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**Sixth report on economic, social and territorial cohesion: Investing in Europe's Future**

{COM(2014) 473 final}

# Chapter 3: Sustainable growth

## 1. INTRODUCTION

Cohesion Policy has invested a large share of its funds to encourage a shift towards a more sustainable mode of development in EU regions. It has co-financed the installation of main water supply to improve drinking water quality and urban waste water treatment plants, invested in solid waste management and recycling schemes and contributed to increased energy efficiency by for instance supporting the modernisation of heating systems in private and public buildings or resource efficient urban transport. It has also contributed to protecting the environment by helping to set up a network of protected natural areas as part of Natura 2000.

Nevertheless, substantial challenges remain to reduce the environmental impact of economic activity and improve the quality of ecosystems.

With the growing awareness of the consequences of climate change, the EU has committed itself to limiting greenhouse gas emissions and reducing consumption of fossil fuels. To this end, an increasing share of Cohesion policy funding is being allocated to help bring about a shift to a low-carbon economy, by, in particular, providing more support for the production of renewable energy and improving energy efficiency. Since climate change is likely to increase the risks of natural hazards such as fires, droughts and floods, leading to more frequent disasters, funding has also been allocated to mitigating these risks, and efforts will continue to be made to ensure that this is used in the most resource-efficient way.

Cohesion Policy also has indirect effects on the environment and sustainability, since helping regions to develop and improve their transport infrastructure may lead to higher energy use. It is becoming increasingly important to mainstream environmental considerations under the Cohesion Policy. Investment in energy efficiency can help to offset this along with judicious choice of the infrastructure that is supported. Similarly, a growing economy can lead to changes in land use. With the right national, regional and local policies, changes can be limited and concentrated in areas with good access to public transport, such as by redeveloping brownfields or by encouraging new developments to locate close to existing public transport routes.

Preserving nature and natural resources, saving energy, expanding renewable energy and green technologies, mitigating and adapting to the effects of climate change and investing in disaster risk management are not only necessary to address environmental challenges but they can also provide new jobs and growth opportunitiesThe conservation and enhancement of natural assets is also necessary to safeguard ‘ecosystem services’ on which many economic activities implicitly rely, i.e. the services provided by nature itself such as for instance clean air and waters or natural ways of protecting against disasters and their consequences. Safeguarding the continued provision of these ‘services’ results in cost-savings to the economy as they contribute avoiding the costs for cleaning up contaminated land or polluted rivers and preventing or mitigating costly (sometime man-made) natural disasters such as floods or landslides.

EU Member States and regions vary markedly as regards their pursuit of sustainable development. In some case, this is because of differences in the geographical context or in the endowment of natural assets, in others it reflects differences in environmental pressures and natural resource management. Significant improvements could, therefore be made by identifying what kind of action is required in what type of region.

This chapter covers four major issues – first, climate change and the progress towards the Europe 2020 targets, secondly, energy efficiency, air quality and transport, thirdly, resource efficiency, especially of land use and, fourthly, potential ways of reducing environmental impact and maintaining or improving ecosystems and the services they provide. It ends by showing how other EU policies linked to sustainable growth are affecting cohesion.

## 2. THE EU NEEDS TO MITIGATE AND ADAPT TO CLIMATE CHANGE

A world-wide process of climate change is currently underway as a consequence of increases in greenhouse gasses in the atmosphere from human activities. Since the late $19^{th}$ century, the Earth's atmosphere and oceans have steadily become warmer and this is projected to continue and even to quicken in the coming years. Since the early $20^{th}$ century, the Earth's mean surface temperature has increased by almost 1°C, with two-thirds of the increase occurring since 1980.

Climate change affects our economies, societies and ecosystems in many different ways. It has a strong territorial dimension. Its effects vary significantly across regions, which differ in both their exposure to climate change and their ability to cope with it, reflecting their different physical, environmental, social, cultural and economic characteristics. In general, urban areas have increased in temperature more than non-urban areas. Given the historical trend in Europe towards increasing urbanisation, ever more people and assets are being put at risk from suffering the consequences of this temperature rise. Regions also contribute to their own climate, in the sense that, for example, the temperature in cities is partly the result of land use and land cover, which implies that the climate change they experience is, to some extent, within their control.

Together exposure and sensitivity determine the potential effect of climate change on a region. Regions, however, also differ in their capacity to adapt to climate change and counteract its effects, and any assessment of a region's overall vulnerability to change has to take this into account as well.

The ESPON Climate project[1] provides such an assessment, based on projections of climate change and climate variability generated by the CCLM climate model.[2] Given these projections, the potential effect of climate change has been assessed for each EU region on the basis of its exposure and sensitivity to change and its capacity to adapt, as gauged from several indicators of its physical, environmental, social, economic and cultural features (e.g. projected changes in the number of summer days above 25°C coupled with the number of people of 65 and older living in hot parts of urban areas and the proven ability to cope with heat).

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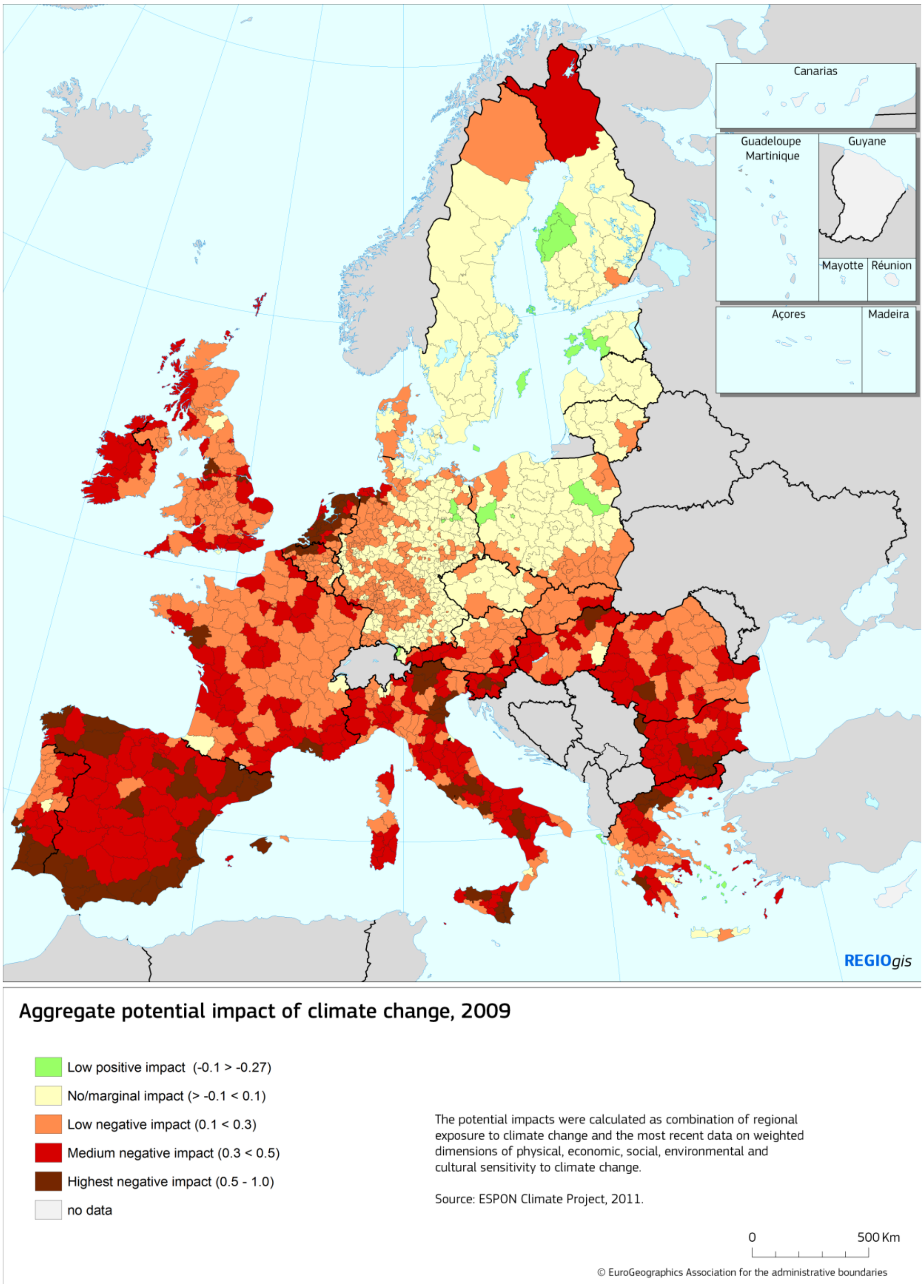
1 See ESPON, 2011, *Climate Change and Territorial Effects on Regions and Local Economies in Europe*, Applied Research 2013/1/4. http://www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/climate.html

2 CCLM is a non-hydrostatic unified weather forecast and regional climate model developed by the COnsortium for Small scale MOdelling (COSMO) and the Climate Limited-area Modelling Community (CLM).

The results highlight the large variations in the potential impact of climate change on regions. While, as might be expected, ‘hot spots’ are mostly located in the South of Europe, other types of region (such as mountainous or densely populated coastal ones) are also particularly affected because of a rise in sea levels or their economic dependence on summer and/or winter tourism. Some areas in northern Scandinavia are affected as well, mainly because of the sensitivity of the environment and the vulnerability of infrastructure to floods.

The general north-south divide in the effects which emerges, however, not only reflects the impact of climate change itself but also the greater capacity of Scandinavian and Western European countries to adapt to it. A medium-to-high impact can, therefore, be expected in large parts of South-East Europe as well as the Mediterranean regions.

