motorways of the sea in the EU.*



Although the number of small airports has increased in the recent years mainly in the south of AA, the number of travellers remains quite low compared to other European regions and did not really increase in the past years[37]. Apart from Manchester and Eastern Ireland, AA regions stand in the lower half of the hierarchy in number of air travellers (Eurostat 2009). It is the same for freight transport. However the fast development of low-cost flights in the southern regions of AA could change this position although this increase concerns all the south of

[36] Eurostat tran_r_mago_nm
[37] Eurostat:tran_r_avpa_nm

Europe (ex Porto, growing something like 15-20% per year in the last 2-3 years, more than 5 million passengers per annum by now). They could for instance follow the growth of Liverpool John Lennon Airport: since 2001, passenger numbers have increased eight-fold, with 5.5 million passengers using Liverpool in 2007.

The inter-regional accessibility of AA regions is below the average accessibility of European region (ESPON). Accessibility describes how easily people in one region can reach people in other regions. It shows well a region is connected to potential markets and cooperation partners in other parts of Europe.

Research and innovation in Transport and Mobility

Several collaborative prospective and/or research projects have been launched in this domain in the AA during the last 20 years. They involved cities, regions as well as transport organizations (instance. g. ports, airports, operators) and researchers.

The main results of all these efforts can be briefly summarised as follows:

- at the local level, some projects were quite successful and brought improvements in mobility and reduction of GHG emissions (cf for instance CIVITAS projects involving AA cities since 2001)
- it seems difficult to reach the same level of success at the regional level
- projects involving several AA cities have difficulties to create a real long term cooperation between cities
- In the case of projects related to inter-regional problems, implementation of improvements or recommendations is difficult due to a series of barriers (political, financial etc.)
- Similar projects developed concurrently in different Interreg Regions. In this case, co-operation is largely dependent on the project partners.
- Research institutions are quite few and their involvement in projects concerning AA is light
- Several networks (GART, CIVINET, etc) behave as nodes of information exchange; they facilitate the construction of multi-city projects but cannot have a direct role in the implementations of solutions.

As a conclusion, research and innovation in Mobility in the Atlantic Area is poorly coordinated. Knowledge transfer and innovation are organised at the local level with local resources leading to a great variability between areas.

4.3 Atlantic Area transport demand prospective

In the coming years, AA regions will not have the same objectives or position with regard to the four topics defined previously (demography, population profile, urbanisation and economy) and this will generate different demands for transport of passengers and goods.

In the same way, several types of context have been identified for the territories which represent significantly the situation of the cities in the Atlantic Area.

Then it would not appear reasonable to have identical recommendations or strategies for all the regions. However, it will not be possible to determine which strategy is optimal for each type of context

Trends in Mobility Demand

The demand for mobility is expected to grow. Mobile jobs, migration flows and a more integrated society and economy would create the need for fast and reliable means of transport between European areas in order to keep Europe's competitive edge, and to be able to communicate with all parts of the world.

For many reasons, (congestion, energy, crisis, ageing of population and of infrastructure 'polluter-pays'principles) transport costs are likely to increase significantly.

If infrastructure upgrading costs are too high there is a risk of increased congestion (due to a decrease of capacity or security) on certain paths (roads as well as railways) leading to congestion and a shift to cars.

The cost of travelling might be further aggravated by the need to decarbonise the economy. Environmental constraints and regulations may lead to an increase in several domains of transport, like road taxes, access control zones (e. g. London, Stockholm and, in the near future Gothenburg), more expensive vehicles, specific driving hours/days, etc., leading to a really high cost per km travelled.

In the future years, the uncertainties related to the energy transition (or multiplicity of energies for propulsion) and the technology evolutions (for instance the utilisation of Hydrogen fuel cells) would make that investment in new transport technologies become very risky as it is not easy to identify the best choices for the vehicles manufacturers, whether to improve the ICE, to invest in hybrid technologies, to develop new electric cars, to wait for the fuel cells to be cheaper, etc. The next 20 years will be hampered by these alternative solutions which will maintain high costs and delay implementation of alternative solutions as well as political decisions

Change and adaptation will also be slowed down as a consequence of the low responsiveness in transport infrastructure and vehicles that is due to their relatively long life span.

Passenger and freight demand projection for EU 25 (source TERM 2009)

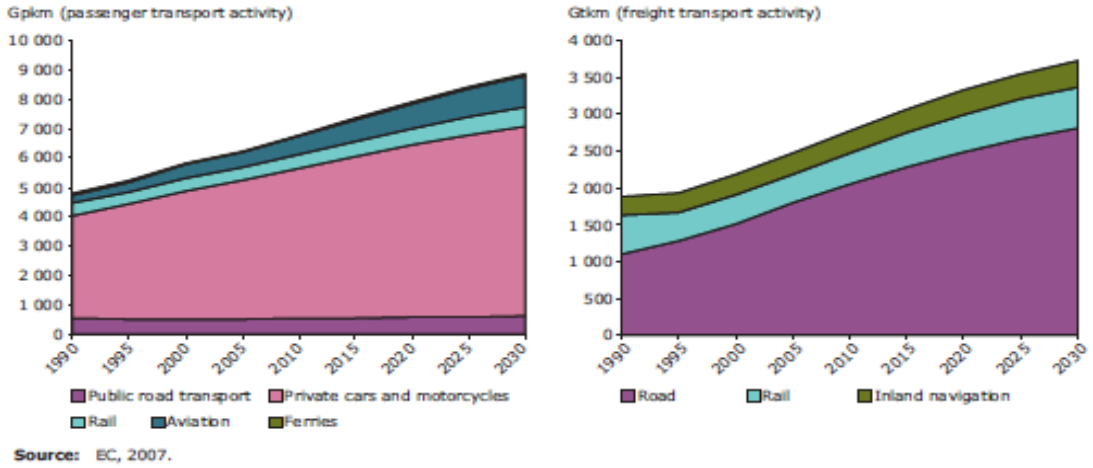


Fig. 4.2.Passenger and freight demand projection for EU 25

Urban transportation

Urban traffic and congestion is expected to grow, mainly as a consequence of increased urbanisation and greater urban sprawl often associated with higher standards of living

Most transport, both passenger and freight, starts and ends in urban areas and bypasses several urban areas on its way. Hence, urban traffic and congestion have an important impact on the daily life of cities. As urbanisation and congestion grow, local traffic interferes with transit traffic. There would be increasing competition for the use of infrastructure between commuter, high speed and freight trains; and between trucks, buses, coaches and private cars.

Congestion reduces the logistic efficiency of deliveries because of delays, increased fuel use and lower workforce productivity. Transport would thus more and more suffer from the 'last mile' problem, i.e. the difficulty in reproducing in individual deliveries the advantages that the consolidation of large volumes of transport can achieve over the long distances.

Cities may not be able to accommodate much larger volumes of private cars as infrastructure space to drive and park may be limited, also causing difficulties to build new infrastructure for public transport or alternative means of transport. Many cities might have to find radical ways of dealing with congestion to avoid episodes of total saturation.

Some of the challenges to a growing demand for mobility come from the existence of a network that is not integrated, it is often overloaded and sometimes obsolete. The different transport modes have historically developed their networks independently of each other giving rise to inter-modality frictions. One of the most critical 'friction' points in a network is the node which is the point where the user or the load joins the network and where different loading and accommodation operations take place.

The development of information and communication technologies would lead to new requirements from travellers in terms of access to traffic information, travel preparation, integration of ticketing, etc.

The increase of diversity of population (different income levels, quality requirements and attitudes) in cities will lead to a broad variety of transport demands.

In the future, there will still be people who will not be able to provide their own transport services or make use of ordinary public transport. This will mostly apply to the elderly, the physically and mentally disabled and to some extent to young children. For these different groups, there has to be a defined right to mobility and a tailored transport service to secure that these groups stay connected to society[38].

There may be a trend towards concentration of ageing people in cities to profit from good and accessible health service centres. Immigrant population will be attracted to cities by the concentration of economic activity. Socially excluded groups may also move to cities to benefit from their social services. An ageing population has different requirements:

- The level of perceived security, environmental awareness and affordability would play an important role in personal decisions.
- An ageing population raised in the Internet era may favour on-line purchases and home deliveries. Extensive e-commerce could contribute to a reduction in transport.
- Retired people or aged employees with more flexible working arrangements could be induced by appropriate policies to travel off-peak.

Long distance freight transportation

Globally transport cost will develop according to opposing forces. On the one hand, there will be higher costs for energy, infrastructure maintenance and development, and environmental externalities. Labour costs might also increase as a consequence of ageing: the lack of skilled labour, which is already felt in many transport modes (road, maritime) could be further aggravated. On the other hand, there will be further efficiency gains brought by technology, by further market opening and by efficient pricing schemes and in a general way improvement of transport in supply chain management.

In any event, the cost of transport is not likely to outweigh the savings that transport allows in terms of labour or inventory costs. As a consequence, the trend of increasing demand for long distance freight transport is unlikely to reverse.

The logistics sector would be creating more flexible, but complex networks using advanced logistics concepts such as hybrid supply chains, collaborative networks (wherein different producers are cooperating in transport in order to achieve economies of scale), e-logistics (both business-to-consumer and business-to-business) and return logistics. These more complex logistics products would be necessary to deal with increased individualized market demand and quicker passing of new fashions. This would have an effect on light vehicle growth figures (vans), which would exceed the growth of other categories.

Large intercontinental ports might reach high congestion levels due to further globalisation. Their hinterland connections might become frequently clogged as a result of the unloading of giant container-carrier ships. Then smaller (medium sized) ports in the Atlantic Area with present spare capacities could expand to match these demand increases.

The emergence of a European network of rail freight corridors through cross-border cooperation and increased competition in the railway markets would facilitate enlarging the

[38]Future of transport, 2009

share of rail in freight transport. A hub and spoke system wherein major production/consumption areas are linked to each other in Europe would help. However, whilst its advantages in intercontinental traffic are clear, a hub-and-spoke system also has shortcomings in servicing more restricted areas. At the Atlantic Area level, these trends will lead to evolutions concerning both the maritime characteristics and the freight corridors.

Ports have great potential not only as providers of freight and passenger facilities but also to service the energy industry. This is already the case in terms of the offshore oil and gas industries but can be the case in the future for the renewable energy industry. Indeed, ports can be locations for renewable energy facilities (wind, wave, tidal, biomass, energy from waste etc) and be generators of energy thus contributing to the national grid and being net exporters of energy. There may also be synergies with the chemicals industry, which might be explored as well. Hamburg is a great example of best practice in terms of embedding low carbon initiatives into the city and port. As a result of consistent reduction of carbon emissions, sophisticated waste recycling, resource-conserving construction practices, Hamburg has been awarded the title “Green Capital” for the broad-based approach of its environmental policy, not for individual showcase projects.

Seaports increasingly function as the interface between ocean-borne and land traffic and international trading centres. Therefore sustainable and efficient transport surface access to ports is vital to help ensure that port operations have minimal adverse impact on the transport network. However rail and road do have limited capacity and capacity constraints, but the coastal waters and water transport have significant untapped capacity and we feel have huge potential to play a greater role in regard to surface access.

Figure 4.3. Forecasted Atlantic corridors of the EU.

However a major disincentive for shipping lines is the high cost of multimodal transport from the ship to the final inland destination due to the need to pay a handling charge every time a container is lifted and transferred between transport modes, thus increasing costs. When a single streamlined “ship to shore” handling charge is established, which can be shared out between transport modes used, multimodal onward transfer of containers from the ship to its ultimate inland destination at reasonable cost is encouraged.

The marine leisure sector has an important role to play and this should not be overlooked. Yacht marinas, canal boats, maritime events and festivals, historic ships, cruise ships etc., all contribute to the local economy and have an important role in the life of the city and the rivers. Cruise ship tourism is one of the strongest growing branches of this sector and one that has regained its importance in several harbours, from Liverpool to La Rochelle and Portugal.

In the last TEN T guidelines for 2030 (September 2011), the forecasted Atlantic corridors (Figure 4.3) show two major bottlenecks, in Aquitaine and the Channel. To day, several bottlenecks do exist in many areas, like in the coastal corridor in the North of Porto the gateway character poses important transport and logistical problems, due to the

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concentration of significant traffic generators like port area, airport, logistic companies, most of them associated with external trade logistics.

In 2030, the traffic evolution may create large difficulties even though the evolution of the "globalised" economy may change, even reverse in 2050. These guidelines do not show any priority for maritime freight transport between Western Europe countries.

The efficiency of the links between sea-gates and freight corridors, as well as regional (interurban) freight transport between these corridors and local distribution will be vital for the economy of the Atlantic Area.

Long distance passenger transportation

Long distance passenger travel will increase as a consequence of globalisation, tourism, regional integration and migration. Labour and business-related mobility will increase as well as the connected social mobility. Moreover, rising incomes, ageing population and in some cases lower transport costs (ex group travelling, low cost companies) would increase leisure travel. Large intercontinental airports (hubs) might reach high congestion levels due to further globalisation. At the same time smaller regional airports may present spare capacities and become more integrated. Distances travelled will also increase involving demands for more comfort and a suitable handling of luggage.

If higher transport cost materialise, this could start a vicious circle in rural areas that could imply closing of shops and services, accelerated migration, depopulation and further reduction of transport services.

Security would remain a general concern, not only in air transport, but also in other transport modes such as high-speed rail. Security checks will be developed which may increase transit time. This, however, may impact travelling convenience and decrease competitiveness of collective transport means, unless new mobile and non-intrusive technologies to conduct security checks are deployed.

In conclusion, trends on mobility demand will differ according to the situation of the cities. It is necessary to identify the main types of cities' situation in the Atlantic Area regarding mobility characteristics. Three main types have been selected (urban, satellites, polycentric); two of which may be split into two sub types (diffuse or dense areas).

The most significant demand's evolutions in the Atlantic Area will concern:

- A general increase of the mobility expectations for passengers and freight both locally (associate to increased urban sprawl) and on long distance (e.g. leisure and global economy).
- The diversification and personalisation (requiring spatial and time flexibility) of the needs adapted to the different categories of citizens from residents (work, shopping, etc) and travellers (tourism, business).
- The growing concern on environmental, security, safety and health criteria in the modal choices.
- The development of e-commerce.

- Rapid transit for passengers and freight as well as hubs facilities and regrouping platforms.

Concerning the ways of life context in which these evolutions will take place three main scenarios are envisaged

- Increasing costs for users, due to several factors related mainly to energy costs, reduction of transport's funding and labour costs
- Development of new services linked to the changes of behaviour and living standards (among them tele-working, high tech SMEs, local cycle of production/consumption, etc).
- Developments of technologies, the most important being related to Information (web native generation) and motorisation (clean mobility).

4.4. Measures and Indicators to reduce mobility-based GHG emissions

Many already mentioned reports and studies have described and classified measures and indicators to reduce mobility-based GHG emissions. Such approaches remained most often at the European level, frequently using regions as case studies to examine the evolution according to several hypotheses or scenarios.

Each instrument may influence several domains of mobility. A typology for these domains has been proposed by CIVITAS. The objective of this section is to identify, in the case of AA regions, the relations between these instruments and mobility domains and to set the degree of influence they have regarding the reduction of the carbon foot-print on the basis of the outputs of the various scenarios and real life experimentations which have been conducted to date.

Types of measure and impacts on carbon footprint

Managerial position

These measures concern the positioning of local authorities regarding the stake holders involved in the transport system and the structure of their relationships. They generally will not have a direct impact on carbon footprint but they will be multipliers (or dividers) of the efficiency of the operational instruments.

Some positive impacts on carbon footprint	Some negative impacts on carbon footprint
Agreed common objectives and solutions among stakeholders	Not identified

Monitoring instruments

Monitoring instruments refer to all the measures which aim to predict and control the transport activities. These include for instance planning, traffic control or regulation, management of demand, and even legal initiatives in certain cases.

Planning instruments comprise all measures that concentrate on planning the utilisation of the various resources to meet the transport demand. Effects of these measures can be short (real time adaptation of a network capacity) or very long term like the planning of infrastructures.

Control instruments concern all measures which intend to control the flows of transport to manage the demand.

Moreover, public administrations and local authorities can implement instruments that influence demand for travel, as well as limiting emissions or optimising fuel efficiency.

Some positive impacts on carbon footprint	Some negative impacts on carbon footprint
More opportunities for non-motorised transport, with associated health benefits Faster more integrated and accessible public transport journeys Greater travel choices and heightened public awareness More public transport use Reduced car trip frequencies Reduced congestion Better air quality and reduction of noise	Reallocating road space away from cars /vans/trucks can be controversial Capacity freed up with improved traffic management will lead to further growth from suppressed demand unless benefits are locked in with other measures

Economic instruments

This type of measure concerns financial actions to encourage more energy efficient vehicles, to reduce demand for transport and encourage modal shift, etc...

The range of these instruments is quite broad. It goes from the pricing strategy of fully integrated networks to incentives for companies to use more environmentally efficient vehicles.

Some positive impacts on carbon footprint	Some negative impacts on carbon footprint
Reduced congestion Revenue stream generated to invest in more fuel-efficient transport modes Consumers can be incentivised to use smaller and more fuel-efficient transport modes	Risk of shifting traffic onto uncharged roads

Information instruments

These relate to the prevision of information to customers and stakeholders and also deal with the development of communications and information media well as the action to raise public awareness or to stimulate the use of alternative travel modes.

Raising public awareness is a multiform process which covers different kinds of actions such as:

- promotion of services, mobility modes through various media from paper news letter to most advanced web2.0 sites,
- organisation of workshops, conferences, manifestations,
- training & education of existing drivers as well as future ones,

Some positive impacts on carbon footprint	Some negative impacts on carbon footprint
Information on optimised travels or vehicle performances make users aware of the benefits (time/cost/environment) Tele-working and similar: Remove and reduce car trip frequencies, less congestion, reduction in energy consumption transport	Information may lead all users to create new congestions or difficulties Tele-working potentially shifts energy consumption to the home Rebound effects: home workers may chose to live further from their place of work, offsetting total savings

Technological instruments

The implementation of technologies which cover a broad range of actions related to fuels, propulsion, other vehicle attributes and all aspects of Intelligence in Transports.

Regarding these instruments, local authorities have three types of action:

- implement innovative equipments or systems in a proactive way to push all actors in mobility to reduce their GHG emissions; guidance systems, real time information on traffic on bus shelters as well as charging/fuelling facilities or optimising delivery bays localisation and usage are examples of such actions.
- facilitate and encourage these actors to use such equipments.
- help enterprises which develop such equipments on their territory.

Bio Fuels "2nd generation'

Some positive impacts on carbon footprint	Some negative impacts on carbon footprint
Effective way to reduce the carbon intensity of transport fuels Do not require costly new infrastructure Required modification to new vehicles is of low cost	Competition for land use with biofuels, displacing food production and natural habitats Use of fossil energy to reduce transportation costs

Motorisation technology

Some positive impacts on carbon footprint	Some negative impacts on carbon footprint
Combustion engines: consumption improvements Gas, less CO_2 than petrol	Combustion Engine: emissions and noise Gas Hybrid electric vehicles: lowered but existing

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Hybrid electric vehicles: best transition alternatives for all types of vehicles, especially Plug in Hybrids Electric vehicles : " zero emission" Hydrogen : " zero emission"	emissions Electric vehicles: production of energy Hydrogen: Sustainable production requires renewable energy

Mobility domains

To propose efficient strategic instruments it is first necessary to determine with a high level of accuracy the domains on which they will be used in order to improve GHG transport emissions. These domains must be approached through actions carried out from local authorities in the context of the Atlantic Area.

The CIVITAS programme proposed eight categories of measures as the basic building blocks of an integrated strategy for clean urban transport. Cities' strategies are designed by combining those blocks. The TIPTAP project[39] approach is more territorial-development oriented like territorial identity or efficiency.

Combining these various approaches and considering the objective of this document, the following domains have been kept as the most susceptible to be the theatre of local authorities' decisions over one of the five types of situations or to link some of them.

- Clean fuels and vehicles.
- Integrated pricing strategies as far as they include inter-modality exchanges.
- Alternative mobility usages or modes.
- Access restrictions: this covers all measures which aim to limit the access in areas, from Park & ride to Zero emission zones.
- Collective passengers transport on several aspects.
- Logistics: this deals with the actions aiming to improve the distribution of goods over an area, urban, peri urban or regional.
- Transport management: covers all actions related to Information technologies, from mobile infrastructures to the design and implementation of any kind of infrastructure not taken into account in the previous topics.

Details on these domains are in Annex1 and can be found in www.civitias-initiative.eu

Indicators

Among the large variety of indicators related to mobility and transport, the categories used in the CIVITAS programme to evaluate the impacts of the projects seem adequate as a basis for CLIMATLANTIC purposes.

Indicators in these categories have been sorted regarding their relevance to carbon foot-print evaluation and they also have been completed when necessary either to be more accurate

[39] TIPTAP: Territorial Impact Package for Transport and Agricultural Policies, ESPON project

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regarding CO_2 emissions or to take into account the spatial dimension of CLIMATLANTIC, larger than in CIVITAS.

Indicators are grouped in five categories:

- Transport: quality of service, transport exploitation and transport organisation.
- Economy: benefits and costs.
- Environment: pollution, nuisances.
- Energy: consumption.
- Society: dependency, acceptance, accessibility, employment.

Each category and sub-category is adapted to evaluate specific impacts that are directly or indirectly connected to reduction of carbon foot print. The table in Annex 1 shows the relations between indicators and impacts. These indicators will be classified according to the strategies and actions which will be decided at local level. They can be either:

- Key performance indicators (KPIs) linked to the objectives of the strategies and measuring the evolution of the situation.
- Monitoring (or control) indicators if they are related to (internal) decision variables on which local authorities have a direct action to setup their strategy.
- In the specific case of mobility since the results of several strategies depend on decisions made at other decision levels, External Indicators which are dedicated to measure changes in these "external" variables.

An indicator (belonging to one sub-category) may be used to measure different impacts.

Each actions identified in the different mobility domains will have impacts on the transportation system. These impacts can be analysed through the evaluation of the indicators. The tables in Annex 1 show these relations between impacts and domain.

Relations between instruments and mobility domains

The previous instruments can be allocated in many different ways for each mobility domain which have been identified. They are all parts of Sustainable Transport Plans that should be elaborated in each territory.

The following matrices intend to show how some of them can be implemented in each of the main types of AA zones. There are similar actions in all types of territory but they have to be adapted to each configuration; for instance focus would be on:

a. Coordination and homogeneity of actions for satellites territories
b. Hierarchical approach and optimisation of links for polycentric territories

Predominantly urban

	Clean fuels and vehicles	Integrated pricing strategies	Alternative mobility usages or modes	Access restrictions	Collective passengers transport	Logistics	Transport management	Infrastructures	Information systems
Managerial position	Choice of motorisation for the different types of vehicles / services	Cooperation with all operators to integrate pricing Integrate parking management tariffs	Cooperation with companies, institutions associations for mobility plans or for Soft modes	Involvement of citizens in definition of clear zones Integration in flows & parking organisation	Linking the business community and public transport	Cooperation with stakeholders, Analysis of the evolution of goods flows	Integration of urban planning in transport planning Demand and flow analysis (linked to urban planning prospective)	Multimodality design of infrastructure	Interoperability between Information systems and stakeholders organisations
Monitoring	Plan for the development of clean fleets in Local Authorities (vehicles and energies) Follow up of emissions, Air quality	Plan of the tariffs evolution,	Plan for implementation of sharing vehicles systems, integration with PT and other transport resources Periodical evaluation of the number of users	Plan for deployment of clear zones and accessibility scheme for all, Definition of access rules adapted according activities Access follow up, respect of regulations	Network optimisation according demand Connectivity with outside world (ex P+r) Periodical inquests for PT and non PT users	City logistics master plan, Mutualisation of resources with passengers transport Evaluation of in/out flows	Detailed requirement evolution analysis Orientation of the demands, influencing behaviours Continuous evaluation of modal share	Integration of all mobility deployment plans in urban infrastructure planning Evaluation of impacts on urban evolution	Planning the evolution of techniques and technologies of Info Systems (ex mobile info, web2.0, RFID, accessibility of public transport data,..)
Economy	Energy costs Local incentives for clean vehicles Funding from various organisms	Parking pricing policies Incentives for multimodality Common tariffs integrating all mobility components	Fiscal incentives to companies that support ecological mobility plans Tariff for vehicles sharing (integrated pricing)	Facilitation of commercial, industrial activities Integration of environmental externalities in access tariffs	Define a clear and sustainable financing for PT	Diversification of activities in UCCs, optimisation of deliveries Access restriction for unclean vehicles Internalisation of costs	Adaptation of transport resource to demand	Localisation (land costs) versus accessibility to transport networks Organisation of services in hubs Use of eco friendly material	On line information
Information	Promotion of Clean fleets for entreprises Awareness campaigns Eco driving learning	Clear Tarification propositions,	Info offices and campaigns dedicated to each specific mode Maps	Maps, routes and rules about access restriction	PT Integrated on-line, on ground information	Traffic information for drivers (remote & real time) info and stake holders	Mobility observatories	Insert Intelligence and communication capabilities in construction Signing, coherence in design….	Ergonomy / accessibility of Information systems
technology	Development of local services providers and manufacturers	Smart card, contact less , internet loading	Shared Vehicles motorisation,	All access and supervision TIC equipement and soft	Accessibility of vehicles and all equipments (ex vending machines)	Advanced delivery bays		Environmental friendly buildings Integration of new services (ex Battery loading facilities, accessible fuelling stations,)	Mobility agencies Car sharing websites Journey planners

City and Satellites

	Clean fuels and vehicles	Integrated pricing strategies	Alternative mobility usages or modes	Access restrictions	Collective passengers transport	Logistics	Transport management	Infrastructures	Information systems
Managerial position	Coordinated choice of motorisation for the different types of vehicles / services	Cooperation with all operators to integrate pricing	Cooperation with companies, institutions associations for mobility plans or for Soft modes	Involvement of citizens in definition of clear zones Integration in flows & parking organisation	Linking the business community and public transport Integration of satellites in global PT, links between satellites	Cooperation with stakeholders, Analysis of the evolution of goods flows in each city Definition of the city logistics areas	Satellite integrated transport planning Demand and flow analysis (linked to urban planning prospective)	Multimodality design of infrastructures	Interoperability between Information systems in and between satellites and stakeholders organisations
Monitoring	Homogeneisation of Plan for the development of clean fleets in Local Authorities satellites Follow up of emissions	Plan of the tariffs evolution, including links between cities homogeneity between cities	Coordination of sharing vehicles systems, integration with satellites PTs and other transport resources Periodical evaluation of the number of users	Plan for deployment of clear zones and accessibility scheme for all, Definition of similar access rules adapted according activities Access follow up, respect of regulations	Central network optimisation including satellites according demand Connectivity with outside world (ex P+r) Periodical inquests for PT and non PT users	City logistics master plan, coordination of good flows between (common) logistics points Evaluation of in/out flows	Detailed requirement evolution analysis Orientation of the demands, Influencing behaviours Continuous evaluation of modal share	Integration of each satellite mobility deployment plans in overall infrastructure planning Evaluation of impacts on urban evolution	Coordination of the evolution of techniques and technologies of Info Systems (ex mobile info, web2.0, RFID, accessibility of public transport data,..)
Economy	Grouping exploitation and maintenance resources Local incentives for clean vehicles Joint procurement Funding from various organisms	Parking pricing policies Incentives for multimodality Common tariffs integrating all mobility components	Fiscal incentives to companies that support ecological mobility plans Coordinated tariffs for vehicles sharing (integrated pricing)	Facilitation of commercial, industrial activities Integration of environmental externalities in access tariffs	Define a clear and sustainable and common scheme for financing for PT	Grouping flows for satellites Diversification of activities in UCCs, optimisation of deliveries Access restriction for unclean vehicles	Adaptation of transport resources to demand	Localisation (land costs) versus accessibility to transport networks Organisation of services in hubs Use of eco friendly material	Common site for all satellites and Center city On line information
Information	Promotion of Clean fleets for entreprises Awareness campaigns Eco driving learning	Clear Tarification propositions,	Coordinated Info offices and campaigns dedicated to each specific mode Maps of the zone	Maps, routes and rules about access restriction	PT Integrated on-line, on ground information	Traffic information for drivers (remote & real time) info and stake holders	Mobility observatories	Insert Intelligence and communication capabilities in construction Signing, coherence in design….	Ergonomy / accessibility of Information systems
technology	Development of local services providers and manufacturers	Smart card, contact less , internet loading	Shared Vehicles motorisation,	All access and supervision TIC equipement and soft	Accessibility of vehicles and all equipments (ex vending machines)	Advanced delivery bays		Environmental friendly buildings Integration of new services (ex Battery loading facilities, accessible fuelling stations,)	Mobility agencies Car sharing websites Journey planners

Polycentric network

	Clean fuels and vehicles	Integrated pricing strategies	Alternative mobility usages or modes	Access restrictions	Collective passengers transport	Logistics	Transport management	Infrastructures	Information systems
Managerial position	Coordinated choice of motorisation for the different types of vehicles / services	Homogeneisation of pricing strategies between cities	Coordination of cities strategies Cooperation with companies, institutions associations for mobility plans or for Soft modes	Involvement of citizens in definition of clear zones Integration in flows & parking organisation	Definition of links between cities, homogeneousness between cities Linking the business community and public transport	Cooperation with stakeholders, Analysis of the evolution of goods flows in/between each city Definition of each city logistics areas	Territory integrated transport planning Definition of Intermodality strategies between cities Demand and flow analysis	Multimodality design of infrastructures	Interoperability between Information systems in and between cities and stakeholders organisations
Monitoring	Homogeneisation of Plan for the development of clean fleets in Local Authorities Follow up of emissions, Air quality…	Global pricing strategy (unity of ticketing) Coordination of the tariffs evolution, including links between cities	Coordination of sharing vehicles systems with cities PT systems Development of inter cities connections Periodical evaluation of the number of users	Coherent deployment of clear zones and accessibility scheme for all cities, Definition of homogeneous access rules adapted according to cities context Access follow up, respect of regulations	Hierarchical network optimisation according local and inter cities demand Connectivity with outside world (ex P+r, links to main stations…) Periodical surveys for PT and non PT users	Hierarchised logistics master plan, coordination of good flows between cities, homogenisation inside cities Evaluation of in/out flows	Detailed requirement evolution analysis Orientation of the demands, Influencing behaviours Continuous evaluation of modal share in/between cities	Coherence in the design and set up of infrastructure Evaluation of impacts on urban & territory evolution	Coordination of the evolution of techniques and technologies of Info Systems (ex mobile info, web2.0, RFID, accessibility of public transport data,..)
Economy	Coordination of exploitation & maintenance resources Local incentives for clean vehicles Joint procurement Funding from various organisms	Parking pricing policies Incentives for multimodality Common tariffs integrating all mobility components	Fiscal incentives to companies that support ecological mobility plans Coordinated tariffs for vehicles sharing (integrated pricing)	Facilitation of commercial, industrial activities Integration of environmental externalities in access tariffs	Define a clear and sustainable and common scheme for financing for PT	Grouping/ dispatching flows for cities Diversification of activities in UCCs, optimisation of deliveries Access restrictions	Adaptation of transport resources to demand	Localisation (land costs) versus accessibility to transport networks Organisation of services in hubs Use of eco friendly material	Common site for all cities and Center city On line information
Information	Promotion of Clean fleets for entreprises Awareness campaigns Eco driving learning	Clear Tarification propositions,	Coordinated Info offices and campaigns dedicated to each specific mode Maps of the zone	Maps, routes and rules about access restriction	PT Integrated on-line, on ground information	Traffic information for drivers (remote & real time) info and stake holders	Mobility observatories	Insert Intelligence and communication capabilities in construction Signing, coherence in design….	Ergonomy / accessibility of Information systems
technology	Development of local services providers and manufacturers	Smart card, contact less , internet loading	Shared Vehicles motorisation,	All access and supervision TIC equipement and soft	Accessibility of vehicles and all equipments (ex vending machines)	Advanced delivery bays		Environmental friendly buildings Integration of new services (ex Battery loading facilities, accessible fuelling stations,)	Mobility agencies Car sharing websites Journey planners

The greatest potential arises from a combined package of all these instruments, customised to a specific area and quite often involving actions dealing with land planning, energy savings or accompanying social evolution. Moreover according to each case, the sequence of the deployment of these instruments may be different, for technical, contextual or economical reasons. The issue of costs and evaluation a priori of the possible impacts in a specific region remain an important issue which must be estimated before launching any actions. This will be considered in the next section.

4.5. Recommendations for developing sustainable mobility strategies in the Atlantic Area

The previous sections presented several measures which could be envisaged to reduce the carbon foot-print of the Atlantic Area according to the context of the cities and the local urban development objectives. The mobility domains to which these measures were related were identified as well as the indicators which could be used to assess the impacts of the undertaken actions.

The European White Paper for transport highlighted several topics which must be taken as a basis for the improvements realised for passengers and freight transport. This last chapter aims to provide some recommendations concerning the definition and the set-up of measures which are particularly relevant for the AA regions and cities in the scope of reducing carbon foot-print without detailing them as they are in the White Paper.

In this document, two types of recommendations will be considered:

1) Those which lead to improvements of the contextual and technical elements on which transportation is based and can evolve in the AA.
2) Those which are related to factors which must be set up or organised by local authorities to organise the deployment of such measures; they are not specific to AA but should be determined coherently in the AA between adjacent regions and cities to reinforce the territorial cohesion's political behaviour.

Two quite important types of recommendation are developed in other chapters of this document; they concern the involvement of local authorities in the facilitation and acceleration of behaviour changes (particularly education and training of all stakeholders) and the connections between transport strategies and Spatial Planning. In the same way other improvements in domains like safety or security are not explored in this document.

Contextual elements

These recommendations are based on the foreseen evolution of the transport activities context. This evolution will have impacts at local level on carbon footprint and their consequences on policy making must be considered when developing new transport strategies.

Ensure the territorial cohesion inside the AA and with Europe

To adopt standards at the European level for all transport related activities is clearly needed. This recommendation does not concern designers of new systems but also the authorities in

charge of the training of transport customers, professionals or citizens. This concern all types of activities such as:

- **Travelling and routing information systems and especially journey planners must be at least interoperable**. Information must be available for all European customers or service providers which can transfer/ transform these data to their own customers in order to facilitate the movement of people and goods. All development should be realised within European Integrated Multimodal Information and management Plan
- **On street/road information must be clear and understandable for any traveller** in order to avoid misunderstandings which can lead to dramatic consequences for road users.
- **The respect of CO_2 and pollutant emissions standards for vehicles or transport activities must be the same** in all territories.
- Interface standards for infrastructure-to-infrastructure, vehicle-to-infrastructure, and vehicle-to-vehicle communications must be agreed.
- **Business-based GHG certification schemes should be encouraged** as well as the utilisation of common EU standards in order to estimate the carbon footprint of each passenger and freight journey to allow better choices of cleaner transport solutions.

Improve the position of the AA as the western European gate

Actions in this domain will lead to a better physical accessibility of the AA regions. Then the recommendations which are the most directly related to carbon foot-print concern:

- **The number of European gates and their efficiency (harbours, stations&airports) must be increased**. Many of the existing gates depend on local authorities. Several types of measures can be undertaken to promote their advantages, to develop new maritime routes (i.e. by encouraging new small companies with clean vessels), to optimise the various technical components (from Information to loading, handling, storing…), to use marine energies and to integrate the connections to these gates in the local transport strategies.
- **Regulations and conditions to access these gates should meet minimum quality standards** assuring homogeneous quality services in all AA gates (stations, ports, airport) whichever the size of the gate and for all type of services (information of travellers, freight handling…).
- **Connections between long distance and local/ regional ones for both passengers and freight must be improved**. This concerns the localisation of hubs, logistics platforms, and the optimisation of their role as decoupling external and internal flows links with Spatial Planning). Although reloading might be considered sometimes as a source of increasing costs and times, the development of optimised inter-modality as well as a global cost/benefit analysis including all externalities should be carried out to determine local and regional strategies and the best organisation of these interchange spots.
- **Logistics organisation to internal (inland) Europe must be created** to facilitate the transit to/from the gates and the related hubs and platforms; multimodal terminals at sea and river ports and city logistic consolidation centres must be implemented.

To develop competences in technological, scientific and organisational innovation

To design and set up more efficient and sustainable transport systems will require innovation in technological domains as well as in mobility patterns. New transport models and more

efficient components of the whole transport system must be developed. To be more effective, research programmes must adopt a systems approach, taking care of infrastructure as well as regulatory requirements, of coordination of multiple actors as well as information systems etc.

Obviously the support of Local Authorities must address these innovative developments which are linked to the improvements of transportation activities in AA. Apart from the funding which should be required, their involvement will concern:

- **Set up an effective coordination of all research works** which intend to improve AA transportation situation. This begins with the definition of coordinated and clear orientations for research organizations, includes support and/or incentive to develop and promote local competences dealing with these specific problems and requires a real management of the cooperation between all stakeholders. An effective network re-grouping all transport research teams in AA should be set up.
- **Develop and implement efficient decision aid tools to monitor the evolution of mobility** (passengers and goods) in each territory of the AA, to develop perspectives related to AA situations according to recent and specific changes and to consolidate the global requirements. Mobility observatories are too few in AA and current forecast surveys and models are too generic and too much "mirror oriented" to provide any help for local decision making concerning transport developments.
- **Support the SMEs which propose innovative approaches** in mobility concepts and technologies, not only on funding but also on several promotional and marketing activities.
- **Create Living labs to** experiment and demonstrate with the citizens of the territories. New mobility concepts cannot be imposed and must be tuned with real life constraints. The diversity of territories in the AA provides a broad range of application domains and situations which should be used to set up global and systemic innovative solutions.

Although training and education are mainly in the scope of the Social Behaviour Pillar, it must be stressed in this document that:

- Education institutions dealing with the specificities of the transport maritime aspects should be developed in order to provide skilled, experienced and competitive labour forces.
- Training of Local Authorities staff specifically in those domains that are related to AA problems must be improved.

Financing and pricing

This is a generic (and crucial) problem for all Local Authorities for which they do not control all the decision variables; however they may use some of them in their territory to reduce carbon footprint. These variables are expressed through:

- **Set up homogeneous & efficient politics of payments of the utilisation of transport facilities.** Transport charges and taxes must be restructured in the direction of wider application of the ‘polluter-pays’ and ‘user-pays’ principle and must include the internalisation of external costs and infrastructure use charges. The cost of local externalities such as land, air or sea pollution, noise and congestion could be internalised through charging for the use of infrastructure or resources depending on Local authorities;

- **Look for the diversification of sources of finance** both from public and private sources; innovative financial instruments have to be designed at local level to widen the possibilities of improvements;
- Tendering process, project assessment as well as various authorisations which must be carried out according to sustainable criteria and more specifically should include life-cycle assessment studies, medium and long-term impact analysis, noise and local pollution costs….

Technical elements

Many technical actions have been identified in the previous chapters concerning the improvements that could be realised in all mobility domains from clean vehicles facilitation to access restrictions methods. The following recommendations represent a summary of the most important improvement orientations which could be set up in the AA.

Modern infrastructures

Building or renovation activities should aim at minimising environmental impacts of transport infrastructures. This means that Local Authorities should encourage:

- the utilisation of renewable energies; marine energies should be used at least in all the sea terminals;
- the development of energy positive buildings and equipments using appropriate material and supervision systems to monitor the life of the infrastructure;
- the localisation in suitable areas in looking for the best compromise between minimisation of global impact, maximisation of efficiency regarding transport demand;
- the implementation of Intelligent infrastructure (both land and space-based) to ensure maximum monitoring and inter-operability of the different forms of transport and communication between infrastructure and vehicles.

Integrated IT Systems

The web native generation will rely strongly on information technologies in transport domain as in other ones. To be in line with these new standards of life which constitutes the informational accessibility to transport services, Local Authorities will have to:

- develop information services for customers especially in the view of seamless travelling and providing a complete set of information for travelling from A to B and to facilitate electronic booking and payment of several services related to the travel[40];
- facilitate and ensure the interoperability between stakeholders which is one of the challenges to improve transport efficiency;
- provide all organizations which depend on their responsibility with monitoring, supervision and interoperable tools, as well as competences that will guarantee the optimisation of the flows between them and with external world and will facilitate intermodal transport and the reduction of overall energy consumption and emissions;
- promote the development and use of intelligent systems for interoperable and multimodal scheduling, information, online reservation systems and smart ticketing.

[40]Several demonstration and research projects are related to this topic in the different Interreg regions related to AA like (START in AA, INTISS in NW…)

Improve the multimodal intercity travel and transport inside AA

Attractive frequencies, comfort, easy access, reliability of services, and intermodal integration are the main characteristics of service quality. These are part of the measures necessary for integrating different passenger and goods transport modes to provide seamless multimodal travel.

Considering the identification of different types of territories, recommendations can address two decision levels: connections between territories and inside the five types of territories as mentioned before.

Between territories

In the intermediate distances, new technologies are less mature and modal choices are fewer than in cities or urban communities. Cars and trucks will remain the most utilised transport modes among the connecting transport modes, unless:

- The connections between AA major cities (and with the gates) are improved using rail or coaches networks which require a complete renovation of the related infrastructure and operating methodology.
- Sea routes are developed (cf Interreg and Marco Polo programmes for instance).
- Capillarity links between territories, infrastructures and transport modes, are adapted to the various demands for passengers and freight transport.

Inside territories

The matrices of chapter 6 described the various actions that can be envisaged to build a Sustainable Transport Plan that every territory should design as demonstrated in the CIVITAS programme. Such plan is integrated in the global development plan of the territory and encompasses the individual Sustainable Transport Plans each city included in the territory.

Influencing factors

The "values" of these factors have to be determined by local authorities before launching improvement projects. They are not specific to the transport domain but they have to be considered since they may become facilitators or barriers depending on their setting. Five types of factor have been identified and are related to:

- the type of governance which will translate the involvement of Local Authorities in the organisation of the transport system;
- the relationships installed between stakeholders; this cooperation function covers existing PPPs as well as the quality of connections and interchanges required between them;
- the qualifications of the organisations involved in the system regarding their ability to modify their behaviour or the services they propose to their customers (passengers or goods) which can be qualified as their Agility;
- the quality of the preparation/anticipation of the future by local authorities;
- the monitoring of the improvements projects;

Determine the Governance exerted by Political institutions in charge of the developments

The two extreme exercises of governance are "Virtual" and "Directed"; between these extremes there are several levels of collaboration:

- Virtual situations occur when there is a lack of central management authority; the equilibrium of the whole systems relies upon relatively invisible mechanisms. The implementation of basic regulations, like delivery hours, is the smallest action that can be undertaken and cannot be considered as a management measure. So the organisation relies upon more or less explicit behaviour of actors (for instance the congestion in certain streets at specific hours).
- Directed systems are centrally managed during long-term operation to continue to fulfil those purposes. The mobility system over a large city is rarely in this extreme situation, however for some times (e.g. implementation of a tram network) part of the mobility system is organised around a specific objective.
- In a Collaborative governance, stakeholders must more or less voluntarily collaborate to fulfil the agreed upon central purposes; in this case, the next item clarifies the level of the collaboration networking between cities (FOCI p 523).

As mentioned previously, several territorial configurations exist in the Atlantic Area. For each of them, the governance concerning transport improvements must be adapted to the local situation, involving one or several urban communities. Regarding GHG reduction and transport, the role of each of them, the links between them and with adjacent territories must be identified so that all decision makers can act respecting global coherence over the area.

Clarify the relationships between stakeholders

It is generally agreed that easing of the transport constraints will be facilitated by the creation of fully integrated, modern and reliable transport networks, capable of exploiting the strengths of each mode, in its own and in combination, and of accommodating the technological progress.

Apart from the technical aspects of this integration which belong to the operational instruments categories (mainly dealing with interoperability, inter-modality..), this integration requires a strong cooperation between stakeholders. This is clearly the role of local authorities, in the framework of their governance principles, to determine and control the behaviour rules between stakeholders.

All actions which intend to improve this collaboration and overcome the intrinsic difficulties of divergent objectives of the organisations belong to this function.

Take into account the agility of all involved organisations

Agility is the ability of stakeholders to adapt their behaviour according to the changes of external and internal constraints and evolutions. Each organisation has its own agility and modifications are limited both by the nature of the organisation and the relations with other institutions.

This means that agile partners of a mobility system will set up faster the modifications required by any internal/external demands and often with a lower cost than a not-so-agile partner.

An agile organisation is designed for velocity and flexibility by reducing the number of vertical and horizontal layers in the organization chart and rearranging them around natural processes. Its main attributes are speed and easiness to change, predictability and quality in changing.

It is then obvious that evolutions will be slowed down by the less agile stakeholders; actions have to be set up to change their practices and/or behaviour. If these stakeholders are groups, such actions are more related to communication, motivation, etc.; if they are professionals changes could be generated through (contractual) requirements, quality of services, specific standards, regional regulations etc.

Develop Preparation/Anticipation competences

This theme covers all the measures launched by Local Authorities,

- in order to determine periodically the possible evolutions of the mobility in their territory;
- to develop inside their territory intelligence and knowledge designing solutions or proposing new operational instruments (RTD level).

The first actions that must be set up to generate these abilities are:

- The creation of a Mobility Observatory covering the whole area and linked with adjacent ones. The role of such an observatory is for one part to analyse the situation and the impacts of changes; then it is necessary to develop evaluation competences and processes for all type of projects (cf indicators in chapter above). The second part is to keep aware of the external evolutions and to compare the local situation to new principles or practices;
- The implementation of a "continuous improvement" process, based on the Observatory findings and the Research activities aiming to identify, determine and assess the practices which could be implemented in the Living labs mentioned above.

Set up adapted projects construction and monitoring

The collaborative and adaptive nature of transport systems require a structured engineering approach which is specific to such large and complex systems Several methods have been experimented to manage such projects which take into account decisions and activities at different actions levels : strategic, action planning and operational levels.

The first action which can be suggested is to strictly respect the ISO 10 006 standards (or PMI ones Project Management Institute) in all projects and to work only with companies and project managers who have been certified by agreed organizations.

5. Spatial Planning

5.1. Terms of Reference

The importance of spatial planning as a cross-cutting policy has already been mentioned in the introduction. It bears a special connection to aspects relating to mobility and social behaviour patterns. Coordination between all such aspects is essential for achieving an effective reduction in carbon emissions.

Spatial Planning is a key factor to achieve a low carbon emission society. Land use regulation is a useful tool to reduce CO_2 emissions as the spatial structure of urban systems is closely related to greenhouse gas emissions. The tendency to concentrate the population around large cities makes it necessary to approach their design in terms of density and accessibility.

Low-density housing urbanizations are examples of unsustainable developments due to the limitations involved in the implementation of public transport. Private car mobility is one of the most important focuses of greenhouse gas emissions in modern Atlantic societies Territorial, spatial and urban planning should provide maximum accessibility to public transport networks, thereby minimizing those areas only accessible by private vehicle. So, a main goal for our society should be to adopt a Spatial Planning approach based on the carbon footprint reduction perspective.

In recent years European countries, both on their own and together in the European Union, have tried to minimize CO_2 emissions by implementing various plans and policies, one of which deals with sustainable territorial planning and its management. At the same time, unsustainable trends persist in many areas and the efforts need to be intensified. Although some advances have been made, further actions should be undertaken in the future.

The most relevant strategic areas on which the Spatial Planning pillars of Climatlantic are focussed are: Territorial and urban planning, Population, housing and urban density, Public transport policies, Land use in rural areas and Tourism and leisure policies.

The European Spatial Development Perspective and its application to Spatial Planning in the Atlantic area

Amongst the guidelines proposed under the European Spatial Development Perspective (ESDP) for the territorial development in the EU Member States as a whole is that it will be necessary to devise policies going beyond national territorial boundaries in search of joint strategies that will facilitate cohesion and the balanced and sustainable development of wider spatial areas than those defined strictly on a national basis.

In this regard, the ESDP refers to Spatial Planning as one of the corner-stones for overcoming disparities between regions. This is therefore the context in which this chapter is to develop its recommendations for reducing the carbon footprint of the European Atlantic Area, with two proposals. The first is to identify a series of major territorial guidelines that can help to reduce emissions on the basis of integrated spatial planning and land management policies; these will be of a strategic and non-binding nature, with no intention of usurping the corresponding powers of the various levels of government, aiming instead to identify the existing possibilities within the spatial planning systems of each Member State with a view to implementing joint planning actions for reducing the carbon footprint. The second proposal is to construct a

carbon footprint cost indicator based on distance from centres of population that can be used in town planning processes to determine the distance at which the impact on emissions becomes too high, thus enabling the necessary corrective measures to be adopted. These proposals thus pursue two fundamental ESDP goals: on the one hand, the balanced and polycentric development of cities and a new urban-rural relationship; and on the other, to improve the integration of peripheral territories, which include a large proportion of those constituting the Atlantic Area, within the European Union.

The ESDP promotes the idea that Europe should seek to achieve a polycentric development model, through the creation of several economically dynamic zones, comprising interconnected urban or metropolitan areas, avoiding high settlement dispersion indices and well linked with the rural areas and cities in their hinterlands. These cities should have a decentralised structure, with a graduated urban network that covers the whole territory. According to these guidelines, this should be the model to enhance in the Atlantic Area, and the goal of the strategic guidelines put forward with a view to reducing the carbon footprint. These strategic provisions will be based on a series of key pillars: control of the physical expansion of towns and cities; a mixture of functions and social groups in urban areas; the wise resource-saving management of the urban ecosystem (water, energy and waste); better accessibility (more efficient and environmentally-friendly means of transport; residential areas closer to city centres); and the conservation and development of the natural and cultural heritage.

In order to moderate the continuing trend towards the expansion of towns and cities, national, regional and local authorities need to promote the idea of the 'compact city' (or the city of short distances), which includes control over the extension of development land, within the framework of a carefully thought-out town-planning policy, particularly at the periphery of towns and cities and in many coastal areas. Furthermore, limiting the expansion of urban centres can only take place within a regional context, making it necessary to intensify cooperation between the city and the surrounding countryside as a way of overcoming and reconciling conflicting interests.

The accessibility of cities thus becomes one of the core aspects, since it will have a direct effect on carbon emissions, the quality of life and economic performance. It is therefore necessary to pursue a policy in which the expansion of towns and cities is in direct harmony with land use and transport planning. The aim is to reduce the expansion of the towns and cities and adopt an integrated approach to transport planning, which will reduce dependency on the private car and promote other means of mobility, such as public transport or the use of the bicycle.

To achieve greater accessibility of European Atlantic regions and facilitate their connections with other European axes, the Rail Corridor initiative for Atlantic Freight has arisen. This corridor will be a real and complementary alternative to road transport with a development and coordination of nodes and intermodal logistic centres as well as terminals, especially in port locations. This corridor will be an opportunity for territorial cohesion of the Atlantic Area, encouraging economic exchange and correcting the present modal imbalance, thus contribution to the reduction of the carbon footprint.

All these aspects drawn from the ESDP and the initiative of the Atlantic Rail Corridor for Freight are included in the Spatial Planning Pillar, which adopts them with a view to applying them to the Atlantic Area. To this end, its associated pilot project will develop indicators for planning

new developments with less carbon footprint and will put forward the need for joint guidelines for action for the Atlantic territory as a whole.

The Atlantic territory

The European Atlantic Area has an uneven urban/rural typology classification (Figure 5.1). As can be seen from the NUTS 3-scale typology recently produced by the ESPON EDORA project, the predominantly urban regions are to be found, going from north to south, in southern Scotland, Northern Ireland, the Manchester-Liverpool strip in the North West England, South Wales (in the Cardiff area), the Basque Country in Spain and Greater Porto and Greater Lisbon in Portugal. Nevertheless, within this typology that defines the urban-rural hierarchy, several territories are classified as 'intermediate, close to a city', with a mixture of urban and rural features, in which a negative ecological footprint is making itself felt, as in more heavily urbanised areas, to a significant extent.

Other regions have a large or very large rural component. These have lower emissions,not so much as a result of good practices in energy use and consumption as of reduced accessibility to urban areas or their low levels of population. These rural region typologies predominate in Ireland, the Scottish Highlands, Lower Normandy, Brittany, Poitou-Charentes, Aquitaine, Eastern Galicia in Spain or the interior of Portugal.