**Map 1: Potential vulnerability from climate change**




## 2.1. The EU needs to reduce its greenhouse gas emissions to reach the 2020 targets

The EU has taken a number of steps to reduce greenhouse gas emissions while at the same time developing adaptation strategies to help strengthen resilience to the inevitable effects of climate change. It has, in particular, encouraged moves towards an energy-efficient, low carbon economy by setting '20-20-20' targets for 2020 – i.e. reducing greenhouse gas (GHG) emissions to 20% below 1990 levels[3], raising

[3] The EU also offered to reduce emissions by 30% if other major emitting countries committed to making their fair share of reductions.

the share of EU energy consumption produced from renewables to 20% and improving energy efficiency by 20%. These are now included as headline targets in the Europe 2020 strategy. It has also set a further goal of progressively reducing EU GHG emissions by 80-95% of 1990 levels by 2050.[4]

EU initiatives to reduce GHG emissions include the EU Emissions Trading System (ETS), a market instrument for allocating and exchanging emission quotas. This is complemented by the Effort Sharing Decision under which Member States have adopted binding annual targets for reducing emissions from housing, agriculture, waste and transport (other than aviation) which are not covered by the ETS and which account for around 60% of the EU's total emissions. The national targets which relate to the period 2013-2020 are differentiated according to levels of GDP per head, ranging from a 20% reduction in emissions (compared to 2005) in the most developed Member States to a 20% increase in the least developed.

Cohesion policy cannot directly contribute to the ETS. But  it can play a significant role in reducing GHG emissions in sectors included in the "Effort Sharing Decision". For instance, Cohesion policy supports initiatives to insulate public building and so reduce GHG emissions in the housing sector. It also provides funding for cleaner public transport and more efficient management of waste both of which should help to lower GHG emissions.

The reduction in GHG emissions in the areas covered by the Effort Sharing Decision has been substantial in some Member States (Figure 34). Between 2005 and 2011, it amounted to 16% in Hungary and over 14% in the UK. In a number of EU12 countries, however, the reduction has been more modest, reflecting their high rate of economic growth up until the crisis. Emissions, moreover, have increased significantly in Poland and Estonia (by 9% in both). Since 2008, however, the economic downturn has generally served to moderate emissions.

The distance from the various national targets also varies markedly between countries. Several countries have already more than achieved their target, such as Hungary or Romania, which committed themselves to limiting emissions to no more than 10% and 19%, respectively, above 2005 levels, and where they have actually declined. In other countries, the target has not yet been reached but emissions have started to fall, such as in Sweden, where the target was a reduction of 17% and emissions have fallen by 10% relative to 2005. In Malta, on the other hand, emissions have risen above the target. Luxembourg, Denmark, Ireland and the Netherlands are furthest from their targets, while the UK (which needs to reduce emissions by a further 2%) and Austria, Belgium and France (which need a further 4% reduction) are closest.[5]

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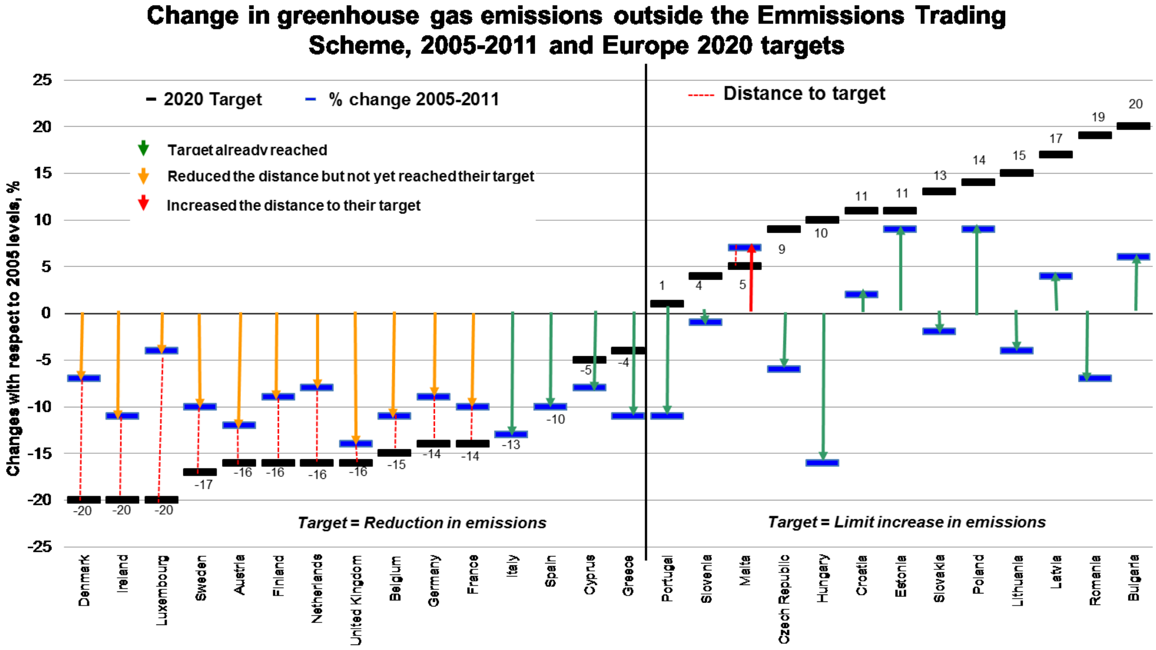
4 Note that these targets are set on a production basis which means emissions arising from within the borders of the EU. However, with globalisation, an ever-increasing proportion of emissions is emanates from regions outside the EU while being a result of EU imports. Indeed, since 1990, net-emission transfers from the Annex 2 countries of the Kyoto Protocol to non-Annex 1 countries have increased fourfold. For details see: http://www.pnas.org/content/early/2011/04/19/1006388108.abstract

5 GHG emissions are closely related to economic activity. The current high level of uncertainty about future economic trends, therefore, makes it difficult to judge the capacity of the Member States to meet their 2020 targets on the basis of their present level of emissions, even in the case of those where emissions are already below the target.

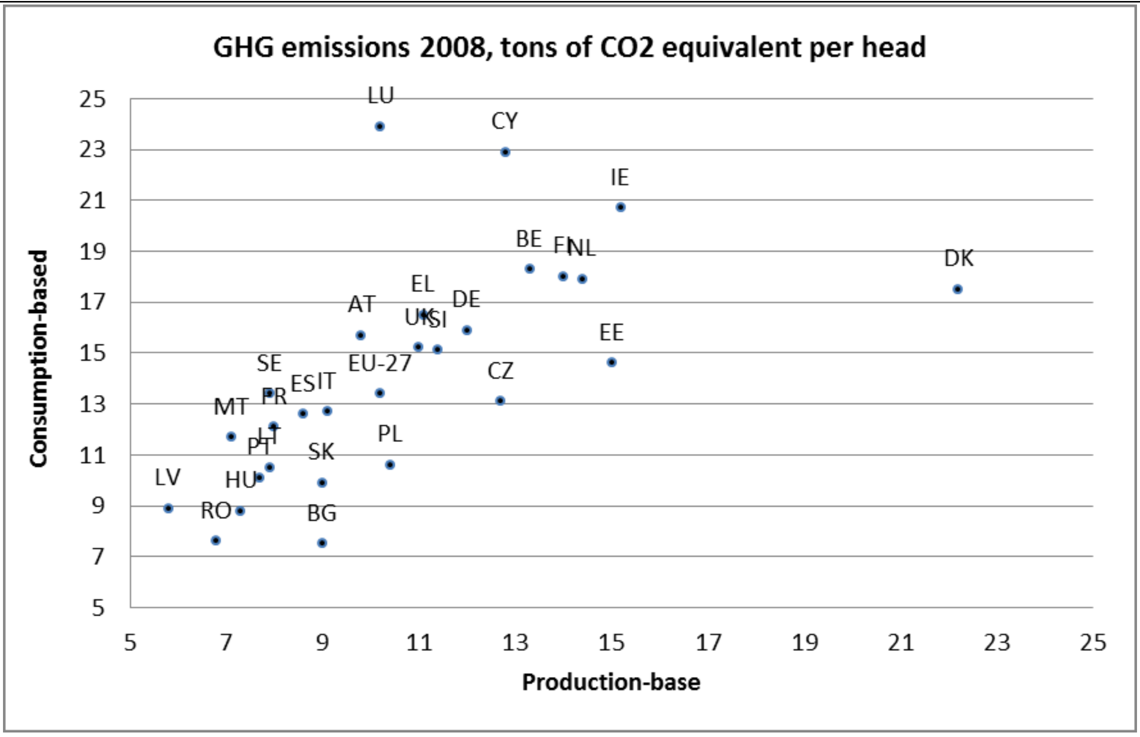
**Figure 1 – Change in greenhouse gas emissions outside the Emissions Trading Scheme, 2005-2011 and Europe 2020 targets**




*Source: European Commission, DG CLIMA.*

> **Box: Production-based and consumption-based emissions**
>
> In greenhouse gas emissions accounting, the level of emissions can be calculated on the basis of either production or consumption. Production-based emissions are calculated from the fossil fuel usage in various types of activities (e.g. industry, agriculture, energy). Consumption-based emissions account for the GHG generated when producing the goods and services which meet domestic final demand in a country (i.e. household consumption, government consumption, and investment), regardless of which country actually emitted the substances concerned.[6]
>
> For a given Member State, production-based and consumption-based levels of emissions can be quite different. For instance, production-based emissions can be low for a country in which few polluting activities are located while its consumption-based emissions could be high if it imports goods and services the production of which generated large amounts of greenhouse gases.
>
> This is illustrated in the following graph in which production-based emissions are plotted against consumption-based emissions for each EU-27 Member State. While there is an obvious positive relationship between the two types of emission, it is far from one to one. For example, in Luxemburg production-based emissions are close to the EU-27 average but consumption-based emissions are the highest in the Union. Conversely for Denmark, production-based emissions are very high but consumption-based emissions are much smaller. It is, nevertheless, the case that in general, highly developed Member States record the highest levels of emission on both a production and consumption basis.