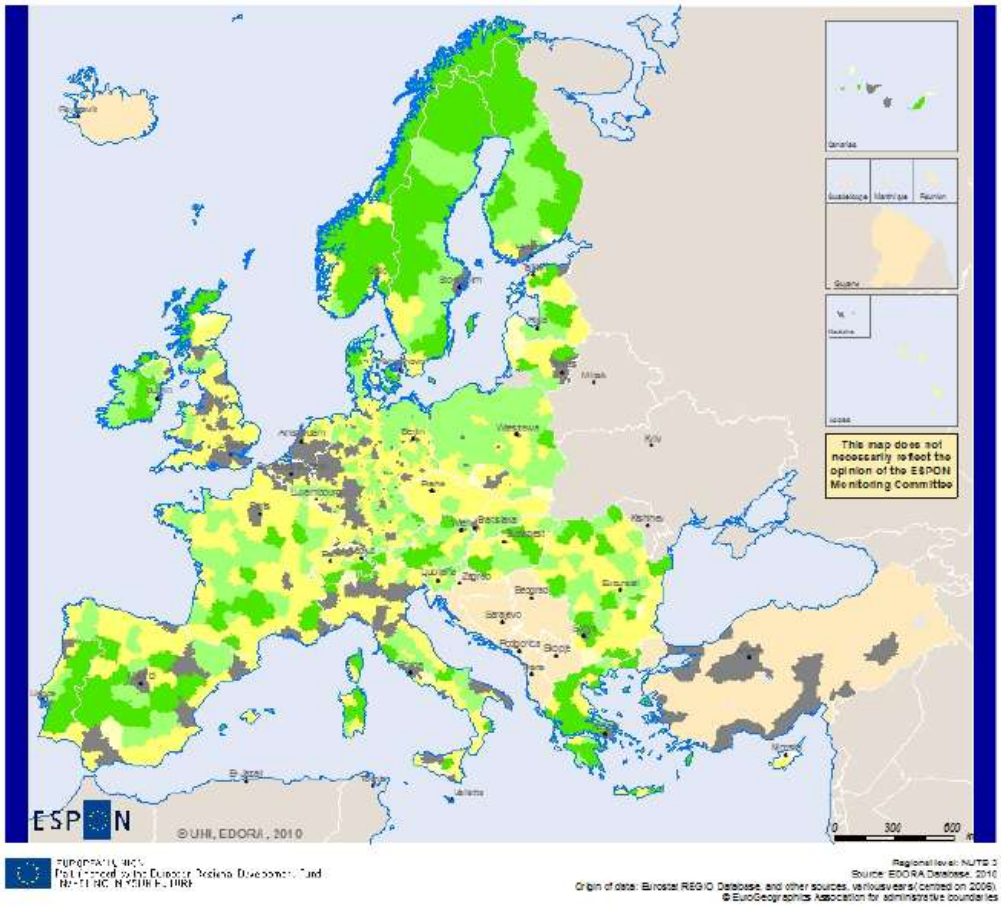

Fig. 5.1.Urban-Rural Regions Types. Source: EDORA ESPON Project (2010)

The demographic evolution of the Atlantic regions overthe past decade shows a moderate to intense increase (Figure 5.2), in spite of the rural or remote rural characteristics of these regions. Exceptions to this pattern are found in the regions of Asturias (Spain) and Ayrshire (Scotland). The greatest population increase was recorded in Ireland and Navarre (Spain), with significant growth also occurring in the Scottish Highlands, Cornwall (UK), the western seaboard of France, Cantabria (Spain) and the north of Portugal, whilst growth rates were moderate in the remaining regions. Population growth was more intense in Larger Urban Zones (LUZ), a concept that combines towns and cities with their functional area, as defined by their commuters.

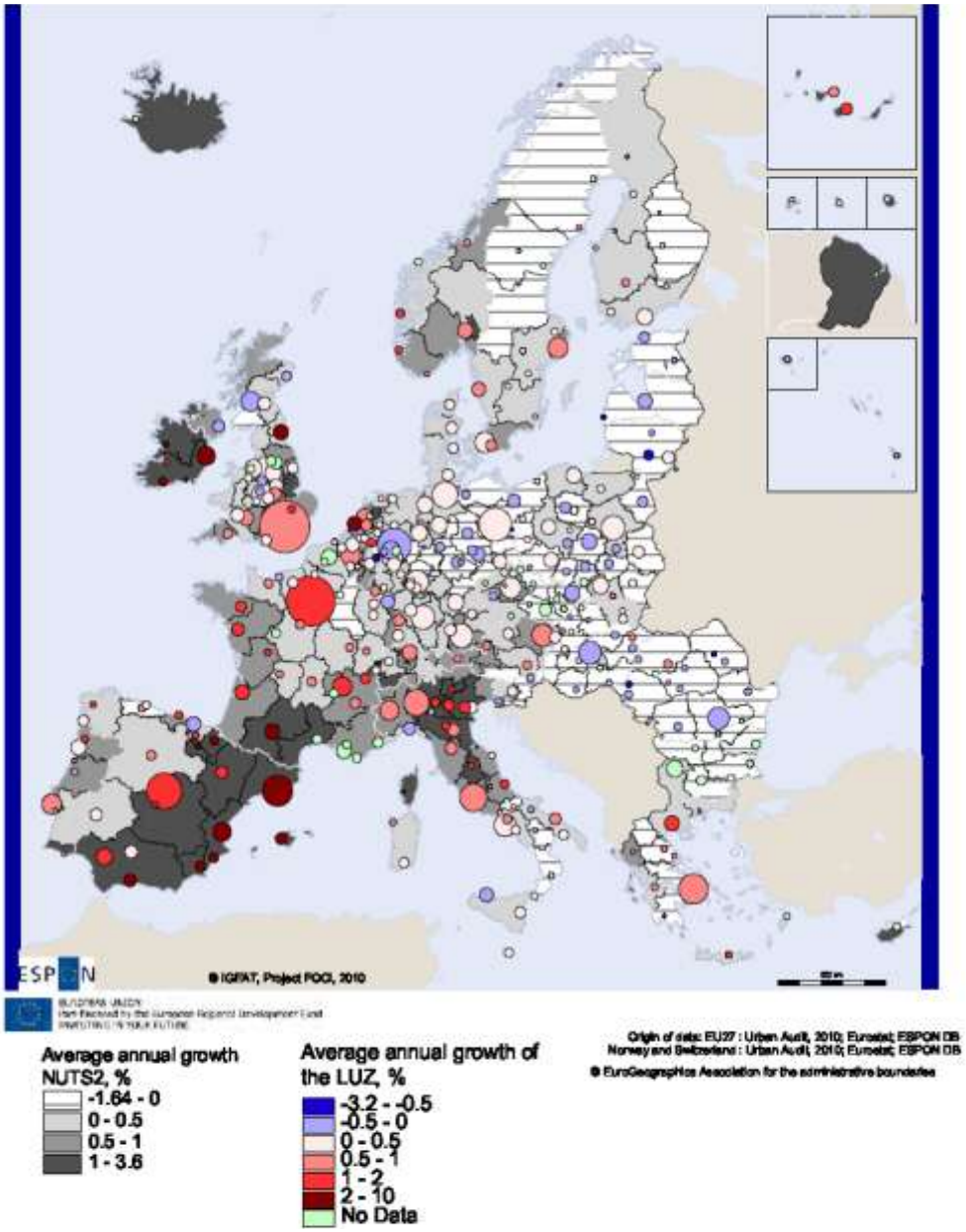

Fig. 5.2.Evolution of the population in Larger Urban Zones and in the surrounding NUTS2 during the first half of the years 2000. Source: FOCI ESPON Project (2010)

Demographic projections indicate that population in the Atlantic Area will continue to increase except in large areas of Scotland, northern Spain and Portugal south of Porto, resulting in enhanced carbon footprint of te region, unless territorial patterns of settlement and mobility are reversed in the other more dynamic regions (Figure 5.3). Nevertheless, the population decrease prorjected for the less dynamic regions is klikely to be compatible with a continuous population increase of their urban areas.

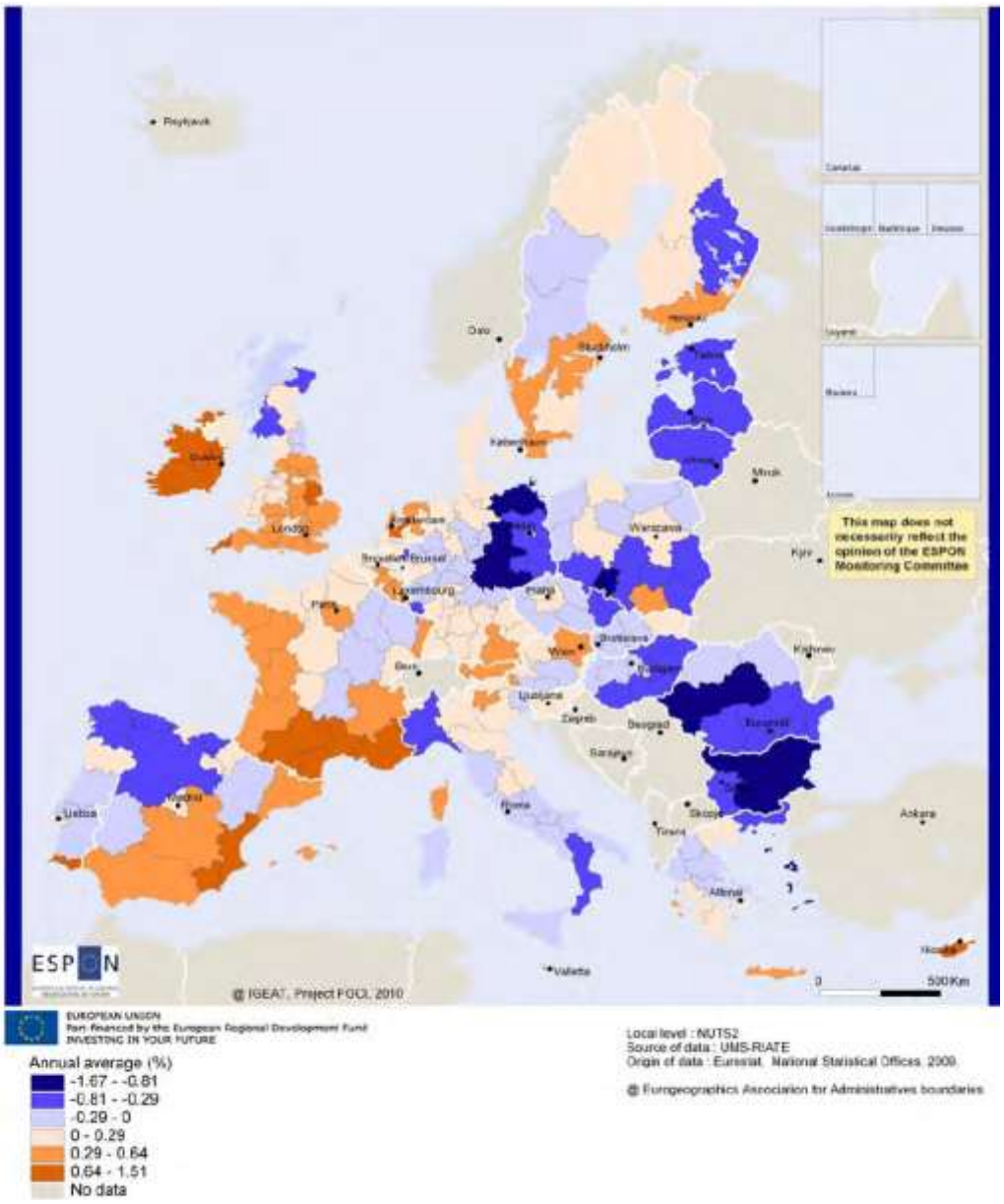

Fig. 5.3. Population Increase 2005-2030. Source: FOCI ESPON Project (2010)

5.2. Present situation and trends in spatial planning in the Atlantic Area

Although rural activities are of relevance for the emission of greenhouse gases, and population growth is becoming a great threat to territorial planning at the global level, transformation occurring in urban areas is the factor of greater concerning GHG emissions derived from Spatial planning.

One of the most outstanding features of the relationship of Atlantic European societies' with their territory over the past twenty-five years is the increase in mobility needs of the population. This has led to a constant increase in GHG emissions, mainly due to a higher consumption of fossil fuel associated to parallel increases in day-to-day travel (and/or weekly travel, in this case to secondary residences). The growing dissociation from the place of residence, work/studies, leisure, shopping, etc. has led to increases in mobility that double every few years across all European countries. This uncoupling, mainly between home and the workplace, tends to involve greater distances, owing to better roads and a denser network of high-capacity roads. In turn, this has led to faster travel and associated increase in fuel consumption and GHG emissions.

The growth of the so-called urban sprawl also implies an increasing consumption of space (that is finite and non-recoverable), which in turn has a significant carbon footprint impact. This pattern is related to an increase of inner city land prices, deficiencies in urban management, lack of planning, and a perceptive culture that advocates closer contact with nature and a supposed higher standard of living in areas away from the city centres, yet well connected with them. In the case of the European Atlantic territories, a cultural trend towards dispersal related to the atavistic value of land and the sociological attachment to the home land needs also to be mentioned. This cultural trend implies a different way of understanding and using the territory that leads to higher habitat dispersal rates than in other European areas.

The unlimited growth of cities is profoundly unsustainable and implies an extremely high increase in GHG emissions. The constant spread of low-density settlements at the edge of cities is closely linked to dependency on private cars and difficulties in making public transport profitable and available to the population. This has direct implications for high energy dependence on fossil fuels and increases in GHG emissions. Moreover, families have to spend more on travel, which lowers their standard of living, particularly in the current context (and presumably in the future) of increasing fuel prices.

In the mid-term, more compact cities where public transport would be easier, or where the cost of car travel, when necessary, would be lower, should be prioritized. Apart from having a lower carbon footprint, compact settlements would also be more economically sustainable than the areas of low-density urban sprawl.

The *Pilot Project* developed in this chapter seeks to attain a synthesis indicator that will use territorial variables, and low-density formulas constituting a multi-criteria spatial decision support system to evaluate urban growth scenarios in terms of the carbon footprint. The indicator will provide urban and territorial managers with a benchmark to be applied to territorial planning (understood as urban and territorial planning). The indicator is highly associated to the cost of travel/mobility with regard to the territorial structure.

In brief, the aim is to derive an index from the different indicators explained afterwards that can be applied to any of the urban areas in the European Atlantic area, to help decision makers

to evaluate urban growth scenarios in terms of potential cost of the carbon footprint. It will be a synthetic tool for measuring the relationship between mobility and urban sprawl. The indicator will indicate areas where, from the viewpoint of potential carbon footprint (associated with mobility, public transportation, existing infrastructure, facilities location, density of population, land use, topography, sensitive areas, sun insolation, etc), it would be preferable to expand/re-use the existing city. This issue (the re-use of urban land) is cited as a relevant element in the Leipzig Charter agreed between the EU Member States in 2007, and is taken up again as an essential issue in this project.

Spatial and urban planning are effective instruments to achieve a low carbon emission society at regional and local level. The effectiveness of these instruments is based on the fact that they strongly depend upon regional and local Authorities' decision making capacity. The enforcement of spatial and urban planning orientations and rules depends ultimately on private and market reactions. But spatial and urban planning are mainly regional and local competences that make a big difference as far as feasibility of the carbon footprint strategy is concerned. This is where the orientation that should be given to the Spatial Planning Pillar comes into play. New territorial development strategies at the regional level are needed. They require the implementation of coherent policies in all the Atlantic Area that apply the principle of less travel and less dependency on private transport to urban and metropolitan planning issues. National, regional and, above all, local authorities should ask themselves whether their planning policies and systems are adequate to bring about intelligent, sustainable growth with a lower carbon footprint. For instance there could be a penalty for growth beyond a certain spatial limit (a specific distance from cities), and public transport by bus, tram or train should be promoted.

Application of the proposed indicator will be feasible only if each member state of the Atlantic Area has similar powers of government over the territory. This similarity should at least apply on a local scale, in which a GIS tool can be used for urban planning purposes. This will lead to changes in GHG emission patterns, the goal being to achieve long-term sustainability. Table 5.1 reflects the distribution of spatial planning powers in the member states of the Atlantic Area.

Table 5.1.Hierarchical system of spatial planning instruments and their scales of application in the Atlantic Area member states.

Country	National scale	Regional scale	Sub-regional scale	Local scale
Spain	No powers. The state only intervenes in matters of general interest: national infrastructures.	Regional Spatial Plans (under a variety of names). Powers: regions	Sub-regional Spatial Plans (under a variety of names). Powers: regions	Municipal Spatial Plans. Powers: municipalities (local level)
Portugal	National Programme for Spatial Planning Policy (PNPOT). Powers: national government	Regional Spatial Plans (PROT). Powers: regions & national government	Inter-municipal Spatial Plans (PIMOT). Powers: municipalities concerned & regions	Municipal Spatial Plans (PMOT). Powers: municipalities (local level)
France	Spatial Planning Guidelines (DTA). Powers: national government	Regional Spatial Planning and Development Scheme (SRADT). Powers: regions & national government	Territorial Coherence Scheme (SCOT). Powers: Groups of municipalities	Local Urban Planning Plan (PLU). Powers: municipalities (local level)
United	Different documents	There is no Regional	There is no equivalent	Local Development

Kingdom	with guidelines: National Planning Policy Framework, National Policy Statements, the National Infrastructure Plan and others Powers: national government	Spatial Strategy because regional level has been abolished. No powers	document for land use and spatial planning issues. Only London have land use & spatial planning document for Greater London (London Plan) No powers (except in London)	Framework (Local Plan). Powers: municipalities (District councils: local level)
Ireland	National Spatial Strategy (NSS) and National Guidelines. Powers: national government	Regional Planning Guidelines. Powers: regions	City, County and Town Development Plans. Powers: Planning Authorities (local & supra-municipal level)	Local Area Plans. Powers: Planning Authorities (local level)

Taking into account the hierarchical system of spatial planning instruments and their scales of application and the different political and institutional conditions prevailing in the countries represented in the Atlantic Area, we conclude that Spatial Planning can act as a key instrument to reduce carbon footprint in the territories and that the indicator proposed in our pilot project can be applied directly by local authorities in all five countries. Thus, the decision as to whether to apply it or not can be taken at local level, although in some cases it may be necessary to obtain the approval of a higher administrative authority.

By transposing the current situation to a SWOT analysis, the following array of features could be obtained:

STRENGTHS	WEAKNESSES
• Good stratifications of the range of cities. • Good coverage of the territory by the population • High density in general • Landscape & territory with high value	• Huge areas of spread cities • Lack of territorial planning • Low number of planning instruments at the local level. The existing one is very old and it does not answer to the actual requirements of the society. Spain and Galicia in particular. • Lack of quality public transportation outside big cities • A poor planning culture that leads people to want to build anywhere. • Lack of instruments above OT level to coordinate activities beyond just viewing local municipal planning.
OPPORTUNITIES	**THREATS**
Culture regard town-planning interventions in inner-city areas (rehabilitation, renovation, regeneration).	Great depopulation of rural population towards cities • Coast/tourism pressure • Big livestock

5.3. Spatial planning indicators

Spatial planning indicators for the Atlantic Area are needed to produce an accurate territorial diagnosis that will serve as the basis for a series of recommendations on carbon footprint reduction. From the various existing indicators for climate change based on spatial planning in the Atlantic region two different categories could be identified: rural (land use) and urban (sprawl) indicators.

Additionally, to study the territorial structure related to population density and demography is clearly needed. In this sense, the similarities and disparities within the studied territory need to be defined, and the territory properly characterized to learn the degree to which the indicator formulated by the pilot experience can be applied to all the countries.

The aim is to get a basic corpus of comparable primary indicators to give a clear idea of the sustainability of each of the Atlantic territories by using concise information. From that information, analytical and/or synthesis indicators may be developed at a later stage to estimate the carbon footprint.

The indicators proposed are listed in Table 5.2 and rated from their availability in each of the participating countries.

Table 5.2. Spatial Planning indicators

Indicator	Brief description	Level
Percentage of urban and rural population(1)	Towns with a population of more than 2,000 are considered urban. The purpose is to know the urban density rates, with more mobility and a higher carbon footprint impact.	Municipal and NUT 3 level
Population density (inhabitants per km^2)(1)	Distribution of the population within the territory. Provides a preliminary interpretation of the degree of population dispersal or concentration.	Municipal and NUT 3 level
Percentage of population living in an urban area or region(2)	This can be obtained by calculating the population that lives within a certain radius (buffer) of the cities. Information that clarifies the impact of urban development and the carbon footprint of travel.	Cities with a population of more than 50,000 in a layer in 'shapefile' or compatible format.
Dwelling density(2)	Together with the population density, it gives a fairly good definition of the degree of population dispersal or concentration.	Preferably municipal. If not possible, at the NUT 3 level.
Reconstructions completed per 100 new buildings(3)	Statistical indicator that can contribute to indirectly measure the reuse of urban land	Municipal and NUT 3 level
Percentage of secondary residences(2)	Also measures the carbon footprint according to its magnitude.	Municipal and NUT 3 level

1) Data available
2) Data exists, not immediately obvious how to obtain
3) Not clear if data exists

Further description of potential indicators

- Regional CO_2 Sequestration Profile

At the regional scale an indicator that translates the potential of carbon capture and storage, built from the profile of land use (as well as the corresponding temporal dynamics) in the rural and natural uses of the different territories could be developed using the existing data sources from both European datasets (like CORINE) and corresponding national land use datasets.

This indicator would allow the enforcement of a new strategy that underlines the role that green and other environmentally-valuable areas in less-developed and inner regions of the Atlantic territory in absorbing GHG emissions (carbon sequestration). This should be a key element of territorial equity allowing for monetary compensations and funding oriented towards territorial cohesion objectives.

- Implementation of CO_2 Reduction Criteria

Atlantic regions and local authorities should increase their efforts to develop new spatial and urban planning processes aimed at reducing GHG emissions, by including this criterion as a priority to be met in public tendering. Thereby, these instruments guidelines and standards for effective control of urban expansion and public infrastructure networks would be progressively incorporated into urban development processes.Other measures and indicators should be considered, such as tele-working promotion in those occupations where this is feasible, public transport use and corresponding system networks extension, measures taken by public authorities for carbon footprint reduction, awareness raising campaigns, changes in the territorial model advocating the recovery/re-use of existing urban spaces instead of the mass consumption of space in growth sprawling into the suburbs, among others.

5.4. A pilot study to foster GHG reductions through sustainable spatial planning

The present study aims at providing planning authorities with a synthetic tool for measuring potential carbon footprint impacts of urban growth decisions and assessing the performance of current urban areas. By classifying urban areas in terms of a global suitability index it defines the areas in which urban expansion has an excessive potential carbon footprint and the areas where urban re-use and densification policies should occur.

The pilot study was developed in two different urban areas, both marked by a highly dispersed urban settlement: Vila Real in the Northern Interior of Portugal and Vilagarcía de Arousa in the Spanish coastal zone of Galicia.

Vila Real is a medium city in northern Portugal with a highly dispersed suburban and rural population and high usage of mobility in private vehicles owing to the difficulty of providing public transport (Figure 5.4). The municipal territory is about 370km^2 with a total population of about 50.000 inhabitants where more than 50% live in the city urban area. The study area has a total area of 43km^{2}and integrates both the city core and the adjacent urban/rural fringes

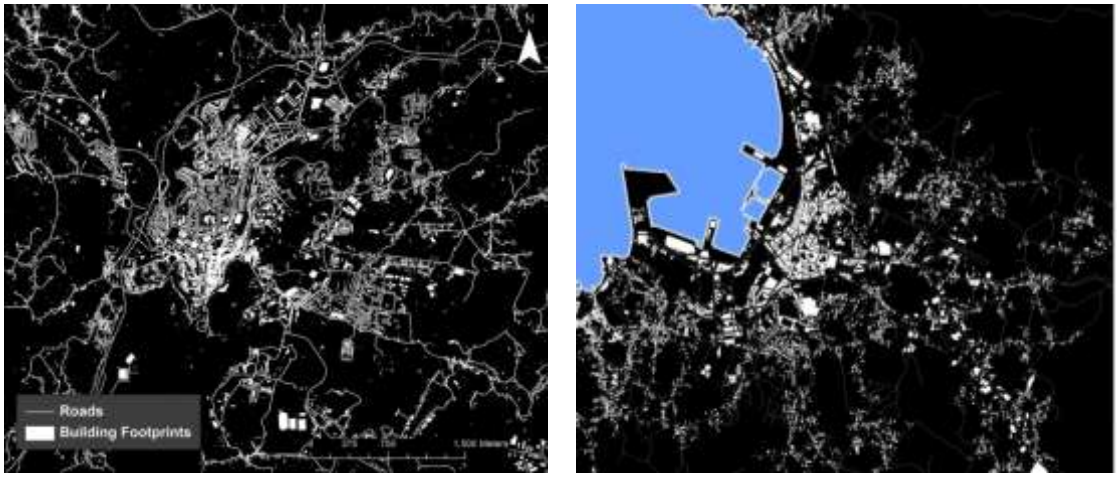

Fig. 5.4. Vila Real city urban fabric (left) and Vilagarcía city urban fabric (right)

Vilagarcía de Arousa is a port town situated on the Ria of Arousa (Ría de Arousa) in Galicia in Northern coast of Spain (Figure 5.4). It is the largest town on the southerly coast of the Ria de Arousa and faces Rianxo on the opposing coastline. It has a population of almost 38,000 inhabitants (Census review in 2010), so it is the eighth largest town in Galicia. The urban area has grown considerably in recent decades with the development of the Port and the canning industry, mostly around the town centre and in a sprawled way of up to Carril and Vilaxoán.

Methodology

The methodology used in this study provides a broad outline of the variables and layers of territorial data employed in the GIS-based multi-criteria analysis. The global indicator was obtained by combining the values from four major groups' suitability indices (Mobility, Public Infrastructures, Energy and Land Use) in which several criteria were considered. It makes use of a GIS system combined with a multi-criteria decision making method (MCDM), namely the Analytic Hierarchy Process (AHP). The latter is a theory of measurement through pair-wise comparisons and relies on the judgements of experts to derive priority scales.

The comparisons are made using a scale of absolute judgements that represents the extent to which one criterion dominates another with respect to a given attribute. Since composite indices can be criticised for their inability to show the negative movements of particular indicators, thus making it difficult to implement strategies that target specific problem areas, the developed model also controls group values in a disaggregated form. Following the entry of the weighting factors, the GIS system produces a set of indices including a composite suitability index in six comparative suitability levels: Unsuitable, Very Low, Low, Moderate, High and Very High. These six comparative sustainability levels are set by assigning scale values between 1 and 6 for each indicator.

The GIS system developed provides a global urban suitability map as well as individual maps for all indicators and indicator groups. A graph report for the global study area presenting grid cells distribution for each indicator group and for the global index is also obtained. Technical details of the developed methodology as well as tools and geo-processing methods used and the weights defined for every indicator can be found at http://www.aaa.com

Mobility

One particular area where urban planning can potentially reduce GHG emissions is by maximizing proximity of new developments to public transportation systems and local amenities. Areas where these overall accessibility indices are better, potentially promote the walking and cycling modes, thus reducing car dependency and consequently GHG emissions.