6 See European Commission, JRC-IPTS, 2012, *Global Resources Use and Pollution*, Volume 1 / Production, Consumption and Trade (1995-2008). http://ftp.jrc.es/EURdoc/JRC71919.pdf




*Source: JRC-IPTS*

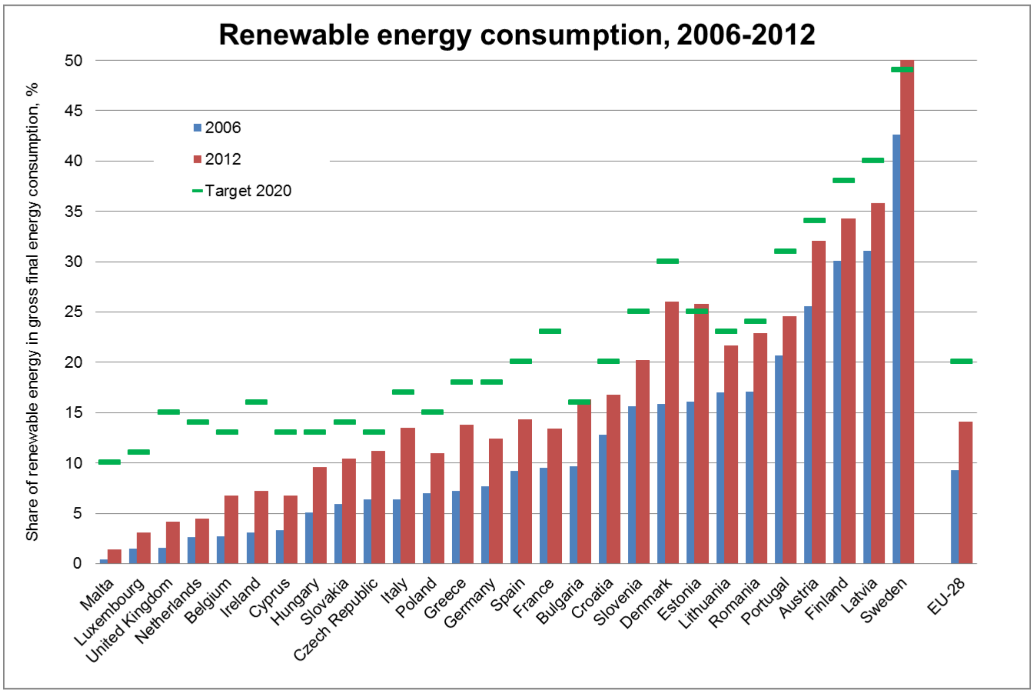
## 2.2. The EU needs to increase the use of renewable energy to reach the 2020 targets

The EU has agreed to source at least 20% of its final energy consumption from renewable energy by 2020. Under the Renewable Energy Directive, Member States have committed to increasing the share of renewable energy in energy consumption by 2020 to targets ranging from 10% in Malta to 49% in Sweden.

The share is already large in some Member States, amounting to almost 51% in Sweden and around 36% in Latvia (Figure 35), though it is small in others, such as Malta, and Luxemburg, where it is less than 4%. Renewables are expected to play an increasing role not only in supporting the transition to a low carbon economy but also in improving energy security.

Member States also vary widely as regards the present share of renewables in relation to their target. The UK, France and the Netherlands need to increase the use of renewables by almost 10 percentage points or more to reach their targets. On the other hand, three countries, Bulgaria, Estonia and Sweden, have already reached their targets, and Romania, Lithuania, Austria and the Czech Republic are close to reaching them. Considerable efforts remain to be made in a number of Member States reach their targets. There is concern, however, that the currently low price of fuel, and carbon in general, does not provide a sufficiently strong incentive to invest in renewable energy. This is partly due to the fact that, because of the slowdown in economic activity triggered by the crisis and the resulting fall in emissions, the ETS has experienced a growing surplus of allowances. Moreover, in the longer term, this could reduce its ability to meet more demanding emission reduction targets in a cost-effective way. The Commission has therefore taken the initiative to postpone the auctioning of some allowances.

**Figure 2 – Share of renewable energy in gross final energy consumption, 2006, 2012, target 2020 (% of total gross final energy consumption)**




*Source: Eurostat*

The largest sources of renewable energy in the EU are biomass and hydropower (which in 2012 produced respectively around 83 and 29 million tonnes of oil equivalent - Mtoe), followed by wind power (17.7 Mtoe), biogas (12 Mtoe) and solar energy photovoltaic, 5.8 Mtoe and geothermal, 5.7 Mtoe. While hydropower and geothermal are restricted to particular locations, wind and solar power, biomass and heat pumps can be used more widely , though the potential to produce energy from either varies markedly between regions. The ability to make full use of renewable energy potential also depends on the existing regional transmission, distribution and storage infrastructure, as well as the pattern of demand[7]. Larger shares of renewable energy supply, which in many cases provides intermittent power, will require improved infrastructure and solutions to its effective integration into the network.

Coastal regions generally have a much greater potential than others for producing energy from wind power, especially those around the North Sea or the southern part of the Baltic. Some islands in the Mediterranean have high potential too. The cost of producing energy from wind power is also lower where the wind is consistently strong enough to produce electricity.

The most suitable areas for using solar power are in the southern and western parts of Europe, where the sun is at its strongest (Map 60, which indicates the suitability of areas for solar power[8]). Northern, central and eastern Member States are less

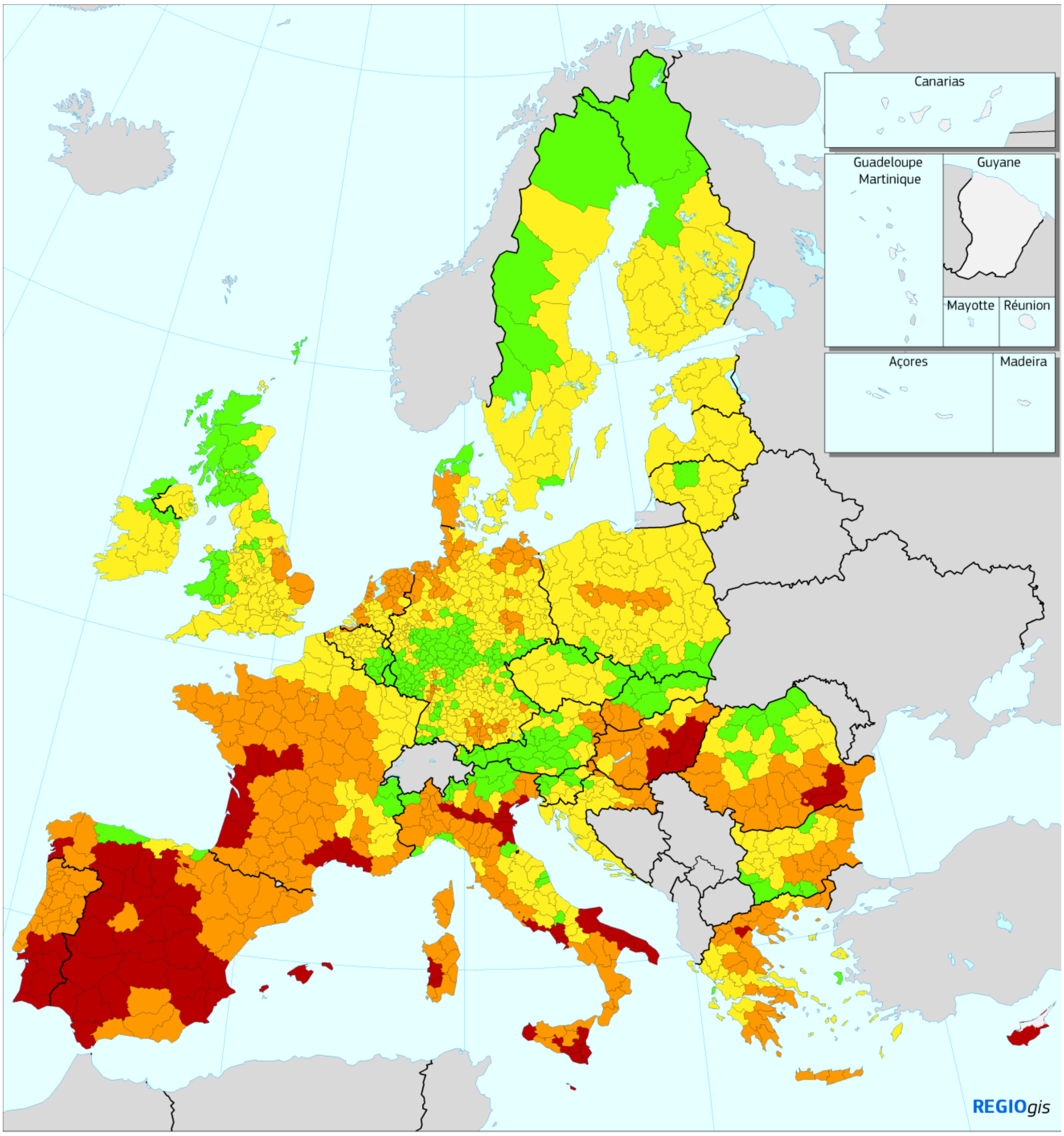
[7] Another consideration would be the environmental effects of the renewable energy. For example, combustion of biomass leads to emissions of PM which is carcinogenic, so it should be accompanied by strict emission limits.