To determine a mobility index, several criteria were considered. The amenities considered include activities related to Health, Sports and Leisure, Education, Food Supply; all of them typical day-to-day movements in an urban area (Table 5.3). The goal was to evaluate accessibility to these amenities for all urban areas and to determine a global suitability index in terms of mobility since high accessibility areas favour low environmental impact transportation choices such as walking and cycling. Distance to the public transportation system was also considered as a criterion; in the particular case of Vila Real bus stops were considered but other transportation modes infrastructures like metro stations and ferry boat terminals can also be considered. A field survey was made and all amenities and bus stops were geo-referenced in separated point layers.

Table 5.3. Data layers considered in Mobility Group

CRITERIA	DATA LAYERS
Education	Nursery and Primary schools
Health	Pharmacies
Food Supply	Supermarkets
Sports and Leisure	Parks and Multi-Use Games Areas
Public Transportation	Bus stops

The following zones were identified in Vila Real and Vilagarcía from the resulting mobility group suitability raster maps (Figure 5.5):

a) ***The city centre***, typically highly densely, mixed-use and with a very high level of accessibility to public facilities and amenities where walk ability and cycling can be efficient alternatives to cars.

b) ***The Outer City***, with a high level of accessibility where residential developments are dominant. Travel mode choices can still be influenced by sustainable measures.

c) ***The Suburbs***, characterized by a highly dispersed urban fabric, mainly constituted by ribbon development areas and some residential developments. These areas are highly dependent on automobiles and 'soft' travel measures are difficult to implement.

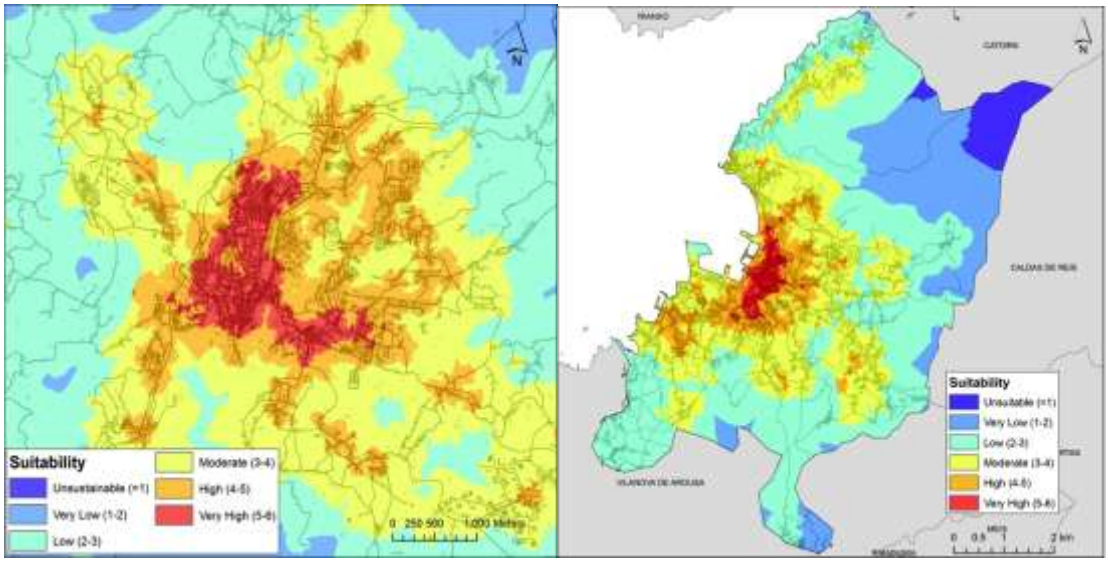

Fig. 5.5. Mobility Suitability Index in Vila Real (left) and Vilagarcia (right)

In Vilagarcía, the city centre is more compact and very well defined, concentrating more than 70% of total urban amenities, but when compared with Vila Real, it also presents more occupied areas classified with moderate and low suitability index which tends to reveal a more dispersed urban development (Figure 5.5). It is important to acknowledge that their urban morphologies are highly influenced by their topography: Vila Real is located in a mountain area and the city is surrounded by two river valleys, leaving few city centre adjacent areas left for urban development. On the other hand, Vilagarcía is located in the coast, on a relatively flat area, where urban development can occur in a more continuous way.

Public Infrastructures

Urban form plays a major role in public infrastructures and utility demands. A clustered and dense structure dramatically increases the efficiency of public infrastructure and utilities, such as roads and highways, wastewater and water supply, thereby reducing carbon emissions from infrastructure construction, use and maintenance. Urban sprawl, on the other hand, consumes more land and requires bigger utility systems, resulting in higher costs of linear utility infrastructures and more energy consumption in construction, maintenance and supply. The goal is to locate new urban developments in order to maximize the use of existing infrastructures. In this group, four criteria were considered to produce a utility suitability index: (1) distance to roads; (2) distance to water supply infrastructure; (3) distance to wastewater infrastructure; (4) distance to recycling points (Table 5.4). Public infrastructure data was collected from local authorities and road network centre-lines were extracted from 1:10k digital cartography.

Table 5.4: Data layers considered in public infrastructures group

CRITERIA	DATA LAYERS
Water supply system	Water distribution network
Wastewater system	Sewerage network
Solid waste system	Point data layer considering only differentiated municipal solid waste collection points
Road Network	Roads considered by its centrelines

In Vila Real, the group results confirm the highly dispersed urban form with more than 60% of the city being classified with high suitability values due to the large extension of public infrastructures that cover most of the study area. The map in Figure 5.6 makes it clear that there are multiple areas (mostly in the NW and SE urban fringes), where urban consolidation can occur thus maximizing existing infrastructures and avoiding sprawl growth. In Vilagarcía, the resulting map in Figure 5.6 shows an even more extended utilities-supplied area resulting in almost half of the municipal territory (49.7%) classified with a very high suitability index.

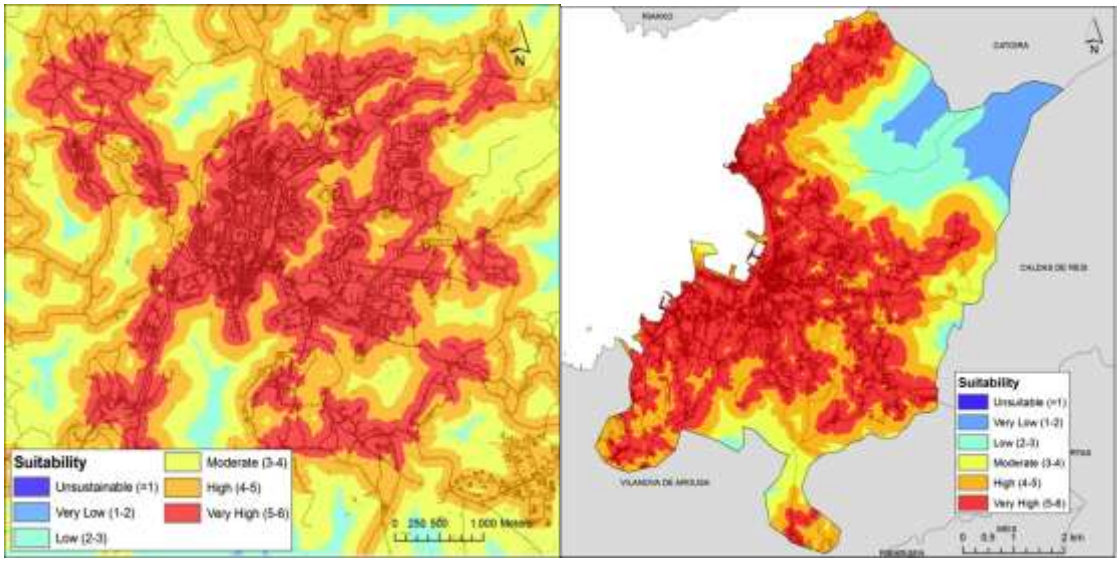

Figure 5.6. Public Infrastructures Suitability Index in Vila Real (left) and Vilagarcia (right)

Building Energy

The building energy suitability group considers only topographic factors related to construction site location that may potentially influence GHG emission reduction by resulting in less energy demand during building and use (Table 5.5). Construction in steep slope terrains requires more earth-work and more materials than building in moderate or flat terrains. Terrain orientation is also an important factor since locating urban developments in well-oriented areas influences the passive energy of buildings by maximizing direct solar gains and reducing heating demands in the winter periods. Elevation data was extracted from 1:10k digital cartography.

Table 5.5. Data layers considered in Building Energy Group

CRITERIA	DATA LAYERS
Slope	Contours and elevation points from which a Triangulated Irregular Network (TIN)[41] is produced
Orientation	

Being a city located in the Northern Interior of Portugal, in a mountainous territory, the results obtained for Vila Real confirms that urban expansion can occur in a sustainable way since near

[41] A Digital elevation model (DEM) can also be use in order to derive slope and aspect values.

36% of the urban area has a high or very high suitability index but not in the immediate surrounding areas of the city core, mostly because of the constraints imposed by the confluence of the two rivers (Figure 5.7). High-suitability vacant areas are located mostly in the northwest and southeast zones.

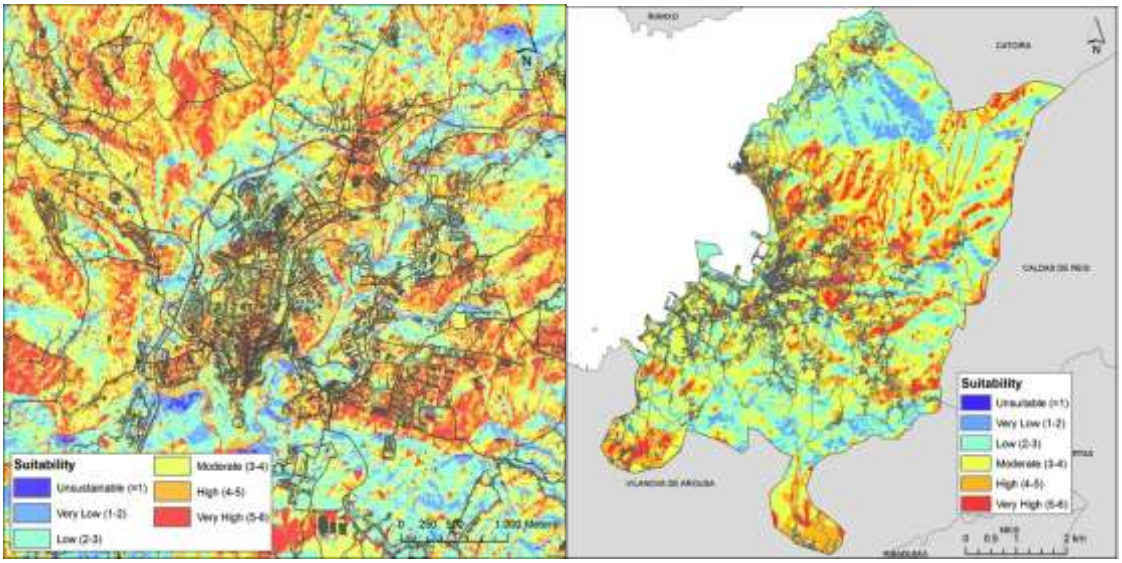

Figure 5.7. Building Energy Index in Vila Real (left) and Vilagarcia (right)

On the other hand, the coastal city of Vilagarcía, has 25% of the area classified with high or very high suitability index and most of the vacant areas are far from the city centre, mostly on the Southern municipal limits (near Vilanova de Arousa) and in the Northeast area (surrounds of Guillán, Xovelle) (Figure 5.7).

Land Use

Land is a scarce resource and its use requires careful planning. A sustainable urban growth strategy should seek to minimize consumption of valuable areas from a carbon footprint point of view, thus preserving land uses that present a high CO_2 sequestration capacity. In general, redevelopment of existing areas leading to urban densification is preferable to expansion of city limits and consumption of arable lands and forests. To determine the land use suitability index, the Corine Land Cover (CLC2006) inventory, obtained from the European Environment Agency (EEA) website was used and each different cover was classified by its carbon density sequestration capacity as presented by Cruickshank et al. (2000).

The obtained index map for Vila Real shows that there are several areas near the consolidated city core very suitable for urban development. It also shows that from the near 21% of areas classified with high suitability, the best available vacant areas are located in the northwest area (Figure 5.8).

In Vilagarcía, the results show that all the areas classified with the highest suitability index are already occupied and from the 14% high suitable existing areas most of the vacant ones are located in the urban fringe adjacent to the city core, especially in the Northeast side (A Torre/Pereira/A Caldigüela) (Figure 5.8).

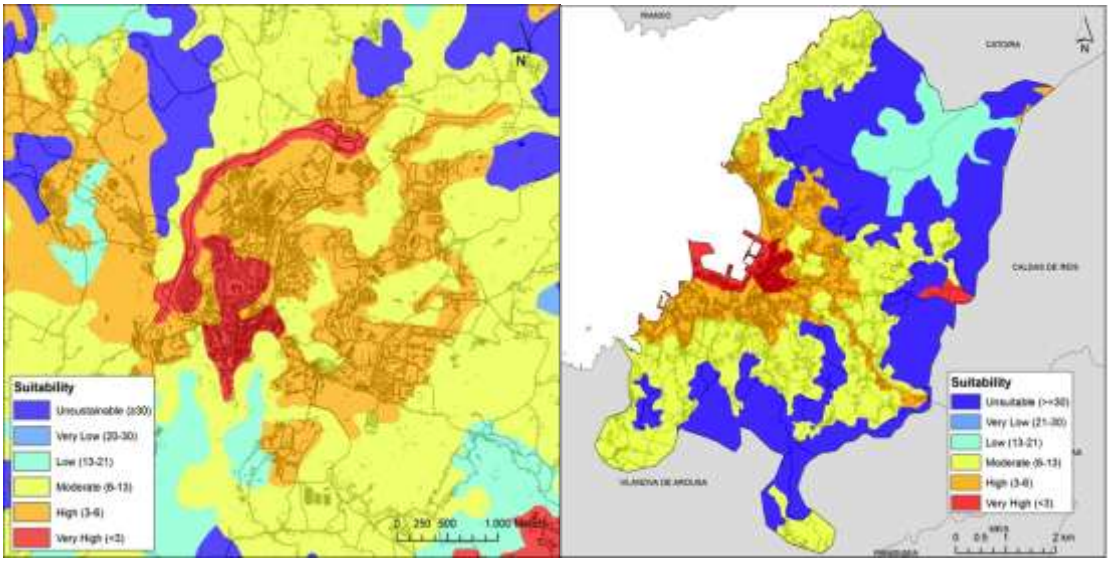

Figure 5.8. Land Use Suitability Index in Vila Real (left) and Vilagarcia (right)

Global Results

The global suitability index was obtained by performing a weighted sum operation where each group raster was weighted as presented in Table 5.6.

Table 5.6. Group Weights

Group	Weights (ωi)
Mobility	0,35
Public Infrastructures and Amenities	0,25
Building Energy	0,15
Land Use	0,25

On a more accurate evaluation several areas must be excluded from the final raster, since they present legal restrictions that prohibit urban developments. In the Portuguese case study, the following protected areas were considered: (1) National Ecologic Reserve; (2) National Agrarian Reserve; (3) Natura 2000 Network (Figure 5.9).

In the Spanish case study, the protected areas were obtained from the current Vilagarcía Municipal Regulation Plan and the Galician Coastal Spatial Plan. The classes identified where arranged for this pilot in: (1) Rural Protection Areas; (2) River Protection Areas (3) Forest Parks (Figure 5.9).

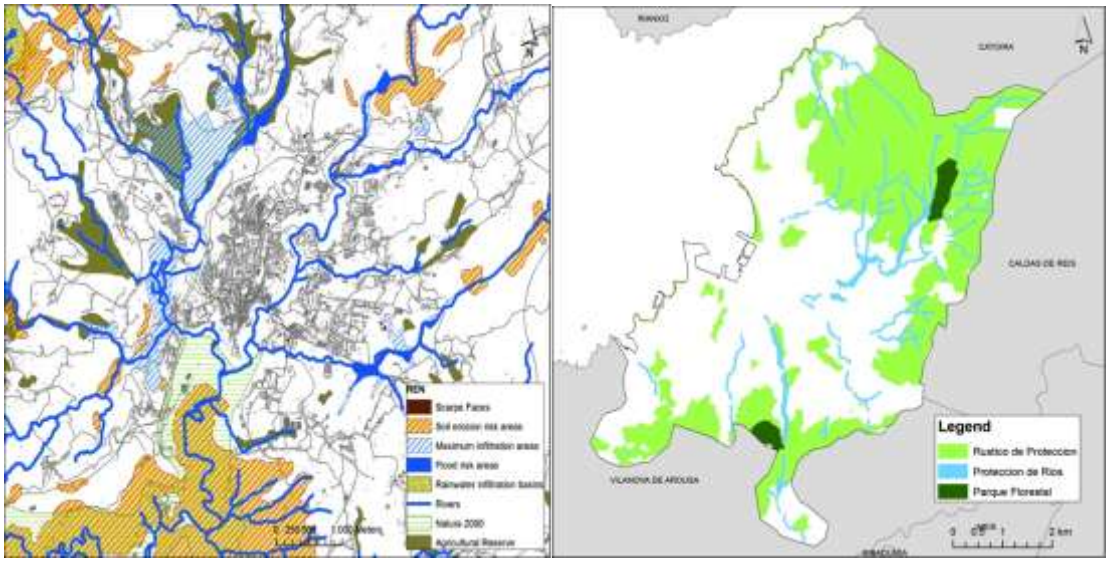

Figure 5.9. Exclusion/protected areas in Vila Real (left) and Vilagarcia (right)

Figures 5.10 to 5.12 present the final results from the multicriteria spatial decision system. The global suitability index maps allow local authorities to evaluate new urban developments in terms of potential GHG emissions impact, and determine which areas are preferable for urban urbanization and/or densification, thus defining effective urban development strategies for carbon footprint reduction

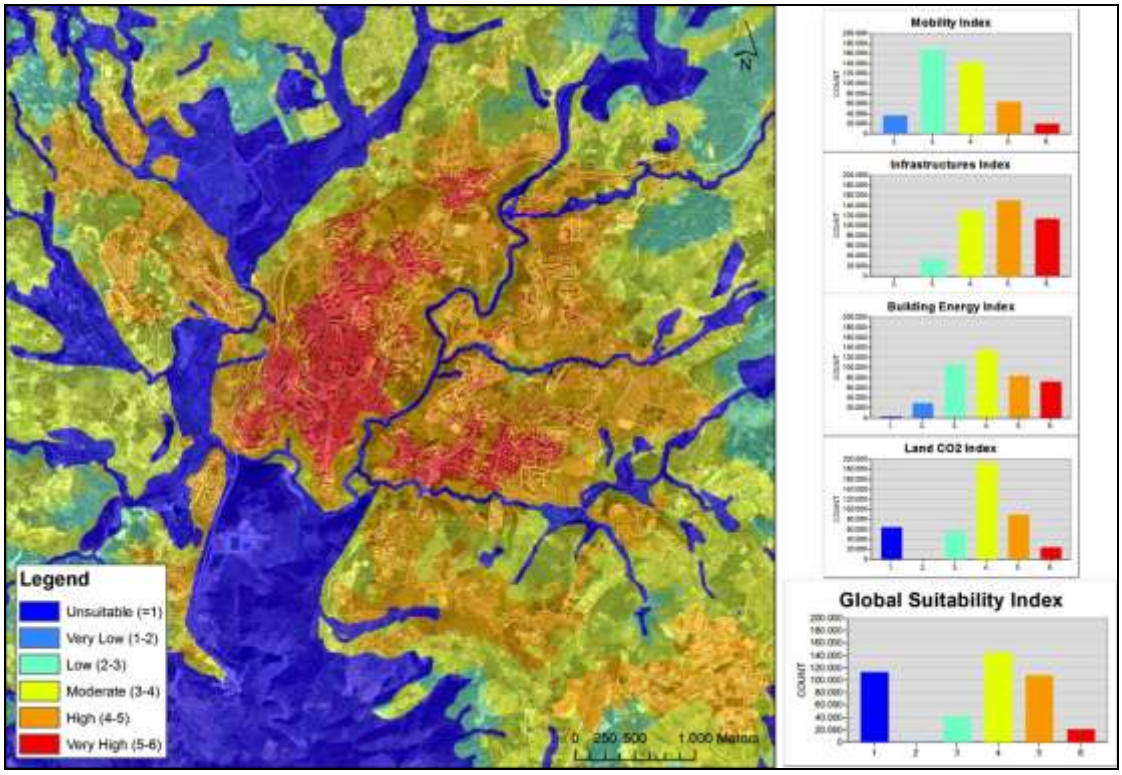

Figure 5.10. Global Suitability Index of Vila Real

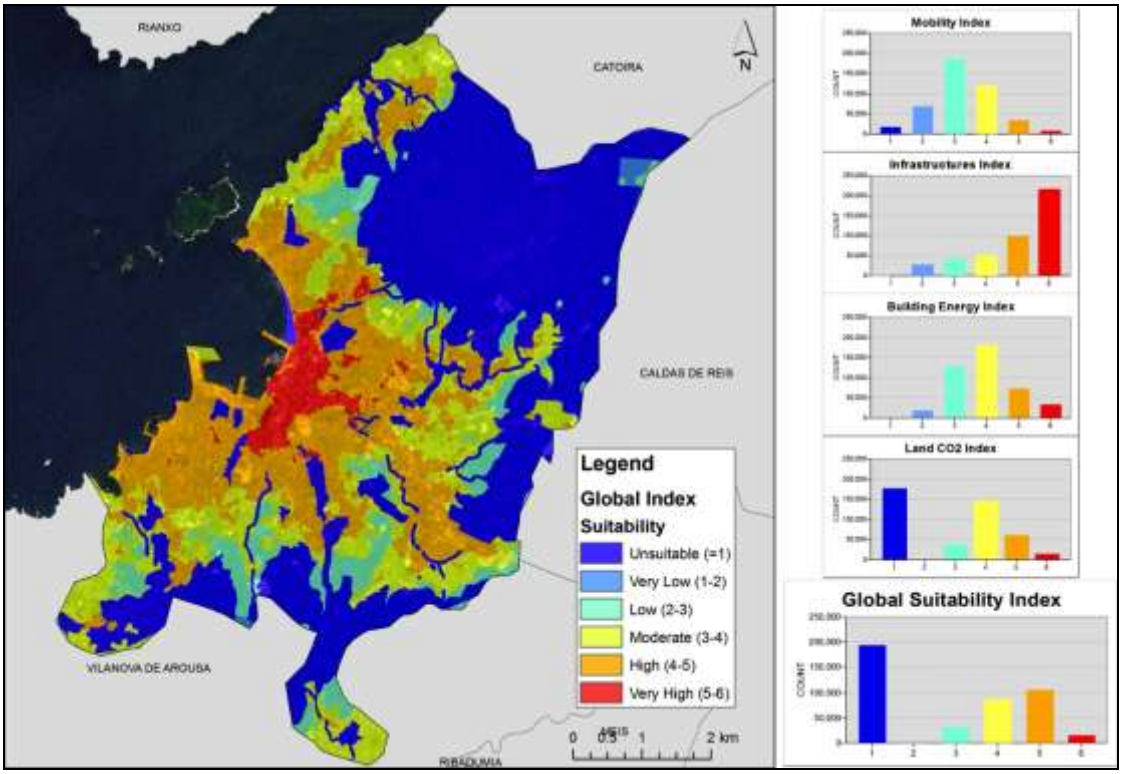

Figure 5.11. Global Suitability Index of Vilagarcia

The methodology developed herein can also be used to evaluate which current urban consolidated areas have the highest and the lowest suitability values, thus allowing decision-makers to identify current problems and implement corrective measures. Results from the Vila Real urban area were obtained both for the global index and for each of the proposed groups. The study area was classified as artificial or available area. Artificialized areas were obtained from land-use cartography for Portugal (COS2007) produced by the Portuguese Geographic Institute (IGP) and the two sets were classified by global suitability level.

For Vila Real, the global results tend to confirm the sprawled profile of Vila Real (Figure 5.10). Only 18% of the artificialized area is located in highly valued lands and there is only a 0.45% land availability for new developments at the highest level. The second highest level represents 25% of the total study area and includes more than half of the total existing built-up area. Almost 25% of the artificialized areas are located in lower and moderate suitability locations and special attention should be given to the unsuitable level (mostly exclusion areas) which comprises about 70ha of built-up area (Figure 5.12).

The results for Vilagarcía also confirm the sprawled pattern of the urban development (Figure 5.11). Almost 13% of the artificialized area is located in highly valued lands and there is also a small portion (0.42%) of available land for new developments at the highest level. The second highest level represents also almost 25 of the total study area also integrating more than half of the total existing built-up area (Figure 5.12). More than 24% of the artificialized areas are located in low and moderate suitability locations and there also some spatial expression (about 57ha) of the artificialized areas integrated in the unsuitable level (also in this case derived mostly from exclusion/protected areas).

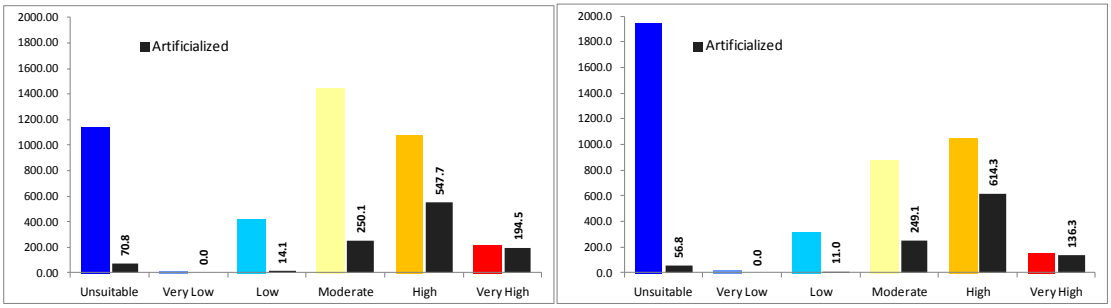

Figure 5.12. Total artificialized areas by global suitability level in Vila Real (left) and Vilagarcia (right)

The main goal of this pilot project is to develop a global indicator that allows planners to evaluate urban developments in terms of their GHG potential emissions, thus developing more sustainable growth strategies for cities. The present methodology allows performing "suitability" analysis in both existing and proposed urban areas by each individual criterion, group indicator or global index value for one single site as for the all urban area. The resulting indicators can also be used to promote public information and general conscience about carbon footprint consequences of urban developments.