[8] Suitability takes into account factors both restricting the development of solar power and supporting it. The criteria include high solar radiation, smooth slopes, distance from densely population settings,

suitable, though solar panels can be installed on the roofs of buildings of all types, industrial and commercial as well as residential, to provide power directly to users without effectively taking up space. While large-scale photovoltaic systems, or solar farms, require more space, they produce energy more efficiently and their impact on the environment can be reduced by locating them on unused, or low-yield, farm land.

proximity to roads and electrical grids. Protected areas, forests, water bodies and land already developed are defined as not being suitable.

## Map 2 Average suitability for photovoltaic systems




**Average suitability for photovoltaic systems at NUTS3 levels**

Suitability levels

- Very low suitablility
- Low suitability
- Moderate suitability
- High suitability

Suitability considers high solar radiation, smooth slopes, distance from densely populated settlements, proximity to roads and electrical grids the presence of protected areas as well as artificial areas, wetland and water bodies and forests.

Source: JRC

0 500 Km

**Box - The territorial dimension of the Climate change and energy package**

The climate change and energy package takes specific account of the level of economic development of Member States in setting the targets for GHG emissions outside the emissions trading mechanism and for renewable energy.

Renewable energy sources contribute to diversifying the energy supply in the EU and to improving the competitiveness of some regions by stimulating the growth of new industries and helping to create jobs and export opportunities. In addition, the proposed energy projects of common interest, with an allocation of EUR 5.1 billion as part of the Connection Europe Facility, can potentially make an important contribution to improving energy security and competitiveness in areas where commercial viability is not attractive enough.

Investment in energy efficiency, such as in reducing the energy used by heating systems, can also bring substantial benefits to those living in cities by improving air quality. The revised Energy Performance of Buildings Directive (EPBD) adopted in 2010, which is not yet fully implemented, should further improve air quality in cities by cutting energy consumption.

In the case of urban transport, the regulations establishing performance standards for light duty vehicles have led to substantial reductions in GHG emissions, reflected in a decline of average $CO_2$ emission of new vehicles from 172 grams per km in 2000 to 135.7 grams in 2011. Such a reduction also benefits public health and ecosystem health by cutting air pollutants such as $NO_2$ and PM10.

Regional and local authorities are important active stakeholders in the process. The effectiveness of climate and energy policies depends on the active support of regional and local authorities, which are responsible for building permits and spatial planning. The authorities are also responsible for public buildings, and in some cases for public housing, which need investment to increase their energy efficiency.

The White Paper on adapting to climate change[9] champions a local, place-based approach to adaptation, which in practice means local authorities cooperating to design and implement joint sustainable climate and energy policies for sustainable transport, improving energy efficiency in buildings and district heating, developing renewable energy sources and distributed energy generation.

Smart Cities and Communities European Innovation Partnership (SCC) is intended to increase inter-linkages between energy production, distribution, and use; mobility and transport; and information and communication technologies (ICT). In addition, the Covenant of Mayors is a European-wide movement supporting local and regional authorities in achieving the European 2020 climate and energy policy objectives. As well as saving energy, the aim of the signatories is to help create skilled and stable jobs; a healthier environment and quality of life; increased economic competitiveness and greater energy independence. To date there are more than 5,000 signatories and over 200 supporting bodies, meaning that it effectively covers nearly 170 million people in Europe.

### 2.3. EU needs to adapt to more frequent and disastrous natural hazards

The number and costs of disasters caused by natural hazards[10] has increased in Europe in recent years. This is due not only to climate change, which is likely to

[9] European Commission, 2009, *White paper - Adapting to climate change: towards a European framework for action*, COM/2009/0147 final.

[10] See SWD(2014)134 Overview of natural and man-made disaster risks in the EU

increase the frequency, intensity and duration of weather-related events in future years, but also to human and economic activity including a higher take-up of land[11].

The most frequently-occurring natural hazards in the EU are heat waves, storms, earthquakes, floods, droughts and forest fires. Heat waves have caused by far the largest number of human casualties over recent year.[12] Extremes of high temperature[13] have become more frequent and are likely to become even more frequent and intense with climate change.

To measure the potential impact, an urban heat stress indicator has been developed (by the JRC in Ispra) for a number of cities in the EU which takes account of both the natural risk and the capacity to mitigate it.[14] This shows that the highest potential impact is in the Mediterranean regions in Spain, southern France, Italy and Greece, which tend to have a low capacity to adapt. This applies equally to cities in Eastern Europe, though these are much less exposed to heat. Regions in central and northern Europe, on the other hand, have low risk and high capacity to adapt.

The rise of temperature in cities is not only due to global warming but also to the way they have developed. In particular, increases in temperature also depend on land use in the city, the energy efficiency of the buildings and the main modes of transport. These are aspects which fall directly under the remit of Cohesion policy.

Forest fires are frequent in Europe, with an average of 70,000 fires occurring every year. Over recent years, forest fires have destroyed over half a million hectares of forest and other wooded land annually, mainly in the Mediterranean. The largest fires have occurred in Portugal (in 2003 and 2005), Spain (2006) and Greece (2007). While forest fires at some level are important for the long-term sustainability of forests, they are also a cause of human casualties, though much less so than heat waves, and lead to substantial economic loss – amounting to an estimated EUR 7 billion over the period 1998-2009 according to the EEA.

Pressure on water resources has increased in the EU and large areas are now more frequently affected by water shortages and droughts, not only in the drier areas but also in more humid parts. Droughts can have severe effects on agriculture, tourism and energy as well as on freshwater and related ecosystems as they often reduce river flows, lower lake and groundwater levels, dry wetlands and lead to a

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11 See EEA, 2010, *Mapping the impacts of natural hazards and technological accidents in Europe - An overview of the last decade*, Technical Report No 13/2010.

12 For the period 1998–2009, the EEA reports 576 disasters due to natural hazards causing almost 100,000 fatalities, of which .over 77,500 were due to heat waves. *Ibid.*

13 Extreme temperatures are relative to the usual weather conditions in a given area, so there is no universal definition of a heat wave. There are, however, proposals for a generic definition – e.g. the European Climate Assessment and Dataset project defines a warm spell as a period of at least six consecutive days in which the mean daily temperature exceeds the 90$^{th}$ percentile of the average daily temperature in the 1961–1990 period. The World Health Organisation’s ( EuroHEAT project proposed a similar definition of a heat wave as 'a period when maximum apparent temperature and minimum temperature are over the 90th percentile of the monthly distribution for at least two days' (see EEA, 2010).

14 Lung T., Lavalle C., Hiederer R., Dosio A. and L. Bouwer, 2013, *A multi-hazard regional level impact assessment for Europe combining indicators of climatic and non-climatic change*, Global Environmental Change 23: 522-536.

deterioration in the quality of water.Also, oceans and seas around Europe are increasingly suffering from the impacts of climate change, affecting in turn sectors such as fisheries, aquaculture, and tourism.

According to various climate projections, the frequency of water shortages and droughts is likely to increase significantly in the future as a result of climate change and the resulting higher average temperatures. Such events are also expected to extend beyond southern Europe increasingly affecting other parts of the EU. Moreover, demand for water in dry periods often exceeds availability and the need to ensure adequate water supplies to vulnerable ecosystems is frequently neglected.

Together with storms, floods cause the largest economic losses. Many parts of the EU areas have been affected by floods in recent years, such as the Elbe Basin, the French and Italian Alps, the Po Valley, the banks of the Rhine in Germany, France and the Netherlands, regions of the low Loire in France and Mecklenburg-Vorpommern as well as western Poland. Several regions in Slovakia and the Czech Republic are also particularly exposed to the risk of floods.

River flooding can be particularly damaging in urban areas to both infrastructure and human life. The impact of floods on major cities in the EU has been assessed by the JRC-ISPRA, using an indicator which takes account of both the risk of floods and the capacity of cities to mitigate and recover from them.[15] The indicator shows a wide variation in exposure to floods between cities, in part depending on their location *vis-à-vis* major waterways. The most vulnerable spots, where a high risk of flooding is combined with low capacity to adapt, are in a number of regions in Romania, Poland, Latvia, Lithuania, Portugal and southern Spain.

The risk is expected to increase in the future in many coastal areas because of a rise in sea levels and temperatures. This is so for those at sea level, or less than 5 meters above this, such as regions along the Dutch coast.

In the light of this, policies for preventing and managing risk are essential to ensure that development, and economic growth, are sustainable.

## 3. SHIFTING TO MORE SUSTAINABLE TRANSPORT CAN INCREASE ENERGY EFFICIENCY AND IMPROVE AIR QUALITY

The EU has taken action to improve energy efficiency through the 2011 Energy Efficiency Plan and the Energy Efficiency Directive. Energy efficiency is mainly to do with reducing energy use in buildings and transport, which in 2010, were responsible for 41% and 32%, respectively of total energy consumption in the EU.

Improving the energy efficiency of housing and buildings comes through applying both current technology and new innovations. Energy efficiency of buildings can be improved, in particular, by adding insulation and improving heating systems, though again, there are large variations across the EU in this regard, with Member States in Central and Eastern Europe, which could potentially contribute substantially to energy savings in the EU, lagging behind.

[15] Lung T., Lavalle C., Hiederer R., Dosio A. and L. Bouwer, 2013, *A multi-hazard regional level impact assessment for Europe combining indicators of climatic and non-climatic change*, Global Environmental Change 23: 522-536.

### 3.1. Improving accessibility and energy efficiency

One of the objectives of the EU's common transport policy is to increase energy efficiency and to ensure that the transport system is a sustainable one by 2050. In order to achieve this, three broad goals have been set: develop and deploy new and sustainable fuels and propulsion systems, (2) optimise multimodal logistic chains, including a shirt to more energy efficient modes and (3) increase effiency with the use of information sysstems and market-based incentives. . Reducing the distance travelled while maintaining or improving accessibility is a means of achieving all three of these goals

Technological advance is another way of increasing energy efficiency. The adoption of new technologies can increase fuel efficiency. A shift to more energy efficient modes of transport can help to achieve all three goals, while an improvement in the transport network can facilitate such a shift and at the same time might reduce congestion.

When people use transport, whether a car, bus, train or bicycle, they usually do so to travel to, or to *access*, a specific destination. Accordingly, transport analysis needs to distinguish how far people travel from accessibility (getting where they want to be). In some cases, distances can be reduced while accessibility is increased. When people and destinations are close to each other, as is often the case in cities, the average distances travelled tend to shrink. For example, in the Netherlands in 2011, people living in a town or city travelled an average of 26 km a day as against 30 km a day for those not living in an urban area.

Due to the shorter distances, walking and cycling are more attractive options in towns and cities than in other areas. There is also a higher demand for public transport which makes it more cost effective and energy efficient, so people use it more and their cars less. The Dutch example also shows that people living in a very urban environment walk more (0.95 km as against 0.6 km), use public transport more (5.6 km as against 1.9 km) and use the car less (16 km as against 24 km) than those living in other areas (Statistics Netherlands 2013). These differences are reflected in the regional figures, with Amsterdam, Rotterdam and Utrecht having the shortest distances travelled and the lowest car use in the Netherlands. Although such detailed data are not available for the EU as whole, the use of more energy efficient modes of transport seems to apply in other EU cities too[16]. Cars tend to account for a particularly large share of travel outside cities because public transport is less efficient and distances make walking and cycling less feasible[17].

In order to compare the relative importance of inland[18] modes of transport between countries, the data can be normalised by expressing the level of passenger distances in relation to population. Luxembourg and France registered the longest distances travelled in 2011, each of these countries averaging more than 15,000 passenger-

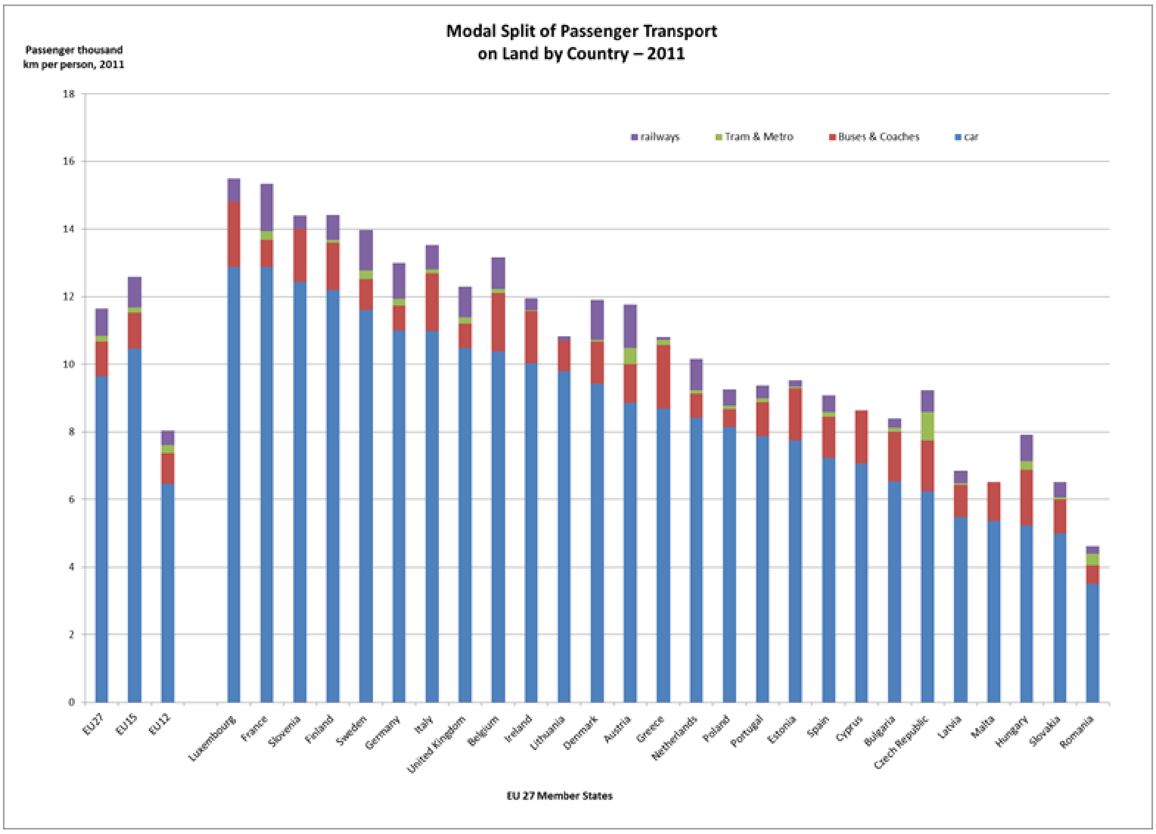
[16] TERM 2013 EEA

[17] See also ESPON, 2013, *TRACC-Transport Accessibility at Regional/Local Scale and Patterns in Europe*.

18 It should be underlined that the analysis above refers only to inland transport by car, bus or train and that a significant proportion of international passenger travel, and in some countries national travel, is accounted for by maritime and air transport (EUROSTAT Pocketbooks, Energy, transport and environment indicators, 2011 edition)

kilometres per inhabitant (Figure 36). By contrast, EU 12 Member States have the smallest amount of travel, with Romania and Malta having the lowest figures. These figures, however, reflect a range of factors, such as, the level of GDP and income, infrastructure endowment, the importance of commuting, the proximity of services to population, access to high-speed rail links and the existence of international transport corridors running through the country.

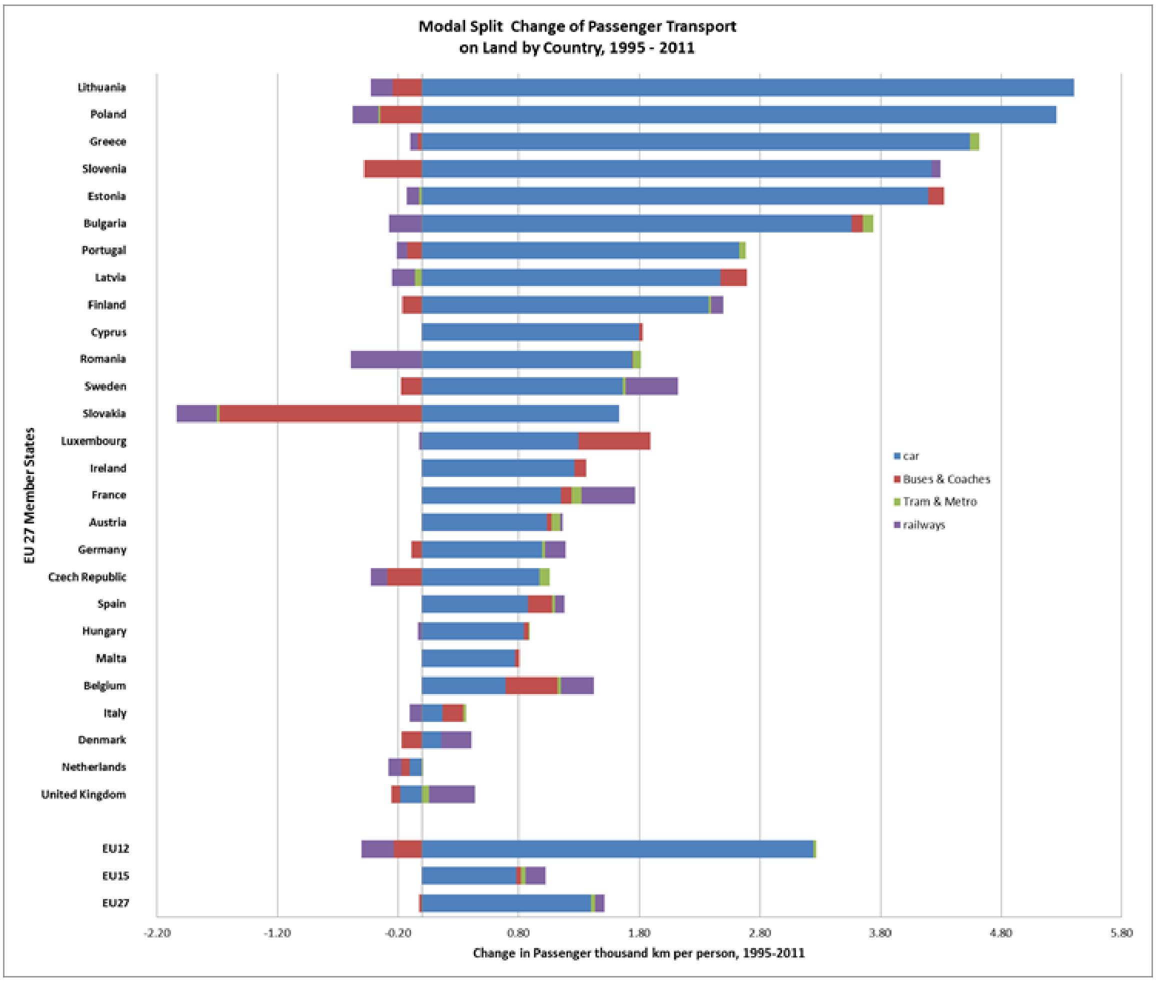
Figure 3 - Modal split of Passenger Transport on Land by Country - 2011




Between 1995 and 2011 there was a marked increase in the use of cars in many of the Member States that have joined the EU since , particularly in Lithuania, Poland, Slovenia Estonia and Bulgaria, There was also a substantial increase in the use of cars in Greece (Figure 35). This increase in car use has been accompanied by a significant reduction in the use of public transport in the EU-12, especially in Slovakia.