5.5. Recommendations for developing sustainable territorial strategies in the Atlantic Area

Some initial suggestions are made at this stage for actions that can be undertaken within the CLIMATLANTIC project scope and timescales. Much of what can be done is focused on influencing others to take up best practice approaches, i.e. focused on first tier stakeholders.

It is necessary to focus the planning of land use and urban and territorial design on environmental, social, economic, health and cultural issues. Of these, the most important of all is to adopt an environmental and sustainable approach and to achieve the necessary reduction in the greenhouse gas emissions. Therefore, it is necessary to establish specific strategic actions based on territorial planning that will contribute to minimizing CO_2 emissions and their consequences on quality of life in the Atlantic Area.

The recommendations proposed below could be applied to any European territory, but are particularly important in the Atlantic Area due to increased sprawl of settlements and population.These recommendations have been taken seriously into account when determining the methodology for the pilot project, and have therefore influenced many of the aspects considered in the multi-criteria analysis carried out. Among others, these actions are:

- **Development and increased use of territorial planning documents at every level:** Atlantic-international, regional-European, national, regional and local. The documents should be imbued from the beginning with environmental logic and propose specific actions to facilitate the reduction of greenhouse gas emissions. Regional and local scales are of particular importance in this development, since they are the scales at which we can act directly through the use of the proposed GIS tool. At the latter scale, joint planning with neighbouring local authorities should be promoted in order to

achieve higher efficiency and sustainability goals, particularly in the most deprived areas.

- **Increased use and deepening of the strategic environmental evaluation** in all plans and projects as an ex-ante procedure allowing for a more deep and coherent control of planning exercises from the point of view of GHG emissions. This action is already contemplated in European directives and policies but it is stagnating at a 'hypocritical' level of compliance. Although most environmental plans and projects are evaluated, they are justified with hypothetical generalizations that are difficult to meet and rarely implemented. Furthermore, such a tool is of vital importance to help in decision-making processes relating to the multi-criteria analysis developed in the proposed indicator.

- **Improvement and consolidation of existing cities** by preventing indiscriminate urban sprawl and, where possible, disproportionate urban growth. Likewise, by achieving adequate urban densities and giving priority to urban development in occupied areas instead of nature areas, as well as upgrading and re-using degraded and abandoned areas. When planning urban development, priority should be given to “brownfields” and “greyfields”, rather than “greenfields”. This can also be achieved by promoting the renovation, conservation, renewal and re-use not only of historic buildings and historic quarters, but also of the neighbourhoods built in the 20th century.

  Land should be considered a scarce resource to be used as efficiently as possible, and urban sprawl should be prevented by re-using empty plots and buildings in urban areas instead of building on virgin land. The aim is to have relatively dense cities (>75 inhab./Ha) without reaching densities that generate negative external diseconomies and, at the regional territorial level, concentrated decentralization based on new areas and a polycentric layout.

  The results of our pilot project can be of great help in achieving this recommendation, because their objective is to reduce urban sprawl and consolidate compact urban fabric.

- **Promote mixed uses as opposed to zoning**: a proper balance of uses for labour, residential, commercial, leisure and services purposes will prevent daily and regular trips that have a high impact on GHG emissions, while at the same time enriching public areas and their continued usage. These aspects are taken into account in the methodology proposed in the pilot project for developing the territorial indicator.

  The utilization of compact buildings should also be promoted to create a range of opportunities and housing options, walkable neighbourhoods, and attractive, distinctive communities with a strong sense of belonging to the territory.

  'Proximity urban planning' should be pursued, accessible with non-motorized transport and low dependency on private vehicles. This would require new urban planning solutions and the existence of basic day-to-day pedestrian distances to diminish forced mobility.

  Neighbourhoods and areas without parked vehicles and traffic could be built to integrate the basic daily functions in areas accessed by foot, using non-motorized systems and areas well communicated by public transport.

- **Public transport needs to be improved and promoted** by providing alternatives and a range of options, facilitating the access of a larger number of citizens so ingrained

mobility habits can change from travel by car to collective transport. Transport needs should be taken on board as a key element when deciding where to locate businesses, internalizing the costs generated in business by transport via taxation.

The new urban planning developments should provide solutions for financing the necessary infrastructures and public transport according to each urban and territorial model, ensuring their execution and financing by developers and the beneficiaries of the new urban planning.

New mobility plans are also needed to establish vehicle-free areas close to basic road networks that prioritize the territory and provide, on a cross-cutting basis, separate, safe networks for each mode of transport: bus, trams, bicycles, and safe footpaths. This new mobility model would reduce greenhouse gas emissions substantially.

The transport of goods should also be targeted to avoid road haulage and promote intermodal connections by creating specialised transport hubs and promoting transport with a lower impact on greenhouse gas emissions, such as rail and shipping.

- **The requirements for sustainable planning, designing and building should be implemented** and high-quality bioclimatic architecture using new building technology should be promoted, especially in public buildings. These environmental requirements and approaches should target related fields: sustainable territorial planning, sustainable urban planning, sustainable urban transport and the construction of sustainable buildings and infrastructure. Current building techniques allow advanced resource saving strategies to be implemented, such as low-energy housing, transport that consumes cheap fuel, city heating systems and recycled water. Particular consideration has been given to these premises during the construction of the proposed territorial indicator.

  Regulations for optimal use of weather conditions should be put in place in the urban planning and construction sectors, as well as an assessment of the needs of plant species and varieties in parks and gardens under different climate change scenarios.

- **Priorities for the strategic location of new urban and territorial planning projects should be defined,** so they will be linked to existing infrastructure and public transport systems, and will respect farming and forestry activities, as well as nature and ecological areas. New developments not linked to existing transport should be taken into consideration prior to or simultaneously with spatial planning processed leading to urban expansion. This includes not only residential developments, but also industrial areas, shopping centres, and large facilities such as hospitals and universities that generate a high demand for mobility. Their communication to previously transformed areas and existing efficient public transport is essential. The relocation of businesses in search of cheaper land has the pernicious effect of forced mobility on territorial policies and actions, as well as a tendency to occupy virgin land with natural values.

  Urban and land use models influence elements such as the generation of displacements, the type of urban and interurban transport used, the urban typologies of energy consumption, urban density, etc. Therefore, energy consumption and GHG emissions are highly related to land development models. Consequently, the appropriate assessment of infrastructure needs, the definition of land use criteria, the precise impact evaluation and the budgetary provisions needed to provide solutions

with lower environmental impact as well as the consideration of additional costs aim at implementing correcting measures must lead to the sustainable territorial design.

- **Conservation and promotion of open spaces, farmland, natural landscape and critical environmental areas.** Likewise, rural areas need to be promoted to prevent their depopulation and the loss of the primary sector labour force that is key to sustaining a large part of the Atlantic territory. This should be accompanied by policies to promote the forestry and agricultural sectors, so characteristic of the Atlantic areas, which not only provide employment for the rural population but also play an important role as CO_2sinks. Maps with preferential forestry and agricultural areas should also be drawn up to prevent them from being colonised by the building industry.
- **Tax policy** is another relevant instrument to achieve the objectives of GHG reduction. Introduction of tax policies with ecological criteria can play an essential role as an instrument to reduce GHG emissions. Tax decreases associated to GHG reduction activities or vice versa is likely to be an adequate instrument to reduce the carbon footprint of a given territory. Thus, for instance, building of new developments far from the centre or without public transportation might be overtaxed.
- **Spatial Planning** should be driven by a cross-cutting articulation and coordination of sector-based policies, and also by a top-down articulation and coordination between the various administrations and bodies with competence and authority in strategic territorial planning. The establishment of working groups for the comprehensive assessment and design of environmental and territorial policies, with a view to a global approach to urban planning and Spatial Planning, including sustainable transport, is highly recommended. Society in general and stakeholders with specific qualifications, in particular, should be involved in the decision-making processes, thus likely leading to a more sustainable design of our territory.

- **Social behaviour**

6.1 Terms of reference

The term 'social behaviour' refers to the behaviour of individuals relative to others. In this context, the social behaviour pillar has investigated how public understanding, awareness and attitudes can influence behaviour, and bring about behaviour change specifically within the context of global climate change, through changing social attitudes.

The implementation of successful actions to combat climate change relies on successfully motivating behaviour change at all levels within society. An understanding of public and political attitudes and motivations and how best to influence these are essential to bringing about the behaviour change needed. The work of the social behaviour pillar involves investigating the present situation and the trends in social behaviour, within the context of actions that can impact on global climate change, and identifies the main areas for improvement and relevant methods to use to target these areas.

The concept of social behaviour, and of behaviour change, clearly matches well with the EU's sustainable development strategy. "Sustainable communities" implies a form of collective action, and in order to tap the innovation potential of the European economies, and to ensure prosperity, environmental protection and social cohesion, effective communication and knowledge transfer about global climate change will be key.

Social behaviour change is particularly relevant to the third headline of the Europe 2020 strategy, i.e. to reduce greenhouse gas emissions. Greenhouse gas emissions from different sectors are open to influence in different ways, but until all of the energy that we consume is carbon neutral, there will be emissions that we are only able to affect through changing how the public and society behaves.

The UK Climate Change Act includes a strong element of reductions in emissions from the public, and in order to realise these reductions it recognises the need to help people overcome barriers related to energy saving and emissions reduction. The website of the UK Department responsible for the environment, Defra, provides links to sector specific advice on climate change.

Politicas Ambiente/AlteracoesClimaticas (PNAC) [42] includes reduced consumption of energy as a factor in these scenarios. In order to achieve the best possible reduction in energy use public engagement and awareness are highlighted as important factors.

Ireland's National Climate Change Strategy (2007-2012) specifically refers to the importance of promoting energy efficient behaviour in order to best address emissions reduction. It also references an ongoing awareness campaign aimed at providing information to householders on how to save energy – "the power of one" www.powerofone.ie. The strategy therefore clearly acknowledges the importance of communications and behaviour change in meeting mitigation goals and encourages this approach.

Le Plan climate de la France specifically states that public awareness, education and training are considered as one of the measures that must be taken in reaction to climate change and as part of the efforts to reduce emissions of greenhouse gases.

The Spanish Climate Change and Clean Energy Strategy has as an explicit objective to mobilize social behaviour, with the goals “To increase public awareness with respect to clean energy and climate change” and “To boost the rational use of energy and saving of resources for both companies and end users”.

The Covenant of Mayors initiative shows a Europe-wide commitment to meet and exceed the European Union 20% CO2 reduction objective by 2020. This involves local and regional authorities voluntarily committing to increasing energy efficiency and the use of renewable energy sources within their territories.

As mentioned in section 2.1, GHG emissions in the EU27 are declining with the exception of those associated with the international maritime transport and aviation and domestic transport. While international maritime transport can be considered beyond the first order influence of the social behaviour pillar (second order effects such as changes in buying patterns based on awareness of embedded carbon may influence this) the other two growing sources of emissions should be included in the targets of the social behaviour pillar.

In addition to these sectors, those sectors responsible for large proportions of emissions that the public have some agency over should be added to the primary targets of the social behaviour pillar. By far the largest portion of emissions (35% in the UK in 2008) comes from energy generation. Another 13% resulted from domestic fossil fuel use. These figures suggest that household energy consumption should also feature in the list of targets for the social behaviour work done through Climatlantic.

The suggested sources of greenhouse gas emissions that the social behaviour pillar should be aiming to influence are:

- Domestic energy consumption;
- Surface (land) transport and domestic aviation;
- International aviation.

People generally change their behaviour because of motivations giving some tangible benefits -for example the cost saving associated with reducing energy consumption or the health benefits of changing travel choice. Campaigns and policies to encourage changes in behaviour must therefore also highlight the benefits of such action to the individual, and remove the barriers to action.

In addition, the understanding and acceptance of climate change by the general public can be a factor in the success of other activities which aim to reduce emissions to help mitigate climate change, including the other pillars of Climatlantic. Success in creating an informed public with a sense of agency about climate change will impact positively upon all other measures taken to reduce greenhouse emissions from the public.

The public may also start to modify their behaviour as they become more aware of the need to act on global climate change and reduce carbon emissions, and as they become more educated about the potential actions which they can undertake to have an impact on

greenhouse gas emissions. If this affects the products and services they choose to consume, this will have knock on effects that are not easily reflected in an indicator.

The three activities with rising emissions point clearly towards the sectors where CLIMATLANTIC pillars should be focused, with the Social Behaviour pillar focused on surface transport and domestic energy consumption.

6.2. Present situation and trends in social behaviour in the context of global change

- Public Awareness, acceptance and change

Levels of acceptance

Climate change awareness is sometimes portrayed[43] on a scale going from:

- Denial, where the problem is either ignored or flatly refuted. This stage may even involve an increase in behaviour detrimental to the situation;
- Token behaviour change, where the problem is accepted, but has not yet taken on board the need for action, and carries out token efforts to address the problem, to
- Full behaviour change, where individuals will adjust important aspects of their lives in order to limit undesirable impacts.

The social behaviour pillar of CLIMATLANTIC investigates ways to move people along this scale, from denial to full behaviour change. The move to full behaviour change is the most important – it is possible for someone to feel that they are addressing the problem by recycling, where a more extensive assessment of how they can reduce their carbon footprint is needed. This is also of importance when the role of individuals as citizens is considered, and this is a key component of social behaviour. An increase in awareness and acceptance of climate change may lead to an increase in political or community engagement, for example lobbying MPs or joining community groups. There is a more direct relationship between awareness and this type of action and so one aim of climate change campaigns might be to encourage public and political engagement on the issues.

Barriers to change

Although the scientific evidence on climate change is largely accepted, public opinion on this issue is more varied. In addition it is likely that individuals feel a lack of agency (an ability to personally influence) when faced with a problem as large as global climate change[44]. This suggests that part of reducing carbon emissions across the Atlantic Area will be a continuing effort to both engage with the public about the reality of climate change and to make them feel capable of contributing to climate change mitigation.

Action to tackle climate change is often framed as requiring some restriction on current behaviour in order to prevent future losses[44]. Previous work has identified that a major barrier in encouraging a public response to climate change is the level of discounting which is applied

[43] http://www.carbonaware.eu/fileadmin/user_upload/Deliverables/CATCH_DEL_DOC_D1.1_20Behavioural_20Inception_20Report_orginal_V1.pdf

[44] *www.futerra.co.uk/downloads/**NewRules_NewGame**.pdf*

to future costs. As these costs will occur sometime in the future they are often undervalued. This may make some people avoid the cost of mitigating actions that could be taken now, not fully taking in to account the proportionally larger costs that will be caused by climate change if these actions are not taken. Finally the issue of global climate change is often presented as a very large problem. This has the effect of individuals being more likely to see the problem as too large and intractable to do something useful about[44]. Addressing this concept about climate change may be best achieved by promoting action in groups and communities, so that people feel that they are part of a larger collective impact. The Atlantic Area could form one of these types of common identity.

In addition to the barriers to change on the basis of attitudes and acceptance of climate change there are a range of barriers related to other factors. These include technical barriers and economic barriers for example, implementation of energy saving measures in the household being restricted by living in rented accommodation; transport choice being restricted by workplace location; and initial cost of implementing measures. There are also social barriers, such as going against established social norms and the perceptions of how easy or difficult behaviour change might be. It is therefore important that campaigns are designed with an understanding of the likely motivations for change amongst target groups, and the relevant barriers (social, technological and economic).

- **Examples of existing successful strategic actions in the Altantic Area**

Some examples of existing actions to change awareness and influence behaviour in environmental areas are presented here. It should be noted that many more examples could be generated, and the Social Behaviour Pillar has produced a report on 'Review of good practice encouraging young people's sustainable mobility and environmental respect[45]'. Many more examples of public engagement campaigns are available; however, although some campaigns have evaluated their success in communicating messages, there is limited data to evaluate how successful these campaigns have been in actually changing behaviour. There are also many examples of actions to change behaviour by looking at other motivations – such as cost savings or health benefits.

- **The Comhar/ENFO schools pilot project, Ireland 2003-2004**

This project looked for ways to incorporate environmental messages into the existing curriculum in schools. It produced prototype plans for workshops, and recommended how schools should go about the issue of sustainable development.

Eight schools in Dublin took part in the project, and following consultation with teachers a set of guidelines for the production of the material was reached.

It was felt that the materials needed to:

- Be simple to use.
- Clearly link the activities to the existing curriculum.
- Be self contained – not to require additional materials to create the lesson.
- Include information about where further research materials could be found.

[45] TTR/Merseytravel project report, July 2010.

- Also include guidelines on taking sustainable actions outside the lesson and in to other areas of the school.
- This work enabled pupils at the schools to link sustainability issues with their other subjects, and was well received both by pupils and teachers.

French "Hurry up, it's getting warmer" campaign 2004-2006

This campaign linked energy use and climate change. It had three main aims:

- To increase awareness among the public of the link between energy use and climate change.
- To educate the public on the economic costs of using excess energy.
- To initiate behaviour change among the public in order to reduce energy use.

The campaign had two tools. The first was a national advertising campaign delivered by newspaper adverts, TV clips and radio broadcasts. The second was a partnership platform which brought together various partners, both national and regional, to implement a behaviour change plan.

A variety of activities were undertaken by these partners in combination with the national campaign. A simple card device was used to connect energy use with environmental cost and with specific solutions to reduce energy use. Creating the partnership drove forwards many of these actions, and the partnership was seen as a key element in the success of this campaign.

At least 71% of people surveyed in France post campaign recalled having seen at least one clip from the campaign. 80% of people said that they would pay more attention to energy saving methods, a large shift towards at least token behavioural change. 45% claimed to have changed at least one of their habits to save energy.

Rennes Métropole "Je change, ça change tout !" ("I change, it changes everything !") campaign

In Rennes a local campaign was run named "Je change, ça change tout!" ("I change, it changes everything!"), as part of the pan-European ENGAGE communications initiative, which seeks to engage citizens and stakeholders at a local level to play their part in building a sustainable energy future. The purpose of the Rennes campaign was to support behaviour change on energy savings and was accompanied by a waste prevention campaign using the same slogan. To support these campaigns, and encourage citizens to participate, four Open Space Forums were held in four towns of Rennes Métropole. These were set up as an informal and collective way of sharing opinions. About 80 people took part in these workshops and suggested numerous ideas; an important lesson learnt through these Forums was that local mobilization is necessary to attract participants.

Preston UK Local Action, Global Agenda Network

In Preston a local network group was set up to encourage the sharing of ideas, experience and enthusiasm on local and global issues and through this to promote action at a community level. Workshop-based training days were held by local experts to encourage public empowerment and this led to the development of community based action, and through this raised awareness of the links between local action and global sustainability issues.

o Actions with Specific Groups, e.g. Young People

From the review of good practice a number of examples of environmental awareness initiatives with young people in Atlantic Area regions were documented:

• Young People's Trust for the Environment (YPTE) - Based in southern England, this iniative enhances young people's understanding of environment and sustainability. The trust runs environmental discovery courses and holidays for children. It provides educational talks at schools, and bulletins and factsheets for teachers, and operates a "Green School Awards" scheme.

• Children As Change Agents - Tested theory that children could be effective agents of behavioural change for greener lifestyles. Also aimed to build community cohesion and contribute to safer neighbourhood in culturally diverse and deprived London borough. Children's activities included bat spotting walk, competition to build floating wildlife gardens on local canal, football match with half time quiz on environmental issues and "Street Dance" programme choreographed around green behaviours.

• Children's Parliament - Project started with consultation with children in Almada on local environmental issues. Now pupils from four primary schools sit on a "Parliament", which presents their ideas, suggestions and criticisms to create a better planet and local council to the City Council Administration.

• Young People's Climate Change Messages - Website, developed primarily for school pupils in West Midlands. Encourages young people to form teams and develop campaigns to help their peers, families and local communities understand climate change and realise importance of taking action. Teams, supported by climate change and communications experts, make use of communications technologies to share ideas and experiences as they develop and run campaigns.

There is a scarcity of campaigns specifically focussed on elder generations. One example from the UK is The Retired and Senior Volunteer Programme (RSVP) Climate Change and the Over 50s project. The aim of this project was to directly engage with local over 50s community organisations such as lunch clubs and faith groups and provide a follow-up resource should individuals or groups wish to take action. This initiative showed that the use of peer-to-peer interaction between well-informed messengers and the audience was very effective.

- Climatlantic Social Behaviour Pilot Projects

o The Mersey Eco-Cruise

Educational 'Eco-cruises' are to be run by Mersey Ferries, in cooperation with Merseytravel. Cruises will be made available to local schools and will use the backdrop of the River Mersey to focus on the environmental aspects of the coastline of the river. Topics covered on the cruise will include raising awareness of wind and tidal energy and encouraging informed decisions of sustainable choices of energy sources in the future.

The first Eco Cruise was held on 27 June 2011. Around 250 pupils took part in the cruise, and a number of activities were carried out on board. These included:

- Bird watching with members from the Royal Society for the Protection of Birds (RSPB).
- Carrying out Plankton scoops to learn about Plankton and marine life.
- Hearing about the Burbo Bank Wind Farm sited along Liverpool Bay.

First hand experiences like these can help children and students to gain a better understanding of the effects that the environment can have, not only on us, but the landscape around us and all who inhabit it.

The Climatlantic Schools Website

The Climatlantic schools website has been produced as a resource for children, teachers and organisations who want to tackle climate change by making sustainable transport choices.

The site hosts a number of interactive games for pupils, designed to present ideas about climate change, the environment and sustainable travel and will also host a chat forum, together with a facility for pupils to add text, videos images and sounds to build projects associated with transport and the environment. The site also includes a database of lesson resources for teachers.

The website has been built by a specialist educational digital design studio, and will be available in English, French, Spanish and Portuguese. The overall style of the website has been developed in consultation with Merseyside school-children, allowing them to give feedback on their experiences with the online games and the characters used on the site.

The site is available here: www.climatlantic.co.uk

The Climantica Project

The Climantica project is an environmental education project run in Galicia, Spain. The project began in September 2006 and is run by a team of experts in four working groups: teaching, graphics editing, multimedia and scientific advice. The groups work together to produce and use teaching resources covering the main environmental problems related to global climate change. Eight teaching units are to be produced. Units are designed to be applied in the different areas, subjects and modules related to secondary education level.

The project has also produced materials directed to primary education level and also for the general public. Primary Education materials include comics, 3D cartoon series and video games. Materials addressed to the general public include blogs, documentaries and magazines.

The project contents have been translated into Galician, Spanish and English. Information about the Climantica project, together with the teaching units and other supporting information, is available at: www.climantica.org

The A21EG program

Axenda 21 escolar de Galicia (A21EG) is an educational program aimed at spreading sustainability among students of participating schools. Climate change is one of the common topics considered. Teachers invite their pupils to engage with a collective challenge of environmental improvement and, once achieved, share this with their peers, teachers, families

and even citizens. Meeting of students from primary and secondary education level are held providing opportunities to share experiences and projects and empowering their challenges.

Information on this programme can be found at: http://www.cmati.xunta.es/axenda21

- Main areas of potential improvement

As recognized in a number of EU and National strategies there is a strong role for promoting behaviour change and education in helping to produce an appropriate response to climate change.

The sectors targeted by the Social Behaviour Pillar for emission reduction are likely to be in the same sectors as targeted by the other Pillars in the CLIMATLANTIC project, and the social behaviour work can be considered complementary to other Pillar's work in the project.

The focus of the social behaviour pillar could be on initiatives that support the following objectives:

- Convincing people of the reality of climate change and the need to act.
- Promoting the benefits of acting now (as opposed to restrictions now for future benefits).
- Understanding that their individual or local action can make a valid contribution.
- Ensuring people have the information they need to act appropriately.

Fulfilling these objectives would help move people along the range of behaviour change, from denial to token behaviour change, and from token behaviour change to full behaviour change. There are several barriers that have been identified which prevent or retard this progress, and action should be taken to address these.

These objectives support awareness raising and motivating change as a result of increased knowledge of climate change issues. It is important that campaigns are designed with an understanding of the likely motivations for change amongst target groups – including those that have no links to climate change - and the relevant barriers. Awareness-raising campaigns can help to increase public engagement and support other behaviour change actions.

The reality of climate change

Convincing people of the reality of climate change is obviously important if we want them to respond to it. Being targeted by good quality information campaigns and having the opportunity to get involved in documenting evidence are potential approaches to tackling this barrier.

Acting now

Due to future discounting most people are not generally good at judging future risk. In fact, as the most serious impacts of climate change will not be felt for many years, there is a high tendency to under-value those costs, and see actions taken now as unnecessary cost with no meaningful benefit. One potential way to address this is to offer comparisons of the cost of acting now against the cost of acting in the future.

Lack of Agency (belief that they can make a difference)

There are two main factors which can create a lack of agency in people who would otherwise be willing to change behaviour to address climate change. The global scope of climate change can create a sense of helplessness which prevents people taking any action, and the negative way in which climate change is framed can lead people to inaction. To counter the first factor, climate change campaigns can promote the power of people acting together to make a difference, even using this explicitly by trying to encourage communities to respond to climate change. The second factor is difficult to address as climate change will have largely negative impacts, but a balanced consideration of potential opportunities that may arise from climate change may offset this.

Ensuring People have the information they need

Even if people accept that global climate change is a present threat, and have willingness to adapt their behaviour accordingly sometimes they are not sure what they can do. Case studies, champions, encouragement to get involved, guidance and coaching are all methods for people to learn new behaviours and habits. At the more complex level, an understanding of the relative impacts of various actions they could take is essential if they are to maximize impacts. Encouraging public engagement on the issues is a valuable tool to increase information exchange and influence social norms.

Alongside these objectives is the need to address the barriers that might prevent a change in behaviour.

- **Principles of communication**

In order to influence these areas of social behaviour as capably as possible, several principles of communication have been identified that will be important to draw upon:

Keep it personal, use empathy

Communications are most effective when the recipient can relate them directly to their everyday life. People also relate best to information about other people – instead of "climate change will destroy a large amount of wetland" we could use "climate change will displace a large number of people from their homes".

Help people to help

People want to be helpful. Communications that make them feel useless take away this urge, whilst helping them to understand they do make a difference can build on it. Increased public engagement can be very valuable in understanding the motivations of the target audience, identifying the barriers to change and helping to overcome them.

Make clear and direct requests

It is important to be specific about what actions are desirable, rather than just deliver a generic "we need to change" message. Concrete examples of the behaviour changes that we want to achieve will make individuals confident about what they could be doing.

Feedback is crucial

Letting people know that they have done well, or are improving is an important tool in motivating further change. It is important that feedback is two way, to get an understanding of how well received messages are, to understand the barriers people, communities or organisations face and to help to overcome them. Communications are less effective if they are delivered and then abandoned.