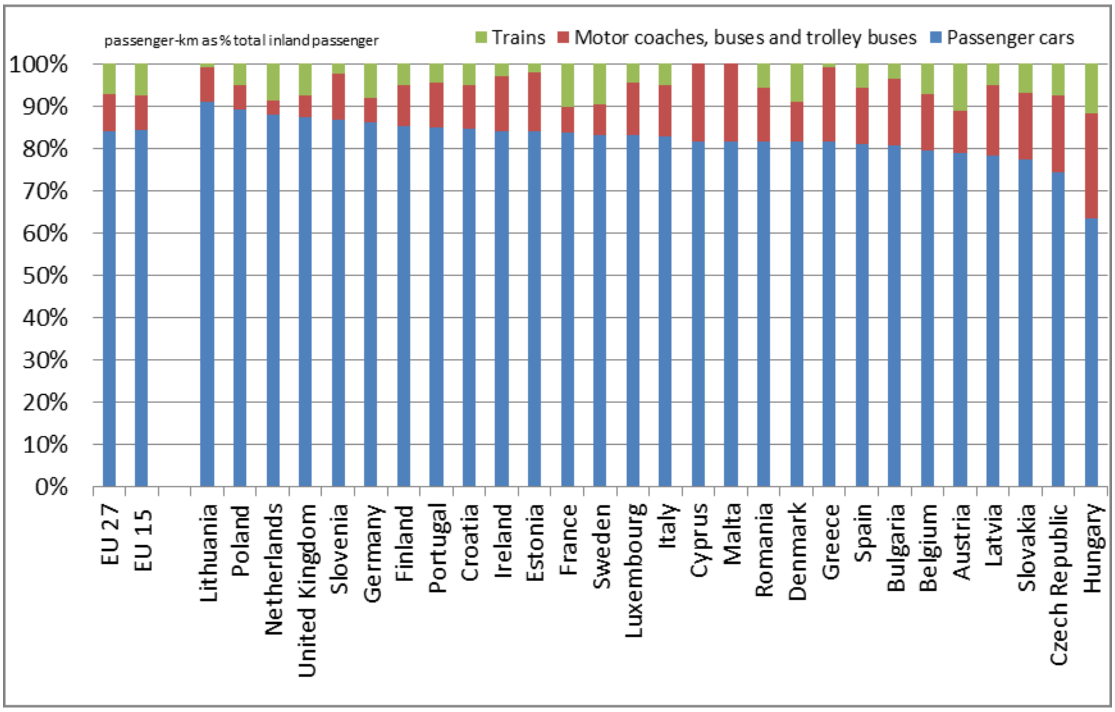
By contrast, the use of cars declined in in the UK and the Netherlands, in the former accompanied by an increase in rail travel.

Figure 4- Modal split Change of Passenger Transport on Land by Country, 1995 - 2011



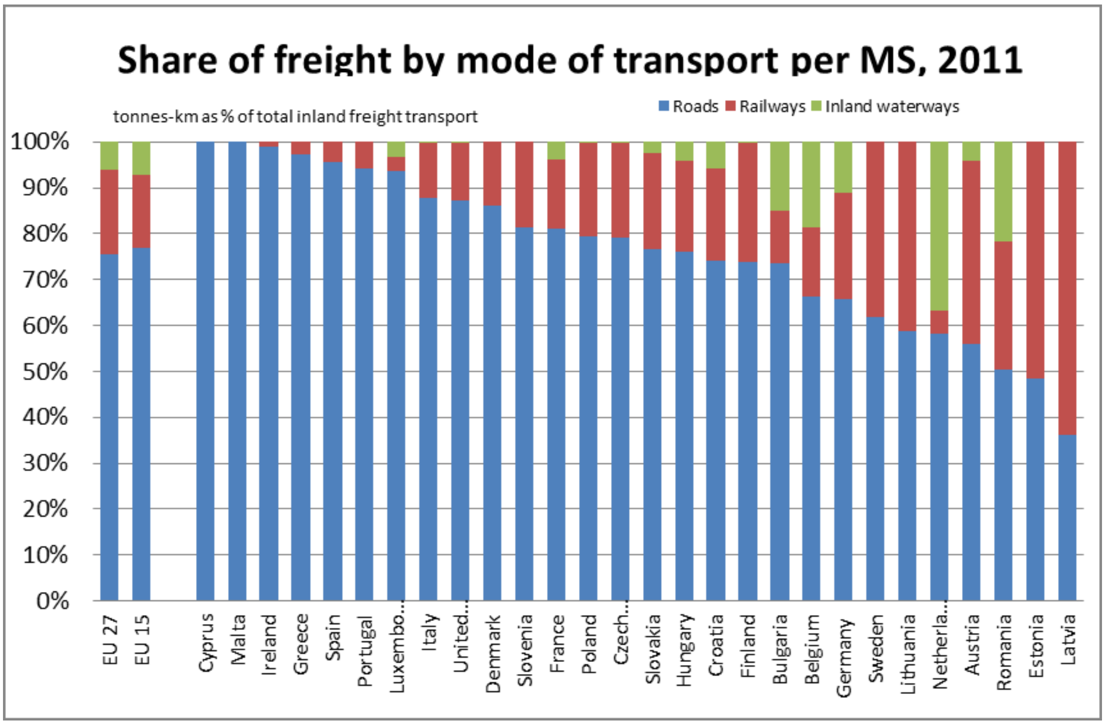

Cars accounts for a sizable proportion of passenger transport in all Member States for which data are available, considerably larger than rail, and buses and coaches. In 2011, cars accounted for 84% of all inland passenger km travelled in the EU, though the figure varies markedly between Member States (from 91% in Lithuania to 64% in Hungary) reflecting differences in infrastructure and geography (Figure 38).

Figure 5 Share of passenger travel by mode of transport in EU Member States, 2011




Buses accounted for 9% of passenger km travelled on average, the share varying from 3% in the Netherlands to 25% in Hungary, while trains accounted for just 7%, though the figure varies according to the state of the rail network and its extent. In France, Austria and Sweden, which have fast and frequent trains, around 10% of travel is by rail, while in Greece, Estonia, Lithuania, where the network is limited and trains slow and not very frequent, relatively few journeys are made by train.

Figure 6 Share of freight by mode of transport in EU Member States, 2011




Most freight transport in the EU (75%) is by road (Figure 39). In some countries, such as Greece and Spain, the large share of freight carried by road is partly due to the lack of inland waterways and a limited rail network (other than high-speed). In Latvia and Estonia, on the other hand, over 50% of freight goes by rail, partly reflecting imports by this means from Russia. Inland waterways are used more than elsewhere to transport goods in Romania, Netherlands and Belgium because of navigable rivers and canals.

Strategies for improving the efficiency of transport need to differ between regions. In Western regions as well as in some of the more developed parts elsewhere, there is already a well-developed road network. Policies here should therefore focus on shifting to more energy efficient modes of transport. In many less developed regions, on the other hand, a good standard road network and connections to the rest of the EU are still lacking.

### 3.2. Large cities provide better access to public transport

Public transport varies from city to city across the EU in terms of the scale and frequency of service and the forms it takes[19]. Up until recently, it was difficult to compare the public transport available in different cities because there was no common definition of a city and data on public transport was limited. These difficulties are starting to be overcome[20].

The EU-OECD definition, referred to earlier in this report, provides a harmonised way of delimiting urban centres, cities and their commuting zones, while more and more public transport operators now give free access to their data in a common format (GTFS, as used by Google maps). These data can then be combined with high-resolution population distribution data[21] and a digital map of streets to produce the first harmonised analysis of access to public transport in European cities.

The analysis distinguishes two modes of public transport:

- Medium-speed modes: buses and trams
- High-speed modes: metros and trains

Ease of access is defined for each mode:

- a five minute walk for medium-speed modes
- a ten minute walk for high-speed modes.

Frequency of service is defined on the basis of the average number of departures an hour between 7 am and 8 pm on a normal weekday:

- very high: access to more than ten departures an hour for both medium- and high-speed modes;

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19 European Environment Agency, 2012, A *closer look at urban transport, TERM 2013: transport indicators tracking progress towards environmental targets in Europe*, EEA Report, No 11/2013, Publications Office of the European Union, 2013, ISBN 978-92-9213-413-6, doi:10.2800/94848

20 Dijkstra L. and Poelman H. 2014, *Access to public transport in European Cities*, . Regional Working Paper, Directorate-General for Regional and Urban Policy, European Commission.

21 Using 100m population grids, neighbourhood or enumeration areas and the Urban Atlas, a new European collection of urban land use maps of all European agglomerations.

- high: access to more than ten departures an hour for one mode but not both;
- medium: access to between four and ten departures an hour on one or both modes, but no access to more than ten departures and hour;
- low: access to less than four departures an hour for one or both modes, but no access to more than four departures an hour

The proportion of people that have easy access to public transport, broken down by frequency of departures, can be compared across a number of European cities. In 12 out of 14 large urban centres examined (Figure 40), between 60% and 84% of the population had access in 2012 to a high frequency service. The proportion of population with very high access was more variable, ranging from over 30% in five centres and less than 10% in three. Dublin has the smallest proportion with access to a high frequency service (38%), much less than Stockholm (71%) or Brussels (84%), which are of similar size.

The Hague and Amsterdam also score relatively low on this measure, though in Amsterdam the construction of a metro should increase the proportion substantially. Public transport services in the Dutch cities have to be seen, however, in the light of the extensive use of bicycles, which reduces the demand for them. The urban centre of Manchester, which covers most of Greater Manchester, has a small proportion of the population with very high access given its size.

In 9 of the 14 mid-sized urban centres (Figure 41), access to a high frequency public transport service in 2012 varied between 12% and 60% of the population, the proportion with very high access not exceeding 7% in any of them. In general, therefore, public transport services are much more frequent in larger urban centres.

**Figure 7 - Access to public transport in large European cities, 2012**

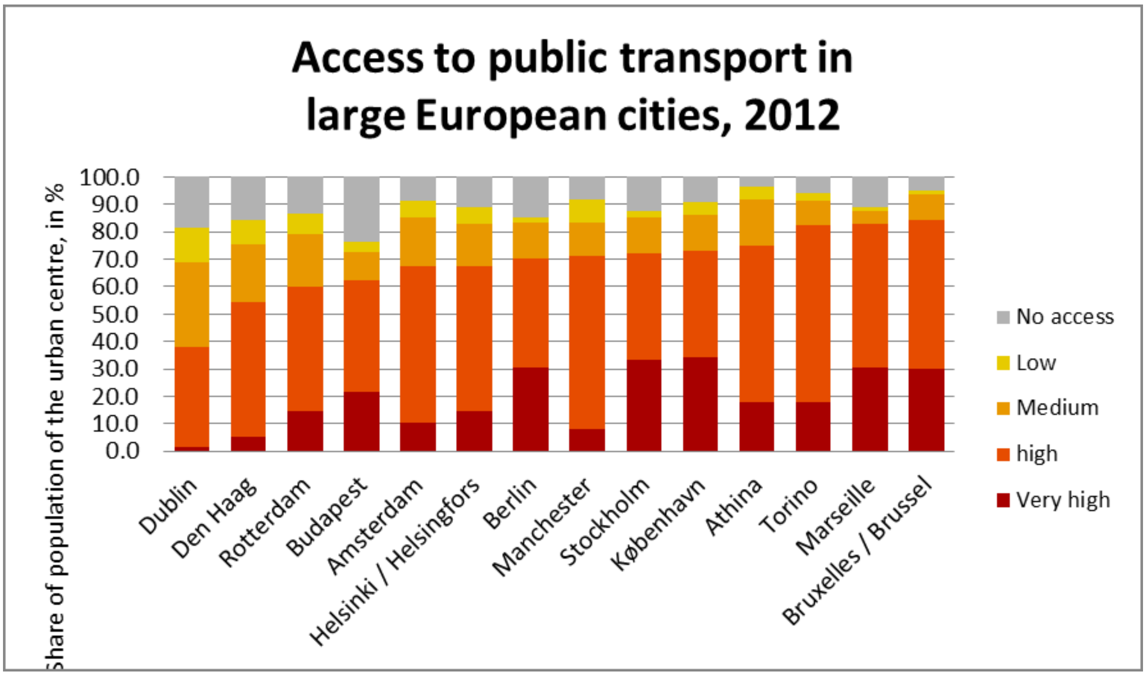
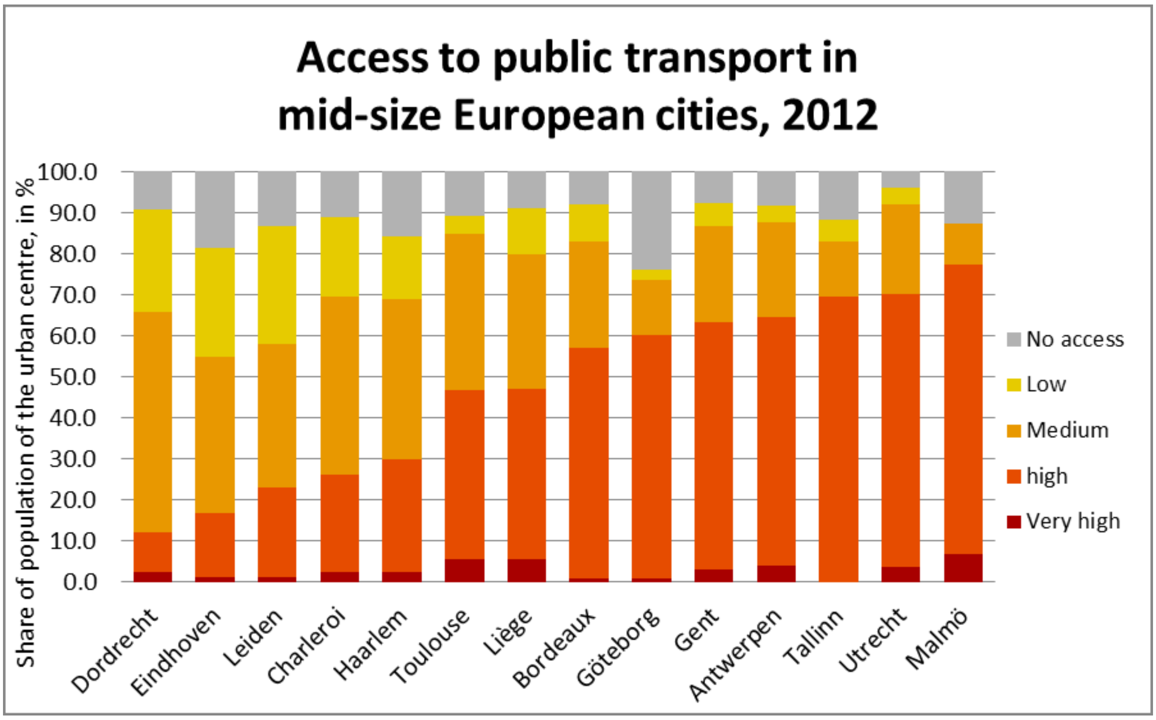


**Figure 8 - Access to public transport in mid-size European cities, 2012**




**Box: Improving access to public transport in Athens.**

Since the 1990s, over EUR 4 billion has been spent on the Athens Metro rapid transit system, which serves the Athens conurbation and parts of East Attica, much of it financed under Cohesion policy (by the ERDF and Cohesion Fund as well as by EIB loans) with the main aim of reducing traffic congestion[22]. Before the metro, public transport consisted only of buses and the Athens-Piraeus electric rail line.

The metro has improved the quality of life in Athens considerably, reducing traffic congestion and smog levels and cutting journey times markedly. It has also helped to reverse the decline in public transport use, the number of passengers increasing by 50% between 1992 and 2008.

Prior to the construction of lines 2 and 3 of the metro, only 8% of the population in the Athens urban centre had access to a very high frequency public transport service, much less than in Berlin, Stockholm, Copenhagen, Brussels or Marseille (30% in each). This was increased to almost 20% after the construction of the lines.

[22] European Commission, 2009, *Good practice in urban transport – Athens Metro*, Ex post Evaluation of cohesion policy programmes 2000-2006 co-financed by ERDF ,Work Package 5A: Transport, DG REGIO

**Box on Urban mobility package**

A successful European transport policy, cannot ignore the urban dimension. Cities are important nodes of the European transport system and most trips originate or end in urban areas. Furthermore, many of the negative effects of transport (like congestion and pollution) occur mainly in urban areas. According to the latest Eurobarometer Survey[23], half of all Europeans use a car every day (50%), which is more than the proportion who cycle (12%) or use public transport (16%) combined. On the other hand, a substantial majority of Europeans believe that air pollution (81%), road congestion (76%), travelling costs (74%), accidents (73%) and noise pollution (72%) are serious problems in cities.

With the Urban Mobility Package, the Commission is reinforcing its support for urban transport in the 2014-2020 programming period. Urban mobility planning is intimately linked to achieving EU policy objectives for a competitive and resource-efficient European transport system, but the organisation of urban mobility is primarily a responsibility of authorities at the local level. For many years, EU initiatives on urban mobility have primarily sought to support efforts at city level by taking action in areas with clear EU added value. The present package invites Member States to

- conduct a careful analysis of the present and future performance of urban mobility in the light of key EU policy goals;
- ensure that sustainable urban mobility plans are developed and implemented;
- review the technical, policy-based, legal, financial, and other tools at the disposal of urban planning authorities.

The central element of the package is the "Together towards competitive and resource-efficient urban mobility" Communication, which is accompanied by an annex that sets out the concept of sustainable urban mobility plans and by four staff working documents on urban logistics, urban access regulations, deployment of ITS solutions in urban areas and urban road safety.