Use the right messenger

This is not always a university professor – having someone speaking the same language as the recipient is often more influential. Trust in politicians and the media is, in general, declining. Creating and supporting champions – individuals, groups or businesses that can set an example of how actions work and can demonstrate the outcomes and benefits - –can be an effective way to motivate behaviour change.

Groups to Engage with

Communications are more effective when they are targeted at specific groups, with a message that works for them, and creating messages that successfully engages those groups will be a factor in successful communications.

The targeted group(s) will vary depending on the aims of the action in question. Different target groups will respond to different motivations and actions will need to be designed accordingly.

1st and 2nd tier communications

The CATCH project describes two levels of communications, aimed at two separate groups, and calls these “1st level” and “2nd level” stakeholders.

1st level Stakeholders describes those in organisations who may have influence over large carbon budgets, or control how communications are aimed at other stakeholders. They are likely to have professional interest in the information being provided for them, and will use this information to either communicate onwards, or to reduce emissions from their organisation. Their involvement in the topic may mean that they have a higher general level of acceptance of climate change than the public. These stakeholders can have a direct influence on actions – for example by setting procurement policies or encouraging elected representatives to demonstrate support.

2nd level stakeholders are the general public, those who do not hold a position where they are professionally interested in climate change communications. As a group they are much less homogenous than 1st level stakeholders, and when planning communications aimed at this group we should consider further segmentation. These are the stakeholders who will be receiving any communications from the 1st level stakeholders. The general public can also be considered to be a group of citizens, and identifying common group identities can be a useful way to increase political or community engagement.

6.3. Indicators of social behaviour in the context of climate change

There are various existing indicators for climate change in the Atlantic region. These can broadly be split in to four different categories of indicator:

1. Indicators reporting the greenhouse gas emissions that will cause future change.
2. Indicators of actual climate change occurring.
3. Indicators of a response to climate change among agents in the Atlantic region.
4. Indications of awareness and understanding of climate change that are precursors to an action-based response.

Indicators of climate change include temperature records, migration patterns and agricultural seasons. Indicators of response to climate change include carbon emissions, public perception, and household energy use.

Both types of indicator are relevant for the social behaviour pillar of Climatlantic. The set of indicators around a response to climate change are most obviously relevant, as they directly measure the changes that the project is trying to enable. The set of indicators around actual change are important to understand due to the impact that they have on public perception. Indeed in the UK indicators of actual change are sometimes rated based on the degree of public resonance that they have, showing a type of feedback-loop between the two sets.

The set of indicators around actual change are considered within the other think tank subject areas. The available indicators that are relevant to social behaviour are identified below. The indicators are then discussed in more detail and following this recommendations are made for indicators that might be collected on an ongoing basis.

The indicators listed in the table below are rated for their availability in each of the participating countries, according to the following scheme:

	Data available
	Data exists, not immediately obvious how to obtain
	Not clear if data exists

Summary of Indicators

	UK	Ireland	France	Spain	Portugal	Source
These are indicators that measure the extent to which people are taking actions designed to mitigate climate change by reducing greenhouse gas emissions						
Share of renewable energy by source						http://www.uibk.ac.at/diamont/downloads/documents/eu_indicators_2005.pdf
Percentage of households adopting a "green" electricity tariff.			n/a			The EU standard for renewable electricity is a REGO, which is issued to producers of green electricity, and sold on to consumers to guarantee that no double accounting occurs. Measuring REGO consumption in various countries may be a way to determine green electricity consumption.
Percentage of planning applications for renewable energy production in homes (e.g. solar panels, heat pumps), as a percentage of total domestic applications						It is likely that planning authorities will have access to this information through planning application documentation.
Consumption of biofuels as a %age of total transport fuel consumption						http://www.uibk.ac.at/diamont/downloads/documents/eu_indicators_2005.pdf

Percentage of new cars sold that are able to be fuelled on biofuels or electricity						The motor industry collects and releases such information regularly. The source will vary by country but the data should be comparable across regions. UK: www.smmt.co.uk Ireland: www.simi.ie France: tbc Spain: tbc Portugal: tbc
Percentage of students attending an educational establishment with a Travel Plan						This data is likely to be being collected by Local or Regional Authorities.
Percentage of respondents who "made a change in the last 12 months"						These are all indicators for which the data was measured in a survey. Absent a repeat survey the data will not be obtainable for future measurements
Percentage of respondents to survey who give their normal travel mode as "car"						These are all indicators for which the data was measured in a survey. Absent a repeat survey the data will not be obtainable for future measurements

Percentage of respondents to survey who say they "usually recycle"						These are all indicators for which the data was measured in a survey. Absent a repeat survey the data will not be obtainable for future measurements
Average "flight hours in past year" given by survey respondents						These are all indicators for which the data was measured in a survey. Absent a repeat survey the data will not be obtainable for future measurements
These are indicators that measure the attitudes and beliefs about climate change.						
Number of connections made to a dedicated site about the climate change plans			?	?	?	UK: Act on CO2; Ireland: Power of one;
Number of events held of a certain profile about climate change or the climate plan						Not believed to be currently collected by any organization
Number of media column inches written about climate change and climate change strategy						Not believed to be currently collected by any organization
Percentage of respondents to survey who claim they are "not concerned with climate change"						These are all indicators for which the data was measured in a survey. Absent a repeat survey the data will not be obtainable for future measurements

Percentage of respondents who say they "will make a change"						These are all indicators for which the data was measured in a survey. Absent a repeat survey the data will not be obtainable for future measurements
Success of public in assigning a list of CO2 emissions to a list of transport modes						These are all indicators for which the data was measured in a survey. Absent a repeat survey the data will not be obtainable for future measurements
Ability of public to assess various questions about the sustainability or otherwise of different activities.						These are all indicators for which the data was measured in a survey. Absent a repeat survey the data will not be obtainable for future measurements

- Further description of potential indicators

Social acceptance indicators- indicators of actions

In terms of indicators of acceptance, willingness to pay forms the basis of several indicators of social acceptance. Willingness to pay is the amount that a person would pay now to avoid perceived potential bad effects in the future.

One indicator of social acceptance to climate change and the need to act would be the willingness to pay to avoid adverse effects, although this is fraught with additional complicating factors. Some potential examples of willingness to pay may be seen as:

Share of Renewable Energy by Source

Measuring the usage of renewable energy in a country is a useful indicator of the extent to which actions have been taken to reduce the greenhouse impact of energy use. This indicator may be complicated by national policy – for instance a mandated 20% increase in renewable energy share may show in the indicator, while not actually reflecting a change in public attitude.

Percentage of households adopting a "green" electricity tariff

This has potential to be a useful indicator, as there is a limited supply of "green" electricity, so the chance that it becomes price equivalent to standard electricity making the indicator meaningless is offset, and it represents solely a cost to the end user (the electricity conveys no benefit to them.) This also makes it an indicator that points at action as a response to climate change, a deeper level of engagement than accepting anthropomorphic climate change exists. However, in some countries (including France) consumers do not have the option to adopt a 'green energy' tariff, and this indicator cannot therefore be used across all regions.

Percentage of planning applications for renewable energy production in homes

This may be a useful indicator as it shows the extent to which individuals are willing to take action. Where renewable energy is incorporated in new homes by a developer, for example, this is likely to be motivated by public interest in having homes with these types of technologies. It is likely that local or regional planning authorities will have access to this information through planning application documentation. Planning requirements and processes will vary across countries and therefore identical data may be difficult to collect and compare.

Share of Biofuels as percentage of transport fuel consumption

This is an existing indicator which demonstrates actions being taken in the transport sector – a sector which has been recognized as being of particular interest – to reduce the greenhouse impact of the sector.

Percentage of new cars sold that are able to be fuelled by biofuels or electricity

This may be a useful indicator as it shows the extent to which individuals are willing to take action. There are some factors that influence this, however – for example, the availability of

incentives/grants to purchase flexi-fuel cars can lead to flexi-fuel cars being bought but run on petrol.

Percentage of students attending an educational establishment with a Travel Plan

This is a useful indicator because it shows the level of action taken by schools, colleges etc. This can be influenced by how active the local and regional authorities are in encouraging travel plans and the levels of support provided. This indicator also provides useful information about the exposure students have to sustainable travel issues. This data is likely to be being collected by Local or Regional Authorities.

The CATCH Research and Design Report[46] offers a range of indicators which are extremely relevant to public acceptance of, and action on climate change. The problem with these indicators is that they are not regularly surveyed, and so are not available as measures of future change in the systems that they act as indicators for. The CATCH indicators particularly relevant to actions are:

- *% of respondents who "made a change in the last 12 months"*

This is a good indicator of the proportion of the public in the "Full Behaviour Change" stage, although it may be an overestimate due to the potential for token change to be reported.

- *% of respondents to survey who give their normal travel mode as "car"*

This is an indicator of the extent to which people have changed their travel habits. Transport is one sector in which it has proved difficult to reduce emissions, so improvement in this indicator may well be an indication of a shift towards the "Full Behaviour Change" state of awareness. There are of course other reasons why people may change their travel habits over time, for example due to economic reasons.

- *% of respondents to survey who say they "usually recycle"*

Recycling is given as a textbook "Token Response" level of behaviour change in some literature. It is certainly an indication of adapting actions in response to the need for environmentally sustainable actions, although it may be caused by concerns other than climate change.

- *Average "flight hours in past year" given by survey respondents*

International aviation is one of the sectors that shows persistent growth in emissions in spite of the overall declining trend. If the public are choosing to actively reduce their flight hours, this is a good indicator of a change in behaviour associated with a response to climate change.

Social acceptance indicators-indicators of belief and knowledge

There are indicators which demonstrate a change in understanding and belief about climate change, which could be considered a precursor to actions by an organisation or individual.

[46] http://www.carbonaware.eu/news/latest-news/article/deliverable-research-and-design-report-online.html

Number of connections made to a dedicated site about the climate change plans

If a climate change plan or campaign has a dedicated website, web traffic to the site is a good indicator of how many people the communications reached sufficiently well for them to desire further information, and go as far as actively seeking that information.

Number of events held of a certain profile about climate change or the climate plan

As awareness about climate change builds, we would expect a greater public profile in terms of actual organised events.

Similarly, number of media column inches written about climate change and climate change strategy

A measure of how much additional media coverage the primary effort made on communication has caused is one measure of how well the resources spent on that communication have been spent. In addition, as public interest in climate change increases and decreases we would expect media coverage to follow the same trend.

There are also indicators in the CATCH survey which cover this area, the indicators specifically relevant to public belief and understanding of climate change include

- *% of respondents to survey who claim they are "not concerned with climate change"*

This is a direct measure of the proportion of the public who are in the Denial stage of behaviour change.

- *% of respondents who say they "will make a change"*

This, combined with the below indicator, is a good measure of the proportion of the public who are in the Token change stage. Expressing a desire to change without having implemented meaningful changes in the last year shows an acceptance that anthropogenic climate change is real but a lack of commitment to direct action.

- *Success of public in assigning a list of CO_2 emissions to a list of transport modes*

e.g. 132g, 230g, 500g, 1100g, and 3000g, to be allocated to : four people in an average car, bicycle (one person), 1.6 people in a large hybrid car, average 4x4 with only the driver, and 100% occupancy (full) diesel bus in city. This is a good measure of how well the public understands the actions which may be required of them if they wish to reduce their carbon footprint.

- *Ability of public to assess various questions about the sustainability or otherwise of different activities.*

The activities for these questions are measured in different ways, and the unit of measurement strongly affected how confident the public were in their answers.

Many indicators of behaviour change are vulnerable to the influence of economic up and downturn. Some of these indicators will respond to changes in the global economy, regardless of

conscious effort to mitigate climate change. For example the number of flight hours an average person makes will tend to decrease during times of reduced economic activity.

It is also possible to directly monitor behaviour change by asking a list of questions about behaviour, as seen in the evaluation of the Act on CO2 campaign[47]. Although self-reported behaviour cannot be relied on to be identical to actual behaviour, it is still a good indicator of how common the desired behaviours are in the sampled population.

In conclusion, a lack of indicators for measuring changes in social behaviour (awareness, attitude, actions) over time that are valid at the regional level has been identified. There are readily available indicators on carbon emissions which are standardised over the EU and frequently sampled, but no such consistent indicator was found for social awareness.

Recommendations for the collection of social behaviour indicators

The project should promote the need for, make a definition of and encourage the collection of a consistent set of indicators of social behaviour at a regional level across the Atlantic area. The ongoing collection of these indicators on a regular basis will give local authorities a clear picture of the baseline, enable trends in behaviour to be identified over time and help to provide supporting information when planning strategies and evaluating campaigns.

An initial short list of indicators suggested for investigation by the project are:

- % of respondents to survey who give their normal travel mode as "car". This indicator shows the results of mode shift away from the car, and includes an increased use of all other modes (public transport, walking, cycling). We recommend that this indicator be collected on an annual basis to enable monitoring of travel trends over time. Modal split of passenger transport is collected on an EU and national level as one of the Sustainable Development Indicators (SDIs) collated by Eurostat; collecting these data regionally would give a fuller picture of mode choice.
- Connections to website on climate change. The early stages of behaviour change can be motivated in part by increasing awareness in the public. As such, this indicator aims to track how interested the public are in the specific national sites on climate change. If a partner region does not currently have such a site, the first step as far as this indicator is concerned is that such a website is produced, demonstrating the initial commitment from government to informing the public about climate change. We recommend that this indicator be monitored monthly on an ongoing basis; this can be done using simple web tools. This will give an indication of trends – for example if more connections are made during winter or summer months.
- Consumption of Biofuels as a percentage of total transport fuel consumption. Transport fuel is a large source of carbon emissions. Biofuels can represent a significant alternative to fossil fuel in transport, and tracking the share of biofuels in the transport fuel market should provide a good indicator of response to climate change within business and the local economy. We recommend that this indicator be collected on an annual basis. The

[47] http://www.dft.gov.uk/pgr/scienceresearch/otherresearch/actonco2research/postcampaignresearchjan/

collection mechanism may vary depending on the data already available in each region or country.

- Percentage of students attending an educational establishment with a Travel Plan. This is a useful indicator because it shows the level of action taken by schools, colleges, etc. and gives an indication of both how active the local and regional authorities are in encouraging travel plans and the exposure students have to sustainable travel issues. We recommend that this indicator be collected on an annual basis.

These four indicators have been chosen as they are expected to be possible to collect; they gather information about a range of responses to climate change, from concern to action; and they are easily understandable. All four can potentially be collected at a local, regional or national level, and they cover general interest, domestic energy and transport energy usage.

We recommend that the pilot actions taking place as part of CLIMATLANTIC consider using these indicators for their evaluation, where appropriate.

6.4. Recommendations for the implementation of climate change communication campaigns

The project itself cannot run climate change communication campaigns across the Atlantic area. Instead, the recommendations from the mobility, Spatial Planning and energy pillars have been studied so as to identify where there may be a need for campaigns at the regional level, and to identify the types of campaign needed. Much of what can be done is focused on influencing others to take up best practice approaches, i.e. focused on providing training to 1st tier stakeholders.

The first step in each region would be to undertake an analysis of the gaps and the opportunities, so as to identify the specific types of campaigns that might be appropriate. A key part of this would be to identify where there is a need for training provision for people working within local and regional authorities to help them in their work. This would be followed by identification of where appropriate resources could be found, and a more detailed process of campaign scoping and planning. Following the production of this paper, the future actions of the Climatlantic project will include engaging in an 'Atlantic debate' to discuss and disseminate the outcomes of this paper. The Atlantic debate could provide a mechanism through which benchmarking of the gaps and opportunities could be done, so as to better identify which campaigns would be most appropriate in each region, and where resources might be available to implement these types of campaigns.

Guidelines for Communication Campaigns

A consistent and well designed message should include the following factors:

Accurate

Information must be up to-date and accurate to ensure that campaigns are as relevant as possible, and as convincing as possible. Campaigns need to identify benefits and address barriers. Depending on the target audience these might be the benefits to an organisation, to society, or to an individual.

Enabling

The campaign should set out to impart a feeling of agency in the target audience. They should avoid suggesting that a problem is too big to make a difference, and should encourage specific actions that the audience can take.

Balance

The campaign should avoid being intimidating by reeling off lists of negative consequences. This may make a problem seem unsolvable. Positive impacts should be mentioned and barriers acknowledged, presenting a balanced view and encourage discussion.

Targeted

Campaigns need to address specific groups and ensure that the message they deliver is relevant and appropriate to the target group. The campaign needs to be designed with an understanding of the motivations of the group and the barriers they are likely to experience.

Social behaviour pilot actions are taking place in the CLIMATLANTIC project and these can be used to inspire and encourage more initiatives to take place in the Atlantic Area. Further details of those pilot projects that have already been established are given in Section 6.2.

Recommendations for Information Campaigns and Activities

Details of suggested types of campaigns, activities or training programmes that could be run at a regional level are presented below. These would need to be subject to a more detailed process of campaign scoping and planning before being implemented.

Activity: Alternative Fuels Information Exchange
Pillar: Energy, Mobility
Region: All regions
Target audience: Fleet managers and fleet procurement officers within the Local or Regional Authority, managers of other fleets in the Region– e.g. public transport operators, freight/logistics operators, taxi drivers.
Objectives: Giving information about alternative fuels to fleet managers and other vehicle users. This will allow fleet managers within local or regional authorities to have greater confidence in deciding whether to trial or use alternative fuels in their fleets and therefore encourage regions to start leading by example. This could be done by means of a training day, and supplemented by an information pack or fuels calculator. Additionally, the information pack can help to disseminate information on a wider basis as taxi and bus drivers work directly with the public, and taxi drivers in particular

have the opportunity to discuss issues with their passengers.

Suggested topics/focus:

1. Background to alternative fuels – what are they? Why are they needed?
2. What are the options?
3. What are the pros and cons? A calculator could be developed to show the costs/benefits of switching.
4. What are the costs involved? Are there any subsidies or schemes available in the region/country?
5. Where can fuels be purchased locally?
6. Best practice examples in the region and in other regions in the Atlantic Area, together with contact details to enable sharing of information.

This campaign could also tie-in with the "Creation of a regular networking event/group for stakeholders involved in the regional response to climate change".

Activity: Training sessions/Information pack on fuel efficiency measures, fuel monitoring and eco-driving

Pillar: Energy

Region: All regions

Target audience: Fleet managers and fleet procurement officers within the Local or Regional Authority, managers of other fleets in the Region– e.g. public transport operators, freight/logistics operators, taxi drivers.

Objectives:

Training fleet managers in the ways to monitor fuel efficiency and conserve fuel will allow them to put measures in place to improve the fuel efficiency of their fleet. A reduction in fuel use means a reduction in energy and emissions and also delivers cost savings.

Fleet managers will then be in a position to pass on some of the training to drivers – for example knowledge of eco driving techniques.

Suggested topics/focus:

1. Why monitor fuel use?
2. How to monitor fuel use – method and technologies available

3. Eco-driving techniques and benefits (fuel saving, costs saving etc)

4. Types of incentive scheme

5. Best practice examples in the region and in other regions in the Atlantic Area, together with contact details to enable sharing of information.

This campaign could also tie-in with the "Creation of a regular networking event/group for stakeholders involved in the regional response to climate change".

Activity: Energy efficiency in existing buildings and installations

Pillar: Energy

Region: All regions

Target audience: Facilities managers of public buildings; facilities managers of other business premises

Objectives:

Training facilities managers in how to monitor energy use within buildings and how to identify and implement improvements, to reduce energy consumption.

Suggested topics/focus:

1. Why monitor energy consumption?

2. How to monitor energy consumption – method and technologies available

3. Energy saving techniques and benefits (cost savings, CSR)

4. Availability of grants and incentives in the region

5. Best practice examples in the region and in other regions in the Atlantic Area, together with contact details to enable sharing of information.

This campaign could also tie-in with the "Creation of a regular networking event/group for stakeholders involved in the regional response to climate change".

Activity: Promotion of alternative energy generation

Pillar: Energy

Region: All regions

Target audience: An information pack for planning committees espousing the benefits of alternative energy. A similar pack could go to energy companies – in this way both would be on the same page when it came to the benefits and requirements of alternative generation, which would expedite the planning process.

Hand in hand with this is an information campaign for the general public promoting alternative energy generation to promote greater public support and public engagement with issues related to alternative energy generation.

Objectives:

To raise awareness of the need for sources of alternative energy, so as to expedite the planning process, and to increase public acceptance and reduce opposition.

Suggested topics/focus:

1. Why is it necessary to find alternative ways to generate energy?
2. What are the options, and what costs and benefits do they bring?
3. Benefits and requirements, from a planning perspective.

Activity: Promotion of public transport

Pillar: Mobility; Spatial Planning

Region: All regions

Target audience: General public.

Could be targeted at specific locations or destinations.

Objectives:

To increase the use of public transport as an alternative to private car use.

Suggested topics/focus:

1. Several mechanisms – some areas might benefit from Personalised Travel Planning to increase individuals' knowledge of how public transport can work for them.
2. General campaigns to publicise routes or improvements when opportunities arise – for example if there are new routes or new buses, or around the introduction of new initiatives such as real time information or smart ticketing.

Activity: Promotion of alternatives to travel

Pillar: Mobility

Region: All regions

Target audience: Major employers in the region

Objectives:

To supply information to businesses to raise awareness of the benefits of alternatives to travel and knowledge of the mechanisms and tools, in order to increase the numbers of people using these alternatives and therefore decrease the demand for travel.

Suggested topics/focus:

1. Overview of the alternatives to travel - measures which can reduce or remove the need to travel, particularly for work, including commuting and business trips and travelling during peak times. The travel alternatives can include:

- Home working and remote working/teleworking
- Flexible working and staggered hours (in order to reduce travel during peak periods)
- Tele conferencing, video conferencing and web conferencing
- Any other alternatives to travel which can help reduce work-related travel.

2. What are the benefits to businesses and to individuals? For example, reductions in parking demand, saving travel time, saving on travel costs, increased flexible working.

3. What practical actions are needed (by a business) in order for staff to be able to use these alternatives?

4. Are there any incentives available in the region to businesses that encourage the use of alternatives, such as tele-working?

This campaign could also tie-in with the "Creation of a regular networking event/group for stakeholders involved in the regional response to climate change".

Activity: Awareness of the environmental impacts of urban sprawl

Pillar: Spatial Planning

Region: All regions

Target audience: Developers and the general public

Objectives:

Include a badge for planning applications with "Excellent" environmental evaluation, which is displayed publicly on new developments. This will raise public awareness and provide an incentive for developers to go an extra step. This could include new developments and refurbishment schemes, and could be tied in with existing tool, such as BREEAM and CEEQUAL.

Suggested topics/focus:

1. Develop a regional set of criteria to enable a planning application to qualify for "Excellent" status.

2. Allow use of a badge in publicity relating to the development

This campaign could also tie-in with the "Creation of a regular networking event/group for stakeholders involved in the regional response to climate change".

Activity: Encourage polycentrism through public campaigns about local business and economies.

Pillar: Spatial Planning

Region: All regions

Target audience: General public (specific communities)

Objectives:

To encourage an attitude of support towards local businesses and a local economy by promoting the benefits these can bring. Encouraging people to support their local economy and use local facilities and local businesses (where such facilities exist) will lead to a reduction in the need to travel for goods and services.

Campaigns could focus on specific local areas or communities, and be carried out in cooperation with, or by providing support to, local community groups.

Suggested topics/focus:

A number of mechanisms could be used, including:

1. Organising fairs or street parties within local areas to promote local business and help develop a community spirit.

2. Developing a booklet of local information – to include details of local services, together with discount vouchers or offers for local businesses.

Activity: Encourage the development and use of car clubs/car sharing

Pillar: Spatial Planning, Mobility

Region: All regions

Target audience: General public, large companies, residents groups, developers of new developments

Objectives:

Encourage the development and use of car clubs/car sharing to reduce car dependency and to create a change in attitude to enable future developments to assume lower car ownership. This could be done in a number of ways, and would depend on the audience to be targeted. For example, meeting with community groups would be a useful way to engage with residents at a community level. It might then be possible provide technical support and advice to help such groups establish car sharing clubs if they wished to do so.

Suggested topics/focus:

1. What is a car club? How does it work?
2. What are the benefits – e.g. cost, convenience
3. Are there any incentives available in the region to organisations/groups wishing to establish a car club? Information about how to do this, or a reference to where this information can be found.
4. Details of any car clubs already available in the region.

This campaign could also tie-in with the "Creation of a regular networking event/group for stakeholders involved in the regional response to climate change".

Activity: Creation of a regular networking event/group for stakeholders involved in the regional response to climate change to discuss a range of sustainability issues

Pillar: Mobility; Energy; Spatial Planning

Region: All regions

Target audience: All regional actors involved in climate change work – including local businesses, fleet managers and facilities managers. The target audience would be those whose day-to-day work involves implementing the types of campaigns and actions discussed within this report and who would therefore benefit from sharing knowledge, experience and

resources.

Objectives:

To improve collaboration between local stakeholders by creating a forum in which contacts can be made and best practice can be shared at a regional level. Monthly meetings could be held to provide peer support and cross pollination of ideas and activities, and to share experiences and best practice.

Suggested topics/focus:

Sharing of best practice on a number of topics, for example:

1. Managing energy consumption in buildings in the Atlantic Area.
2. Fuel use management, in regional fleets in the Atlantic Area.
3. Encouraging sustainable travel modes and tele-working.

This group could tie-in with a number of the other suggested campaigns.

Activity: Campaign to encourage people to respect or comply with environmental legislation

Pillar: Social behaviour

Region: All regions

Target audience: General public and/or businesses

Objectives:

To increase the acceptance of and compliance with environmentally motivated legislation.

To bring about an adjustment in social norms such that people are more likely to comply with environmentally motivated laws, because they understand their importance, and because not respecting environmentally motivated legislation becomes social unacceptable and likely to attract the disapproval of peers.

Suggested topics/focus:

1. Explain why environmental actions are necessary
2. Explain the implications of non-compliance, particularly for specific individual sectors of society – particularly those most vulnerable.

The Table below gives an overview of the campaigns and activities for consideration by regional authority.

Sector/actions	**Transport**	**Buildings/sites**	**Renewable energy (RE) production and use**	**General**
Short-term direct actions by regional authorities - Internal campaigns directed at operations within the Regional Authority.	Alternative Fuels Information Exchange Training/Information pack on fuel efficiency measures, fuel monitoring and eco-driving Promotion of alternatives to travel Encourage the development and use of car clubs/car sharing	Energy efficiency in building and installations	Promotion of alternative energy generation	
Short-term actions co-ordinated by regional authorities: Campaigns directed at operations within external organisations and businesses.	Alternative Fuels Information Exchange Training/Information pack on fuel efficiency measures, fuel monitoring and eco-driving Promotion of alternatives to travel Encourage the development	Energy efficiency in building and installations	Promotion of alternative energy generation	

	and use of car clubs/car sharing			
Ongoing campaigns – to be implemented either on an ongoing basis or as appropriate opportunities arise	Promotion of public transport			Awareness of the environmental impacts of urban sprawl Creation of a regular networking event/group for stakeholders involved in the regional response to climate change to discuss a range of sustainability issues Campaign to encourage people to respect or comply with environmental legislation Encourage polycentrism through public campaigns about local business and economies.

6.5. Recommendations for influencing social behaviour in the Atlantic Area

Some recommendations are made for actions that can be undertaken to monitor and influence social behaviour and behaviour change within the Atlantic area.

- **A set of social behaviour indicators should be defined and collected across the Atlantic Area region.** At present there are no indicators that are regularly collected to show changes in attitudes, awareness and social norms. The collection of such indicators on an ongoing basis would allow better monitoring of changes in attitudes and social behaviours, and allow better evaluation of campaigns and actions targeted at changing behaviour. An initial short list of indicators suggested for investigation by the project are: Percentage of respondents to survey who give their normal travel mode as "car"; Connections to website on climate change; Consumption of Biofuels as a percentage of total transport fuel consumption; and percentage of students attending an educational establishment with a Travel Plan.

  These four indicators have been chosen as they are expected to be possible to collect; they gather information about a range of responses to climate change, from concern to action; and they are easily understandable. All four can potentially be collected at a local, regional or national level, and they cover general interest, domestic energy and transport energy usage.

- **A benchmarking analysis should be carried out in each region to identify the gaps and the opportunities for training, campaigns and actions.** This benchmarking exercise would identify the specific types of campaigns that might be appropriate within each region to support the principles of the energy, mobility and Spatial Planning pillars. A key part of this would be to identify where there is a need for training provision for people working within local and regional authorities to help them in their work. This would be followed by identification of where appropriate resources could be found, and a more detailed process of campaign scoping and planning.

- **The contribution to reducing greenhouse gas emissions should be considered by all projects with EU support.** All projects should include a topic within their communication strategy to discuss and publicise the contribution of the project to reducing GHG emissions.

7. A strategy to reduce the carbon footprint of the European Atlantic Area

7.1. The rationale of the strategy

This final chapter aims to present a comprehensive strategy to reduce the carbon footprint of the European Atlantic Area. Previous chapters are focussed on specific thematic fields of action; this chapter adopts a synthetic, horizontal approach integrating thematic and sectorial contributions and searching for synergies and complementarities.

The carbon footprint concept has several key dimensions to explore and this project aims to give useful insights to cover their diversity. But a comprehensive and integrated strategy is more than the sum of the parts. It surely encompasses the technical inputs offered by the different fields of analysis but it goes beyond them, seeing their contributions within a global and integrated perspective. Thus, the strategic inputs proposed by each thematic field represent the basis for the carbon footprint reduction strategy

The aim of the strategy is to reduce the carbon footprint in the Atlantic regions and at the same time increase the competitiveness of the productive sectors of the Atlantic regions, thus contributing to economic growth and employment. This is indeed a very relevant issue as this strategy stresses the role of carbon footprint reduction in the territory as a reliable way to increase the competitive advantage of the European Atlantic regions.

The strategy to reduce the carbon footprint in the Atlantic regions is seen as an opportunity to transform these regions into a competitive growth space, enhancing the socio-economic value of relevant endogenous resources and building a new development trajectory. The synergies and complementarities of this strategy with the Maritime Strategy for the Atlantic Ocean Area proposed by the EC significantly increase its intrinsic value as an opportunity to restore the status of space of growth. From this perspective, the strategy proposed in CLIMATLANTIC will strongly enhance the accuracy of the Atlantic macro-region approach under preparation.

The carbon footprint approach is also a post-crisis new rationale to guide the integration of territorial public policies. It can further develop the sustainable development approach, introducing a metric and an operative way to explore synergies and complementarities between different public policies. Monitoring of the integrated impacts of these different policies will be facilitated by adopting the carbon footprint metric.

Additionally, the strategy proposed here should be seen as a leverage factor for a new cycle of co-operation projects between the Atlantic regions. The strategy aims at placing the reduction of the carbon footprint in all co-operation programmes as a priority intervention axis to which the different co-operation field should contribute.

The present chapter presents strategic guidelines – the priorities, including the contributions of the different pillars to each strategic priority and some proposals for anchor projects that ensure an operational dimension to the strategy. Finally, governance and funding opportunities complete the framework of the present strategy.

7.2. Priorities of the strategy

The previous chapters of this report identify ways to improve policies to reduce the carbon footprint in various sectors within the Atlantic Area: public spaces and buildings, the residential sector, transport, spatial planning, energy and social behaviour. Nevertheless, and despite of the specificities of each level, there are some cross-cutting issues to be approached adopting an interdisciplinary strategy.

In this chapter we define horizontal and integrated priorities as those that present higher synergies and complementarities between carbon footprint sectorial policies and a more decisive role in ensuring the fostering of more environmental-friendly patterns of territorial development in these territories. The seven priorities identified in this strategy are as follows:

1. To increase the use of renewable energy and promote energy efficiency.
2. To improve mobility patterns in the Atlantic Area.
3. To control urban and rural sprawl.
4. To enhance the role of the Atlantic Façade to reduce greenhouse gas emissions at the EU level.
5. To develop education and communication campaigns to disseminate the approach of reducing the carbon footprint of the Atlantic Regions.
6. To foster research and development to generate the scientific and technological foundations for carbon footprint reduction.
7. To include carbon-footprint-reduction-based projects as a new priority axis in transnational, inter-regional, trans-border co-operation programmes.

PRIORITY 1: TO INCREASE THE USE OF RENEWABLE ENERGY AND PROMOTE ENERGY EFFICIENCY

The proposed strategy reinforces the need to design public policies focused on saving fossil fuels, enhance energy efficiency and increase the use of renewable energy.

This priority is in line with the understanding of the EC in the 2020 Energy Plan (January 2008) and of the EU by its Directive 2009/28/EC regarding the fostering of renewable energies, binding each Member State to present its National Action Plan. Later, the EU has converted the climate and energy 20/20/20 objective into one of the five goals to meet with the 2020 European Strategy. It is a contribution to tackle the challenges that community authorities and member states face in coming years concerning the need to articulate a common energy policy with the CFSP (Common Foreign and Security Policy).

As far as the saving and efficiency modalities are concerned, the priorities are:

- Stabilise a set of transparent, sound and feasible fiscal incentives (positive and negative)
- Promote the energy mix as the more feasible alternative to ensure the orderly transition to a low carbon economy and a better use of available resources

- Use the public sector as a benchmark of good practices.

Regarding the intensification of renewable energy use the priorities are:

- Explore distributed generation as an alternative to generate new energy resources, reduce the energy dependency and foster citizens' responsibility and environmental education.
- Support the different forms of intelligent regional specialization opening new opportunities for endogenous development and the creation of new jobs based on the exploitation of renewable energy resources.
- Disseminate the renewable energies as a key topic to transform a peripheral territory into a core one through wind and marine energies-based economic development.

To implement this priority we recommend a set of proposals as follows:

- To 2020 the public authorities should achieve the goal of reducing the consumption of energy by 20-30% saving in public buildings, lighting in public spaces, transport, heating and other consumptions.
- To introduce energy efficiency binding measures in building regulations.
- To implement forestry policies to facilitate the reduction of GHG emissions through decrease in forest fires.
- Eco-lending, with a low or zero interest rate to rehabilitate buildings submitted to energy efficiency norms.
- Temporary compensatory measures in tax policy to renovated houses introducing energy efficiency criteria.
- Negative fiscal incentives to houses that alter 2030, have not been adapted to energy efficiency criteria.
- Compensatory measures in fiscal policy depending upon their contribution to distributed generation.
- Positive and progressive fiscal incentives to firms having reduced energy consumption more than 10% of original consumption without penalising their productivity through exportable innovations.
- Positive fiscal incentives to universities and research centres, public and private, according to registered patents with a demonstrated transfer and to applied research results in the energy efficiency domain.
- CO_2 and pollutant emissions standards for vehicles or transport activities must be the same in all territories.
- Business-based GHG certification schemes should be encouraged as well as the utilisation of common EU standards in order to estimate the carbon footprint of each passenger and freight journey to allow better choices of cleaner transport solutions.
- Marine renewable energies to be used at least in all the sea terminals.

- Development of energy neutral buildings and equipments using appropriate material and supervision systems to monitor the life of the infrastructure.

PRIORITY 2: TO IMPROVE MOBILITY PATTERNS IN THE ATLANTIC AREA

New low carbon-based mobility patterns are needed within the Atlantic Area to increase significantly the contribution of these territories to a reduction of the carbon footprint of the European territory. This change of paradigm in mobility patterns should be combined with the generalised view that the Atlantic regions should not only minimise their peripherality and marginalisation regarding the more dynamic centres of the European territory, but also increase the flows of people and goods along the Atlantic façade.

This is a challenging combination, requiring the contribution of EU (the Trans-European networks), national (priorities for transports system and degree of coverage of all the territory) and regional and local (through the integration with priority 3 regarding spatial and urban planning) policies.

To tackle this priority different formulations should be adopted according to the territorial development typologies identified within the Atlantic Area: predominantly urban areas, cities and their satellites and polycentric networks of small and mid-size urban centres. Despite these differences, the strategy considers that maritime transport seems to be a common asset for all the Atlantic regions. Maritime transport issues are a true opportunity to the Atlantic regions in order to recover their centrality visa-vis United States, Latin and Central America and, through the new Panama Channel Pacific regions.

To implement this priority we recommend the following actions:

- Set-up strategic and planning guidelines for public transport and mobility policies inspired by carbon footprint-based land use criteria.
- Design new guidelines and rules for tourism and leisure facilities and infrastructures to monitor and reduce their impacts in GHG emissions.
- Increase the efficiency of European gates (harbours, stations & airports) mainly through the optimisation of the various technical components, fostering the use of marine energies and supporting the development of new maritime routes
- Ensure the dissemination of similar CO_2 and pollutant emissions standards for vehicles or transport activities in all territories.
- Interface standards for infrastructure-to-infrastructure, vehicle-to-infrastructure, and vehicle-to-vehicle communications must be agreed.
- Set up homogeneous and efficient payment policies for the utilisation of transport facilities. Transport charges and taxes must be restructured in the direction of a wider application of the ‘polluter-pays’ and ‘user-pays’ principle and must include the internalisation of external costs and infrastructure use charges. The cost of local externalities such as land, air or sea pollution, noise and congestion could be internalised through charging for the use of infrastructure or resources depending on Local authorities.
- Look for the diversification of sources of finance both from public and private sources; innovative financial instruments have to be designed at the local level to widen the possibilities of improvement.

- Tendering process, project assessment as well as various authorisations which must be carried out according to sustainable criteria and more specifically should include life cycle assessment studies, medium- and long-term impact analysis, noise and local pollution costs, etc.
- The implementation of Intelligent infrastructure (both land and space-based) to ensure maximum monitoring and inter-operability of the different forms of transport and communication between infrastructure and vehicles.
- Improve the disseminated use of information technologies in transport domain, mainly through facilitating the informational accessibility to transport services, generalising electronic booking and payment of several services related to the travel, ensuring the interoperability between stakeholders and guaranteeing the optimisation of the flows between them and with external world.
- Develop the use of intelligent systems for interoperable and multimodal scheduling, information, online reservation systems and smart ticketing.
- Develop and implement efficient decision aid tools to monitor the evolution of mobility (passengers and goods) in each territory of the AA, to develop perspectives related to Atlantic Area situations according to recent and specific changes and to consolidate the global requirements. Mobility observatories are too few in the Atlantic Area and current forecast surveys and models are too generic and too much "mirror oriented" to provide any help for local decision making concerning transport developments.
- Connections between long distance and local/ regional transport for both passengers and freight must be improved. This concerns the localisation of hubs, logistics platforms, and the optimisation of their role as decoupling external and internal flows links with Spatial Planning). Although reloading might be considered sometimes as a source of increasing costs and times, the development of optimised intermodality as well as a global cost/benefit analysis including all externalities should be carried on to determine local and regional strategies and the best hierarchised organisation of these interchange spots.
- Building or renovation activities should aim at minimising carbon footprint levels of transport infrastructures. This means that Local Authorities should encourage the localisation in suitable areas in looking for the best compromise between minimisation of global impact, maximisation of efficiency regarding transport demand.
- Improve the multimodal intercity travel and transport inside the Atlantic Area. Attractive frequencies, comfort, easy access, reliability of services, and inter-modal integration are the main characteristics of service quality. These are part of the measures necessary for integrating different passenger and goods transport modes to provide seamless multimodal travel.
- From the point of view of regional and local intervention, urban transportation should be considered as the easier way to introduce more friendly carbon footprint-based solutions. At urban level, accessibility and mobility modalities should be wisely combined: better accessibility conditions, increasing the proximity of people to services and equipments, will tend to better accommodate mobility needs.

PRIORITY 3: TO CONTROL URBAN AND RURAL SPRAWL

The strategy proposed sees spatial and urban planning as key fields of intervention of spatial planning, which is one of the more effective instruments to achieve a low carbon emission society at regional and local level. The effectiveness of these instruments is based on the fact that they strongly depend upon regional and local Authorities decision making capacity. The enforcement of spatial and urban planning orientations and rules depends ultimately of private and market reactions. But spatial and urban planning are mainly regional and local competences which makes a big difference as far as the feasibility of the carbon footprint reduction strategy is concerned.

In post-crisis periods, spatial and urban planning search for a new rationale in designing the allocation of resources within territories. The sustainable land use regulation, strongly based in targeted patterns of low carbon emissions, should be seen as a new rationale to be followed by planners and planning operations.

The strategy underlines the role that green and other environmentally-valuable areas in less-developed and inner regions of the Atlantic territory as absorbing GHG emissions (carbon sequestration) should play as a key element of territorial equity allowing for monetary compensations and funding oriented towards territorial cohesion objectives.

To implement this priority we recommend the following set of proposals:

- Disseminate more compact forms of urban settlements.
- Set-up strategic and planning guidelines for public transport and mobility policies inspired by carbon footprint-based land use criteria.
- Manage land use in rural areas, countering the residential dispersion and trying to enhance already existing situations of sprawl.
- Design new guidelines and rules for tourism and leisure facilities and infrastructures to monitor and reduce their impacts in GHG emissions.
- Generate cooperation practices between Atlantic regions in full respect for their planning institutional and political contexts and implement experimental joint planning actions.
- Increase the participation of Atlantic regions in research projects generated within the framework of ESDP, combining planning strategies with a more intensive incorporation of scientific knowledge in these processes.
- To implement forestry policies to facilitate the reduction of GHG emissions through decrease in fires.
- Eco-lending, with a low or zero interest rate to rehabilitate buildings submitted to energy efficiency norms.
- Temporary compensatory measures in fiscal policy to renovated houses having introduced energy efficiency criteria.

PRIORITY 4: TO ENHANCE THE ROLE OF THE ATLANTIC FAÇADE TO REDUCE GHG EMISSIONSAT THE EU LEVEL

Atlantic regions should take advantage of its geographical position as gates connecting the EU with other parts of the world. To enhance the role of the Atlantic façade as a very relevant space to allow the EU territory as a whole to have a better performance in reducing GHG emissions and higher levels of quality of life through new modalities of transport networks, information systems-based logistics, inter-operability and inter-modal transport operations, principally between maritime and train ones. The development of the Atlantic freight corridor project would provide a relevant contribution to this objective. This priority is compatible with the need to open up these regions and reduce their marginalisation relatively to the more dynamic regions of the centre of Europe. In this sense we recommend the following set of measures:

- Complete Atlantic priority projects under TEN-T policy, and especially the North-South connection along the Atlantic seaboard.
- Promote a West-East link to connect the Atlantic façade with the main centres of Europe.
- Increase the number of short sea shipping routes and motorways of the sea connecting the Atlantic façade with the main European hub ports.
- Travelling and routing information systems and especially journey planners must be at least interoperable. Information must be available for all European customers or service providers which can transfer/ transform these data to their own customers in order to facilitate movement of people and goods. All development should be realised within European Integrated Multimodal Information and management Plan.
- Logistics organisation to internal (inland) Europe must be created to facilitate the transit to/from the gates and the related hubs and platforms; multimodal terminals at sea and river ports and city logistic consolidation centres must be implemented.
- Regulations and conditions to access these gates should meet minimum quality standards and provide quality services (homogeneous in all AA gates) for all types of actors in each type of gates (stations, port, airport) whichever is the size of the gate and for all type of services (information of travellers, freight handling…).
- Taxes and pricing policy to increase the attractiveness and competitiveness of Atlantic ports.

PRIORITY 5: TO DEVELOP EDUCATION AND COMMUNICATION CAMPAINGS TO DISSEMINATE THE APPROACH OF REDUCING THE CARBON FOOTPRINT OF THE ATLANTIC REGIONS

The implementation of successful actions to combat climate change relies on successfully motivating behaviour change at all levels within the society. People generally change their behaviour because of motivations giving some tangible benefits - for example the cost saving associated with reducing energy consumption or the health benefits of changing travel choice. Campaigns and policies to encourage changes in behavior must therefore also highlight the benefits of such action to the individual.

The public may also start to modify their behaviour as they become more aware of the need to act to mitigate global climate change by reducing carbon emissions, and as they become more

educated about the potential actions they can undertake to have an impact on greenhouse gas emissions.

Communication campaigns addressed to different targets of public and proactive education are key conditions to disseminate the strategy for reducing the carbon footprint in the Atlantic regions. At regional and local levels, schools should be supported in developing specific projects of raising awareness on carbon footprint issues among the youth population. A benchmarking analysis should be carried out in each region to identify the gaps and the opportunities for training, campaigns and actions.

To implement this priority we recommend a set of proposals as following:

- To develop citizens awareness campaigns and school campaigns focused on energy consumption saving;
- To create award of prizes and distinctions to local authorities having achieved high energy efficiency results as a result of good exportable transferable practices;
- To create living labs to experiment and demonstrate with the citizens new practices to improve energy efficiency;
- To improve training programs to professional stakeholders about energy efficiency;
- To develop campaigns for Regional Authorities and managers of fleets in the Region– e.g. public transport operators, freight/logistics operators, taxi drivers - giving information about alternative fuels.
- To implement training programs on fuel efficiency measures, fuel monitoring and eco-driving for fleet managers and fleet procurement officers within the Local or Regional Authorities;
- To develop campaigns on energy efficiency in public buildings about how to identify and to implement improvements to reduce energy consumption;
- To develop campaigns to improve alternative energy generation;
- To develop campaigns to promote the use of public transport and the development of car clubs and car sharing;
- To develop campaigns to raise awareness about the environmental impacts of urban sprawl, including a badge for planning applications with “Excellent” environmental evaluation, which is displayed publicly on new developments. This will raise public awareness and provide an incentive for developers to go an extra step;
- To develop campaigns to encourage people to respect or comply with environmental legislation to increase the acceptance and compliance with environmentally motivated legislation;
- To produce educative materials to provide information on the actions that tend to increase the awareness of the actions individuals can take to reduce their carbon emissions.

PRIORITY 6: TO FOSTER R&D TO GENERATE THE SCIENTIFIC AND TECHNOLOGICAL FOUNDATIONS FOR CARBON FOOTPRINT REDUCTIONS

To improve the role of knowledge in designing scientific and technical sound foundations for carbon footprint reduction policies is a major opportunity to increase the role and participation of Atlantic research centres and companies in knowledge-based European projects and to reinforce the cooperation networks among them. The close association between the enhancement of knowledge and the quality of monitoring should also be improved. Research and development in carbon footprint is a cross cut issue, it concerns the four pillars of the present project crossing themes such as energy efficiency, the production of renewable energies, mobility and urban and spatial planning.

To implement the present priority we recommend a set of proposals as follows:

- To increase the participation of Atlantic R&D centres and companies in research projects generated within the EU framework programmes for research and technological development stimulating the carbon footprint approach and increase the participation of regions within the ESDP framework combining planning strategies with a more intensive incorporation of scientific knowledge in the carbon footprint matters.
- To foster the carbon footprint priority within the science and technology regional and national policies in the Atlantic Area.
- To provide economic support through R&D regional and national programmes to projects focused on energy efficiency, with a 20% funding depending upon the transfer of results.
- To implement positive fiscal incentives to universities and research centres, public and private, according to registered patents with a demonstrated transfer and to applied research results in the energy efficiency domain.
- To foster research on renewable energy storage and removal of interconnection barriers and generation of high power turbines.
- To foster research in marine energy, in particular in the fields of materials technology resistant to corrosion, technology adapted to the wind offshore production in deep sea (floating platforms) and technology improvements to explore the power of waves and marine currents.
- To set up an effective coordination of all research projects which intend to reduce the carbon footprint in the Atlantic Area by creating a network of research in this field. This begins with the definition of coordinated and clear orientations for research organizations, includes support and/or incentive to develop and promote local competences dealing with these specific problems and requires a real management of the cooperation between all stakeholders;
- To support the SMEs which propose innovative approaches in carbon footprint research.

PRIORITY 7: TO INCLUDE CARBON FOOTPRINT REDUCTION-BASED PROJECTS AS A NEW PRIORITY AXIS IN TRANSNATIONAL, INTER-REGIONAL, TRANSBORDER COOPERATION PROGRAMMES.

The strategy of cooperation between the Atlantic regions should be obviously adapted to the Europe 2020 guidelines for the next programming period. The carbon footprint approach will be at the heart of the new cycle of cooperation projects and initiatives, covering at least two of the three main dimensions of the Europe 2020 strategy, smart growth and sustainability. The call for carbon footprint reduction-based projects should be seen as a new priority axis in the new cycle of trans-national, inter-regional and trans-border cooperation programmes covering the Atlantic territory and involving several fields of intervention such as energy, transports, spatial and urban planning and R&D. Cooperation projects will be a main instrument in order to disseminate in the Atlantic territories experiences and policies targeted at tackling climate change and generate shared knowledge about these issues.

To implement the present priority we recommend a set of proposals as follows:

- Negotiation with EU, national and regional authorities to create a new priority axis in trans-national, inter-regional and trans-border cooperation programmes concerning carbon footprint-based cooperation strategies.
- The same for urban cooperation networks.
- Generate cooperation practices between Atlantic regions focused on fostering low carbon activities in full respect for their planning institutional and political contexts and implement experimental joint planning actions.
- Increase cooperation among harbours, sharing knowledge about optimisation models, energy saving-based logistics, integration of transport modes, monitoring and regulation of environmental impacts, marine energies, etc.
- Increase cooperation among R&D partners focused on establishing carbon footprint research field as a multi-disciplinary convergence of different sciences: climate, economics, energy, spatial and urban planning, sociology, transports, information systems, biotechnology, etc.
- Cooperation with public-private partnerships, enhancing the exchange of experiences between different governance models.

7.3. Projects to develop the strategy

Climatlantic identifies five strategic projects deriving from the above mentioned priorities which are to be implemented to reduce the carbon footprint of the Atlantic Area. These projects, although horizontal in nature, are mainly based on each of the sectorial pillars addressed in this study: energy, mobility, spatial planning and social behaviour.

7.3.1. Strategy for the reduction of fossil energy consumption by local authorities

Objective: To devise, evaluate and where possible demonstrate strategies for the reduction of energy consumption by local authorities.
Contribution to priorities nºs: (mainly 1 and 2)**.** The Energy Plan for 2020 presented by the Commission in January 2008 contained a target to save 20% of energy use by public bodies. Preliminary results from the Climatlantic Pilot Action "Assessment and demonstration of measures to reduce electricity consumption by local authorities" are indicating that it will be very difficult for public bodies to achieve this target, that new strategies will be needed, every option considered, and better information made available to local/regional authorities to help decrease the carbon footprint of local authorities in the buildings and in service provision. Target achievement may require the use of REs that would not otherwise be justifiable.
Deliverables: • Current energy usage report • Preliminary evaluation report • Evaluation of high-priority options • Develop an implementation Strategy • Route to compliance with energy reduction targets
Activities: • Assessment of current energy usage by local authorities • Preliminary evaluation (from existing experience and installations) and ranking of options for energy reduction • More comprehensive trial and evaluation of high-priority options • Develop strategy/micro local action plans for rolling out and implementing selected measures

7.3.2. Atlantic Area efficient harbour of the future

Objective:

As far as reduction of the carbon footprint is concerned, and efficient harbour is characterized by a) the integration within a network of mass transports, port services integrated in sustainable logistic chains, b) the development of eco-design of port planning and services, c) the improvement of the energy performance and d) The intelligent relationship between city and port and its integration in spatial planning and territorial economy.
Atlantic ports have been focus of several projects in recent years at the European level (Marco Polo, interreg programs). Several aspects of the ports' life have been studied and experiences conducted to improve their efficiency (Intrade, Duratinet, ATMOS...), the use of renewal energies (MAREN), their environmental impacts (ex IMPACTE, Portonovo, NewDelta..,) their connection with the hinterland or their position regarding the city. Commercial harbours are more under consideration than fish or leisure ones although there are some projects dealing with fish farms or improvements of leisure sailing facilities.
The objective of this project will be to design, develop and experiment actions to reduce the carbon footprint of the ports of the future allowing the coexistence of economic development activities and environmental protection.
Obviously some carbon footprint reduction actions are guided by the same principles already mentioned in the report (i.e. production and/or use of renewable energies, connection to grid, waste management, dredging, accessibility of travellers and goods...). Solutions might, however, differ according to the nature of the port, its size and location.
The project will concentrate mainly on medium/small ports for which very few projects have been launched. This approach fits in the development of the coastal economy promoted by CAAC & CRPM.
Ports of the future (even off shore ports) must be conceived as a concerted development of the port and peri-port locations exchange and processing of goods involving greater coordination of the various authorities concerned.

Contribution to priorities nºs: 1, 2 & 3. Also involved: 4, 5, 6 & 7

Deliverables:

- Demonstration of actions regarding CO_2 reduction and RE production/use in ports
- Decision aid tools for optimising flows in and out ports
- Web site on best practices
- Training and information material

Activities:

- Detailed state of the art information on: a) actions aiming to reduce CO2 footprint in different types of harbours and b) technologies for marine energies (sea, sun, wind) connected to ports, based on previous EU and national projects.
- Cartography of the ports, of their activities (based on existing data) and identification of port activities with impact on the carbon footprint (from transport to waste management) and of the key variables to reduce these impacts.
- Design of a holistic conceptual approach of port activities and their relations to the carbon footprint.
- Definition of types of actions which can be undertaken in the field of : a) RE production/use in ports, b) waste optimisation, c) optimization of flows in and out the ports, d) general port management, e) building improvement, f) maintenance,

renovation and repairing of infrastructure and boats

- Development of a web site describing best practices, case studies, examples, etc., directed towards the main stakeholders
- Definition and implementation of actions at demonstration sites
- Evaluation and transferability analysis

7.3.3. Integrated Atlantic Area Mobility

Objective: To increase the use of collective transport in the Atlantic Area

Several cities and regions of the European Atlantic Area have set up projects to improve passengers and goods mobility. Europe (ex CIVITAS) and Interreg programs encouraged such projects (ex PARTNER, START, ITISS, PIRENE IV…). Solutions and results concern mainly local travellers and city logistics. They are rarely specific to maritime issues. Outcomes depend on local strategies and funding as well as acceptance and involvement of stakeholders. This project aims at building up a holistic approach based on experiences resulting from these previously developed relevant projects.

The proposed project concerns the whole Atlantic Area and addresses common issues. When travelling in the Atlantic Area, two main barriers regarding the usage of collective transport are identified: a) the lack of knowledge of the potential users on the multimodal facilities on collective transport at local or Atlantic Area levels and on the ways to use them the most efficiently and b) the area covered by collective transport and the various solutions developed to satisfy travellers demands.

The global aim of the project is to overcome these barriers and to increase by 20% the usage of collective transport among Atlantic Area travellers by promoting a minimum quality level of transport services provided by cities to their visitors. Results must facilitate the mobility of passengers and goods at the Atlantic Area level from the preparation of the travel to the return at the origin.

Contribution to priorities nºs: 2 & 3. Also involved: 1, 4, 6, & 7

Deliverables:

- Collaborative Web Site on travel facilities over the Atlantic Area
- Quality brand on mobility information services at the cities level and association to control the quality levels
- Guidelines / methodologies for local mobility Community Transport improvements based on real case studies, adapted to the characteristics of the Atlantic Area
- Specific demonstrations for the Atlantic Area

Activities:

The project is structured into three types of technical activities and two monitoring ones:

1. Information systems
   - Development of a web site (cf for instance INTEGRA Interreg project)
   - Development of standardised street information for interregional connections

(from/to city gates)

2. Mono ticketing strategies
   - Promotion/ validation of the utilisation of common standards for all mobility software among local authorities and their interrelated stakeholders
   - Development of mono ticketing applications for interregional travels
3. Improvements of Local / regional travels
   - Development of capillarity facilities at regional level (car sharing, TER...)
   - Development of rapid clean sea collective transport (electric or hybrids)
   - Low carbon infrastructures and stations
   - Elaboration of mobility guide lines
4. Management
   - Design or development of an association in charge of ensuring the quality level, of monitoring the development of the common tools, as well as facilitating the construction of projects between members
   - Development of audit procedures for cities in order to help them too reach or maintain the quality level
5. Evaluation and transferability analysis

7.3.4. Knowledge generation for sustainable spatial planning of low-density, highly dispersed habitats

Objective:

The ultimate goal of this project is to train local/regional technicians to implement the global sustainability index for reducing carbon footprint in low-density highly dispersed habitats. This will be implemented through advanced training courses in GIS-analysis for local and regional civil technicians. Courses will allow technicians to acquire technical skills on SIG multicriteria analysis to calculate the global sustainability index (resulting from the pilot project of this pillar) at the local level. One of the major problems for the success of the proposed methodology is the scarcity of technicians with sufficient skills in the local planning teams. This is especially relevant in low-density areas where the size of the municipalities is reduced, and the weakness of the technical team is more conspicuous. These spaces usually coincide with the areas of greatest dispersion and where the implementation of spatial planning procedures based on indicators is even more needed.

Contribution to priorities nºs: 1, 2, 5, 6, 7

Deliverables:

- Training and information in GIS for municipalities, local entities and/or regions that have trained technicians to implement the global sustainability index in its urban planning and contribute in an effective way to reduce the carbon footprint.
- Web Portal for the dissemination of the Living Lab experience results (Pilot Project improvements and application results in the AA urban areas) - mainly guidelines / methodologies for local urban planning, adapted to AA cities situation.

Activities:

The project is structured along two types of activities:

- Training would begin with a course of basic concepts in GIS (100 hours) in each of the countries involved in the project CLIMATLANTIC (Portugal, Spain, France, England and

Ireland) for approximately 50 students per country. Existing structures such as Eixo Atlântico, and its Agency of Urban Ecology, could be used.

- After the basic training period could be promoted the creation of a Living Lab for GIS spatial planning for one year of an initial duration but endure over time. In the Living Lab students (municipal and/or regional technicians) and the different actors (trainers, planners, academics, experts, politicians, etc.) will participate in implementing the global sustainability index created within the framework of the project Climatlantic.
- In the Living Lab could participate all those local and/or regional entities interested in implementing the proposed indicator. Its main functions would be to continue the initial learning process online. Serve to exchange experiences and/or improvements in the methodology as part of the experience.
- It would monitor the application of the index by the technicians involved in the process. Encourage a continuous process of feedback that would allow for changes and improve the model. Accelerate the adoption of standards on the methodology, although always adapting to the differences between territorial areas.
- In this way would result in a growing training and specialization as a result of the interaction between universities and research centres, municipalities and technicians in a real situation.

7.3.5. Transnational, multilingual master courses for local authorities, technicians and postgraduate students

Objective:

To develop a training course addressing the key strategic topics for delivery across the Atlantic area, to provide:

- training to Local Authority officers and technicians; and
- course modules for postgraduate students.

Contribution to priorities nºs:

Main priority: 5.

Also involved: 1, 2, 3, 4, 6, & 7

Deliverables:

1. Production of training materials for local authority officers and technicians in English, Spanish, Portuguese and French.

2. Production of teaching materials for postgraduate course modules in English, Spanish, Portuguese and French.

Activities:

Local authority mastercourse

LA1. Review of strategic paper to identify the key strategic topics for inclusion in the mastercourse.

LA2. Review and benchmarking of Atlantic Area cities to identify the key training needs of Local Authority officers and technicians across the key strategic topics.

LA3. Production of training materials – via a series of training modules - for Local Authority officers and technicians.

LA4. Review of benchmarking in each Atlantic Area city to identify which components of the mastercourse should be delivered and specifically to whom.

LA5. Delivery of courses to Local Authority officers and technicians.

Postgraduate course modules

PG1. Identification of courses offered within the Atlantic Area with some interest in the

	key strategic topics.
PG2.	Consultation with relevant course providers to assess current course content, level of interest and potential partnership opportunities.
PG3.	Identify the needs for specific course modules.
PG4.	Production of materials for postgraduate course modules.
PG5.	Inclusion and delivery of modules within postgraduate courses.

Partnership:

- Local authorities across the Atlantic Area
- Universities across the Atlantic Area

Schedule:

Months 1-6: Tasks LA1, LA2; Tasks PG1, PG2, PG3
Months 6-12: Task LA3; Task PG4
Month 12 onwards: Task LA4; ongoing delivery of Task LA5 and Task PG5

Cost estimative:

Cost would depend on the quantity of course materials developed, the targets identified for training and the level of involvement of partners.

7.4. Governance and Monitoring

7.4.1. Governance

The core idea of the strategy proposed as a result of the Climatlantic project is that it only can be successfully implemented within the framework of a complex multi-level governance model.

As it is acknowledged by the more recent literature in this field[48], two types of governance models should be taken into consideration: (i) formal but more rigid governance models; (ii) informal and more flexible ones. The option for one of these framework models or the combination of both depends upon the governance practices in regions and principally the characteristics of the political and institutional contexts. At least in Portugal and Spain, governance experiences, either formal or informal, are incipient and lacking dissemination for organizational learning. This fact will certainly be a bottleneck for the implementation of the strategy. However, cooperation could be a very useful instrument to overcome these difficulties and try to build the more pertinent models of governance to implement such an important strategy for the Atlantic regions.

The role of regional and local authorities will be crucial. Notwithstanding this, one cannot ignore the strongly different political and institutional contexts that regional and local intervention face within the Atlantic Area. So, it is practically impossible to design a unique governance model.

On the other hand, the role of member states involved and EU authorities will be decisive to establish the global guidelines and to contribute with EU and national projects inspired by carbon footprint reduction goals.

[48] See, for example, Tosics, Iván (2011), "Governance challenges and models for the cities of tomorrow", Cities of Tomorrow (2011), BackgroundStudy, DG Regio, in which one may find an updated set of references.

The preparation of the whole new programming period to 2020 will be the key institutional place to design and assess what governance models should be put into practice in order to achieve the best results.

The implementation of this strategy needs a cooperation space to be well succeeded in the negotiation of all these complex operations and integration of policies. We propose that the Atlantic Forum, which has been created within the framework of the Atlantic macro-region, could be extended and include this issue. We suggest that a Carbon Footprint Forum should be created further to manage and monitor the implementation of the strategy.

7.4.2. Monitoring and Indicators

To assess the achievement of the objectives of the strategy and to monitor the results of each priority a set of indicators should be identified. Indicators should be few, simple and easy to calculate. As far as possible they should be available for all the Atlantic façade, at national and regional levels. The following framework presents a selection of indicators proposed under each pillar in the previous chapters of the report, which are identified to monitor the development of each of the seven priorities defined in this strategy.

GENERAL OBJECTIVE: TO REDUCE THE CARBON FOOTPRINT IN THE EUROPEAN ATLANTIC AREA
Indicator • Diffuse greenhouse gas emission reduced in the Atlantic Area in 2020 compared to 1990 levels, in line with the 2020 strategy

PRIORITY 1: TO INCREASE THE USE OF RENEWABLE ENERGY AND PROMOTE ENERGY EFFICIENCY
Indicators • Percentage of the electricity generated from renewable sources of energy in the regions of the Atlantic Area • Consumption of energy in public buildings and lightning in public spaces in the Atlantic Area • Share of renewable energy in fuel consumption of transport

PRIORITY 2: TO IMPROVE MOBILITY PATTERNS IN THE EAA

Indicators

At the local level:

- Number of Community Transport passengers/ total population on the area corresponding to the Community Transport network (bus, tram, metro…)
- Average speed of vehicles in city centres

At the National and regional levels:

- Number of purchased clean vehicles / total number of purchased vehicles (pet type of buyers: citizens, companies, local authorities….)
- Volume (tons) of fuel/ Total nr of vehicles or Volume (tons) of fuel/number of people
- People *Kms per transport mode

PRIORITY 3: TO CONTROL URBAN AND RURAL SPRAWL

Indicators

At the local and regional level:

- Percentage of discontinuous artificialized urban area
- Artificialized land area per capita
- Artificialized land area per dwelling
- Ratio of population weighted density to standard density

PRIORITY 4: TO ENHANCE THE ROLE OF THE ATLANTIC FAÇADE TO REDUCE HGG EMISSIONSAT THE EU LEVEL

Indicators

- Share of the freight transported by the motorways of the sea over the total freight transportation from and to the ports of the Atlantic façade
- Share of the freight transported by the motorways of the sea over the total freight transportation connecting ports from the Atlantic façade with European hub ports

PRIORITY 5: TO DEVELOP EDUCATION AND COMMUNICATION CAMPAINGS TO DISSEMINATE THE APPROACH OF REDUCING THE CARBON FOOTPRINT OF THE ATLANTIC REGIONS

Indicator

- Number of people participating in education and communication campaigns by target (students; professional stakeholders; people in general)

PRIORITY 6: TO FOSTER R&D TO GENERATE THE SCIENTIFIC AND TECHNOLOGICAL FOUNDATIONS FOR CARBON FOOT PRINT REDUCTIONS
Indicators • Total amount of economic resources mobilized in research projects aiming at the reduction of the carbon footprint financed within the R&D regional, national and European programmes • Nº of companies involved in the development of R&D projects about carbon footprint • Nº of patents registered related to the reduction of carbon footprint

PRIORITY 7: TO INCLUDE CARBON FOOTPRINT REDUCTION-BASED PROJECTS AS A NEW PRIORITY AXIS IN TRANSNATIONAL, INTER-REGIONAL, TRANSBORDER COOPERATION PROGRAMMES
Indicators • Total amount of economic resources mobilized in cross-border and interregional cooperation projects about carbon footprint within the Atlantic Area • Nº of partners from the Atlantic Area involved in cross-border and transnational cooperation projects about carbon footprint

7.5 Funding

The seven priorities identified in the Climatlantic Strategy to reduce the carbon footprint point out to actions in several areas: energy, transport, planning, R & D policies, environmental education and territorial cooperation. Similarly, funding opportunities for public policies to be implemented to achieve the goal should derive from a series of diversified funds. A good example of this statement is the model of Directive 2009/28/EC about fostering the use of renewable energies which requires that each Member should present its National Action Plan. The five states represented in the European Atlantic Area have already elaborated and presented these plans according to this Directive. They require that national, regional and local authorities should ensure budgetary resources to meet the objectives established in their plans. It is important to insist on the idea that a basket fund from all levels of governance is needed to act in all the sectors involved in the reduction of the carbon footprint.

The EU funds

The 2020 European Strategy has as one of its seven emblematic initiatives the following: "A Europe able to use effectively its resources", in order to detach economic growth from the use of resources**,** *to facilitate the change towards a low-carbon economy, increase the use of renewable energies, modernise our transports sector and to promote energy efficiency.* A very ambitious goal of saving 60.000 millions of euros in oil and gas imports is established and it is also quantified the creation of one million jobs as a result of 20% of increase in renewable energy use and energy efficiency. There is also the proposal to complete the energy internal market and to implement the Strategic Plan on Energy Technologies.

As far as the financial instruments are concerned, the EC committed itself to mobilise the EU financial instruments (*for example, rural development funds, Structural Funds, Horizon 2020,*

Trans-European networks, EIB) as an element of a coherent funding strategy, joining EU and national funds, public and private. Other commitments are: (i) reinforce the institutional framework to generalize the use of market-based instruments (*for example, emissions trade, revision of energy tax policy, public aid instruments, promotion of green public procurement*); (ii) present an initiative to improve the European networks, integrated in the energy Trans-European networks, aiming at building a super –network, "Intelligent networks and inter-connectivity", particularly of renewable energy network sources (*supported by Structural Funds and EIB*).

The ERDF regulation presents among its new priorities two that have an effect in reducing GHG emissions: *climate change and actions towards a low-carbon economy, transport infrastructures, energy and communications.* At least 80% of ERDF resources at national level should be allocated to energy efficiency, renewable energies, innovation and support to SME and at least 20% to energy efficiency and renewable energy. The less developed regions will have a more extended set of investment priorities, although at least 50% of the ERDF resources should be allocated to energy efficiency and renewable energy, innovation and support to SME.

The EU has planned a new funding line for the transport sector related to the construction of large high-speed rail corridors for moving merchandise.The 2014-2020 multi-year financial proposition presented by the EC in June 2011 provides for the creation of an *inter-connectivity instrument* for Europe targeted at improving the energy, transport and information technologies trans-border projects, with a budget of 40.000 millions of euros.

Other existing instruments such as JESSICA ('Joint European Support for Sustainable Investment in City Areas') should be also taken into account. This is an European Commission initiative that has been developed with the cooperation of the European Investment Bank (EIB) and the Council of Europe Development Bank (CEB). JESSICA's goal is to foster sustainable investment in Europe's urban areas and promote economic growth and jobs. JESSICA allows managing authorities in the Member States to invest some of their EU regional funding allocation for 2007-13 into Urban Development Funds (UDFs). UDF funding can take the form of recyclable loans, guarantees and equity, which could be invested in a variety of urban renewal projects. JESSICA funding may be used to boost investment in urban infrastructure, help with the rehabilitation of brownfield sites, promote energy efficiency and finance social housing projects.

The National and Regional Funds

The financial commitment of member-States is based on the following decisions: (i) eliminate subventions generating environmental damages, limiting exceptions to this rule to socially deprived people; (ii) design market-based instruments, such as fiscal incentives and public procurement, to adapt production and consumption methods; (iii) use regulations, building norms and market instruments such as taxes, subventions and public procurement to reduce the energy and resources consumption and use Structural Funds to invest in energy efficiency of public buildings and a more effective recycling.

The European Atlantic Area Funds

Finally, the regulation about territorial cooperation, one of the novelties of this programming period, the thematic concentration and the trans-national dimension that the European Atlantic Area should explore, selects the implementation of macro-regional strategies and the

maritime basins (within the objective of enhancing the institutional capacity and the efficiency of public administration) as main priorities.

In this context, we propose as a key idea to promote a macro-regional strategy targeted at reducing the carbon footprint, using in the same programme, and with an integrated approach, the structural funds dedicated either to the European Atlantic Area NUTS II or to the trans-border and trans-national cooperation programmes established for those macro regions.

Regional Operational Programmes to be elaborated in the regions covered by Structural Funds should continue to be one of the more relevant funding opportunities. The carbon footprint approach will be a suitable way to adapt these programmes to the 2020 guidelines.

Annex 1

Mobility domains and indicators

To propose efficient strategic instruments it is first necessary to determine with a high level of accuracy the domains on which they will be used in order to improve GHG transport emissions. These domains must be approached with a political point of view i.e. which will correspond to possible actions from local authorities in the context of AA. The sub domains which are not under the responsibilities of these authorities will not be considered. For instance motor tax on vehicles, the technical improvements of motorisation are considered out of our domains.

For each of these domains it will also be necessary to determine indicators, the "appropriate metrics" which will help decision makers to measure and control the strategies and corresponding actions they will have initiated.

Mobility domains

CIVITAS programme proposed eight categories of measures as the basic building blocks of an integrated strategy for clean urban transport. Cities strategies are designed in combining those blocks. In addition, the TIPTAP project[49] approach is more territorial development oriented like territorial identity or efficiency.

Combining these various approaches and considering the objective of this document, the following domains have been kept as the most susceptible to be the theatre of local authorities' decisions over one of the 5 types of situations or to link some of them.

- Clean fuels and vehicles which include actions concerning
  - all types of bio fuels (Biogas/CNG, Biodiesel,…) and related infrastructures (Fuelling Station)
  - all motorisations : Hybrid, Electricity, LPG, for any kind of vehicles
  - Procurement & tendering

- Integrated pricing strategies as far as they include intermodality exchanges ; this concerns
  - Road pricing/ congestion charging,
  - Integrated ticketing
  - Parking Management
  - Smartcard

- Alternative mobility usages or modes which can be described as
  - Less car intensive life style : this concerns mainly vehicles "sharing" or "pooling", fleets developments and includes all actions aiming to decrease car's dependency, like travel plans for instance or to reduce private cars use
  - Soft measures : this is linked to alternative transport modes from cycling routes in country sides to walking incentives, Intermodal mobility services,

[49] TIPTAP: Territorial Impact Package for Transport and Agricultural Policies, ESPON project

Mobility centres, Mobility management (for Events, for housing areas for companies and organisation)

- Access restrictions : this covers all measures which aim to limit the access in areas, from Park & ride to Zero emission zones
    - Access management / Enforcement
    - Car Restrictive Zone /Living Streets, Traffic calming / Speed reduction
    - Multifunctional areas, Pedestrian Areas,
    - Parking Management

- Collective passengers transport on several aspects
    - Quality of services : frequency, speed, accessibility, flexibility, security, safety
    - Travel information
    - Network development and integration, intermodality
    - Ticketing and tariffs
    - Promotion and awareness, marketing

- Logistics: this deals with the actions aiming to improve the distribution of goods over an area, urban, peri urban or regional. They can be related to
    - Distribution scheme
    - Co-modality / inter-modality
    - Fleet management & route planning
    - Public private co-operation
    - Storage facilities (city proximity, freight villages or logistics platforms), delivery zones or areas

5. Transport management : covers all actions related to Information technologies, from mobile exchange to exploitation software
    - Access management / Enforcement
    - Guidance Systems
    - Multi modal travel information
    - Real time travel information
    - Smart card
    - Traffic control / management centre
    - Traffic information
    - Vehicle location based services

- Infrastructures: covers all actions related to the design and implementation of any kind of infrastructure not taken into account in previous topics.
    - Passenger Interfaces
    - Cargo interfaces (ports, airports, logistical platforms)
    - road
    - rail
    - air
    - sea and inland waters

Indicators

Categories of indicators

Among the large variety of indicators related to mobility and transport, the categories used in the CIVITAS programme to evaluate the impacts of the projects seems quite adequate as a basis for CLIMATLANTIC purpose.

Indicators in these categories have been sorted regarding their relevance to carbon foot print evaluation and they also have been completed when necessary either to be more accurate regarding CO_2 emissions or to take into account the spatial dimension of CLIMATLANTIC, larger than in CIVITAS.

Indicators are grouped in 5 categories:

- Transport : quality of service, transport exploitation and transport organisation
- Economy : benefits and costs
- Environment : pollution, nuisances
- Energy : consumption
- Society : dependency, acceptance, accessibility, employment

Each category and sub category is adapted to evaluate specific impacts which are directly or indirectly connected to reduction of carbon foot print.

The table on the next pages shows the relations between indicators and impacts. In this table, it's shown indirect impacts and D direct impacts.

CATEGORY	SUB-CATEGORY	IMPACT	
TRANSPORT	QUALITY OF SERVICE	Ease of use	I
		Service frequency	I
		Service integration	I
		Service reliability	I
		User Information	I

CATEGORY	SUB-CATEGORY	IMPACT	
	TRANSPORT EXPLOITATION	Congestion & Traffic levels	D
		Freight movements	D
		Journey times/duration	D
		Journey length	D
		Modal split	D
		Network efficiency	D
		Parking levels efficiency	D
		Passenger movements	D
		Vehicle occupancy	D
		Vehicle speed	D
		Waiting times	I
	TRANSPORT ORGANISATION	Network capacity	D
		Connectability	D
		Transversability	D
		Infrastructures	I
ECONOMY	**BENEFITS**	Economic development	D
		Operating revenues	I
		Profitability	I
	COSTS[6]	Investment costs	I
		Maintenance costs	I
		Operating costs	I
		Car park costs	I
ENVIRONMENT	**POLLUTION/NUISANCE**	Air quality	D
		Emissions	D
ENERGY	**ENERGY CONSUMPTION**	Fuel consumption	D
		Fuel Mix	D

CATEGORY	SUB-CATEGORY	IMPACT	
SOCIETY	DEPENDENCY	Motorisation level	D
		Geographical situation	D
		PT Network Access	D
	ACCEPTANCE	Awareness	I
		Social acceptance of transport	I
		Political acceptance	I
		User acceptance/satisfaction	I
	ACCESSIBILITY[9]	Economic Accessibility	I
	EMPLOYMENT	Long term indirect employment	I

Indicators and metrics

D or I	EVALUATION CATEGORY	INDICATOR	DESCRIPTION	DATA /UNITS
	Economy			
	Energy			
D	Energy Consumption	Mode Consumption	Energy per transport mode may be difficult to have per mode, probably aggregated Regional level	Tep/1000 persons, (tons?)
D		Alternatives Fuel representativity	Ratio between all types of alternative fuels and fossil derivated fuels idem	Tep/tep
D		Vehicle fuel efficiency	Fuel used per passenger km and Ton km Project and local level	MJ/vkm, quantitative, derived or measurement
D		Fuel mix	Energy used per type of fuel, per passenger or tons km	MJ, quantitative, derived or measurement
	Environment			
D	Pollution/	CO2 global	CO2 per transport mode	T CO2 equivalent/ 1000 p

D or I	EVALUATION CATEGORY	INDICATOR	DESCRIPTION	DATA /UNITS
D	Nuisance	CO2 fuel	CO2 per fuel type	CO2/kg fuel /p
D		CO2 vehicles	CO2 per vkm t(ype of vehicles)	G/vkm, quantitative, derived
D		CO emissions	CO per vkm t(ype of vehicles)	G/vkm, quantitative, derived
	Society			
D	Dependency	Vehicle owning	Number of people using vehicles for their travels	
I	Acceptance	Awareness level	Degree to which the awareness of the policies has changed	Index, qualitative, collected, survey
I		Acceptance level	Attitude of current acceptance with the changes induced by the improvements	Index, qualitative, collected, survey
I	Accessibility	PT accessibility	Attitude survey of perception of physical accessibility of PT network (distance to nearest PT stops) Quantitative approach rather than perception (time, length,.. to get to transport network)	Index, qualitative, collected, survey

D or I	EVALUATION CATEGORY	INDICATOR	DESCRIPTION	DATA /UNITS
I		PT services relative cost	Cost of PT (Public Transport) related to average personal income (i.e. cost of a weekly, monthly or annual pass in proportion of the average weekly, monthly or annual income, respectively)	Index, quantitative, measurement
	Transport			
I	Quality of Service	Accuracy of PT frequency, Deliveries…(according project)	Percentage of services arriving/departing on time compared to timetables (each city should fix the interval of time considered as a delay compared with timetable)	%, quantitative, collected, measurement
I		Quality of PT service	PT network density	km of PT / urban superficy Km of PT/ inhabitants
D	Transport Exploitation	Vkm by vehicle type -	Total trips length per vehicle per day	Vkm per day, quantitative, derived
D		Average vehicle speed - only peak	Average vehicle speed over total network	Km/hr, quantitative, derived
D		Total number of goods vehicles moving	Assessment of the daily no. of goods vehicles	Quantitative, derived or measurement

D or I	EVALUATION CATEGORY	INDICATOR	DESCRIPTION	DATA /UNITS
D		Average freight transport	Representativity of freight	Tonnes/km
D		Average modal split-PAX	Percentage of pkm for each mode	%, quantitative, derived
I		Average Truck occupancy	Effective loading	% load/capacity
I	Transport Organisation	Motorways density	Km of motorways vs superficy urban area	Km/km^2
I		Rail density + Cycles	Km of rail tracks vs superficy urban area	Km/km^2
		Time	Time to travel and to come back to a zone from another one	

* Cars occupancy is already analysed in modal split

In conclusion, CLIMATLANTIC has identified the domains in which mobility influences carbon footprint and has developed relevant indicators to measure this influence.

These indicators will be classified according to the strategies and actions which will be decided at local level. They can be either:

- Key performance indicators (KPIs) linked to the objectives of the strategies and measuring the evolution of the situation;
- Monitoring (or control) indicators if they are related to (internal) decision variables on which local authorities have a direct action to setup their strategy;
- And, in the specific case of mobility, since the results of several strategies depend on decisions made at other decision levels, External Indicators which are dedicated to measure changes in these "external" variables.

An indicator (belonging to one sub category) may be used to measure different impacts.

Each actions identified in the different mobility domains will have impacts on the transportation system. These impacts can be analysed through the evaluation of the indicators. The tables in Annex 1 show these relations between impacts.