### 3.3. Congestion is high in several of the large EU cities

Efficiency of transport networks is a main priority for transport policy at EU level as expressed in the European Commission's *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*[24]. The existing routes in the road transport network vary significantly in terms of the volume of traffic carried and, consequently, capacity utilisation and congestion[25].

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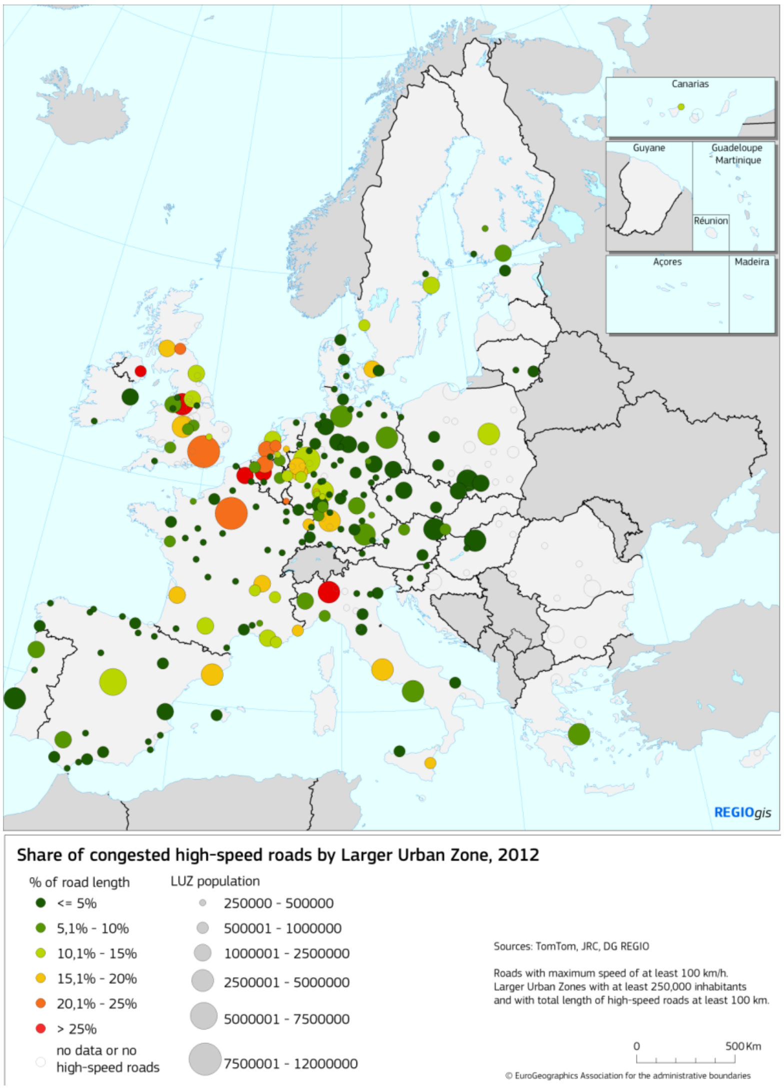
23 European Commission, 2013, *Attitudes of Europeans towards urban mobility*, Special Eurobarometer 406, Survey co-ordinated by the Directorate-General for Communication

24 European Commission 2011, *White Paper: Roadmap to a Single European Transport Area*, COM(2011)144.

25 European Commission – JRC IPTS, 2012, *Measuring Road Congestion*, Panayotis Christidis, J. Nicolás Ibañez Rivas, Luxembourg: Publications Office of the European Union, EUR – Scientific and Technical Research series .

Congestion is estimated to cost over EUR 110 billion a year in the EU[25]. It also has a range of indirect adverse effects, such as increased fuel consumption, air pollution and noise as well as affecting the quality of life and access to shops and other services[26]. Congestion is severe in several large cities (Map 61). In Brussels, Milan, Lille and Manchester, over 25% of high-speed roads are congested. This could be reduced by the introduction of congestion charging – which the OECD has recommended in several countries – to encourage people to adjust the time they travel, the route they take and/or the mode of transport they use.

**Map 3 Congestion index on the high speed road network, 2012**




## 3.4. Air quality can still be improved in many places in the EU

Air quality is a key aspect of well-being that can affect human health and the environment. In the EU, emissions of many air pollutants have declined substantially over the past decade, reducing exposure to substances such as sulphur dioxide ($SO_2$), carbon monoxide (CO) and lead (Pb). However, some air pollution problems persist in a number of regions in the EU where air quality is regularly

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26 OECD-ECMT, 2007, *Managing Urban Traffic Congestion*, ISBN 978-92-821-0128-5

lower than the standards specified in EU Directives. This is especially true of cities, where the majority of people live.

At present, airborne particulate matter ($PM_{10}$)[27], ground-level ozone ($O_3$) and nitrogen dioxide ($NO_2$) remain the most problematic pollutants in terms of harm to health. Despite the emission of many pollutants from industry, agriculture, transport and housing being regulated by EU Directives[28], many Member States do not comply with air quality limits which are intended to be legally binding. Measured concentrations of $PM_{10}$ and $O_3$ have shown no significant reduction in recent years. The Air Quality Guideline level for $PM_{10}$ set by the World Health Organisation (WHO) of 20 µg/m3 is regularly exceeded all over Europe in rural as well as urban areas. In many EU cities, $PM_{10}$ concentrations have not changed since 2000 or so.

Regions most affected by high $PM_{10}$ concentrations are those in the Po Valley in Italy, in southern and central Poland, the Czech Republic, Slovakia and Bulgaria (Map 62). High concentrations of $O_3$ occur mostly in the southern EU, notably in Northern Italy, where the target level is exceeded for 25 days a year or more (see map) ().

Although the EU has not reached its interim environmental objective set to protect sensitive ecosystems from acidification, the area affected by excessive acidification from air pollution was reduced considerably between 1990 and 2010, as a result mainly of previous measures to mitigate $SO_2$ emissions. The area of sensitive ecosystems in the EU affected by excessive atmospheric nitrogen, however, diminished only slightly between 1990 and 2010[29], and ambient $O_3$ concentrations still reduce vegetation growth and crop yields.[30]

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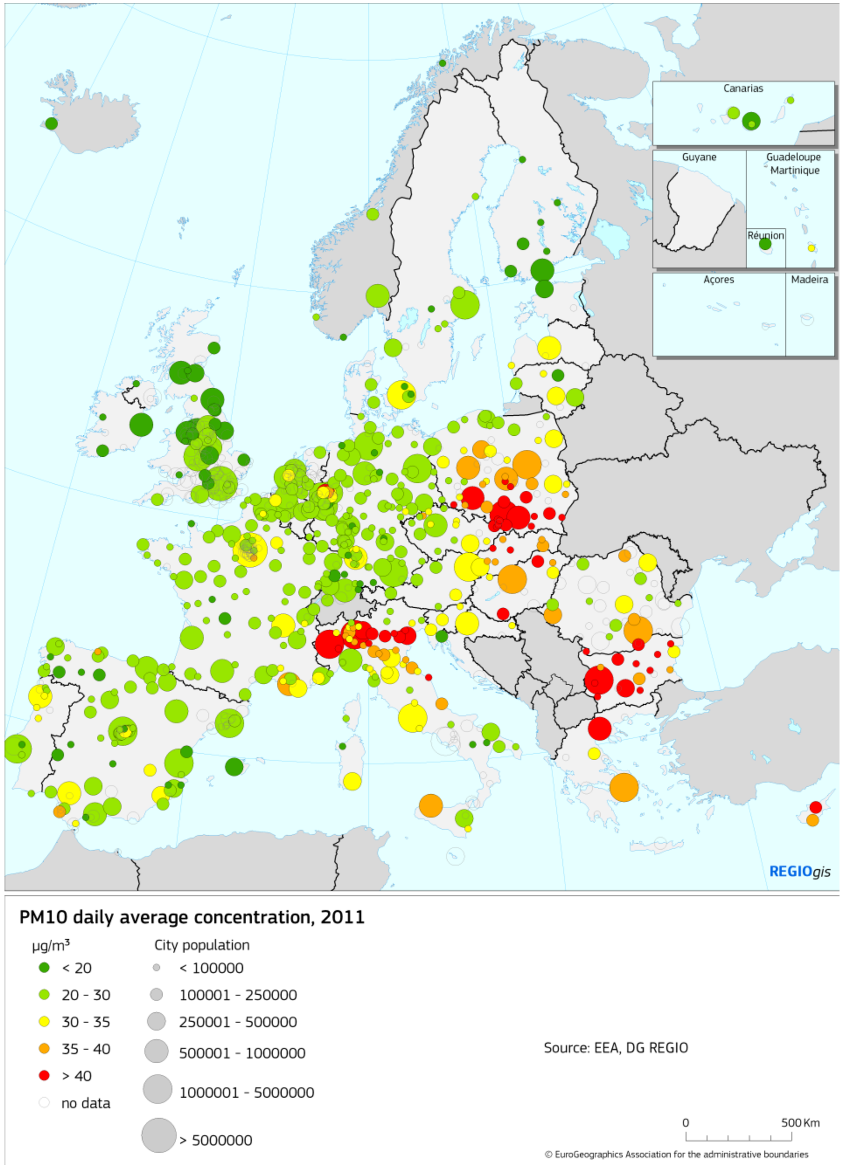
27 $PM_{10}$ ($PM_{2.5}$) is particulate matter with an aerodynamic diameter of 10 (2.5) µm or less, suspended in the air. While EU Directives impose limits on the concentration in terms of PM10, concentration in terms of $PM_{2.5}$ is not regulated, despite of the fact that these particulates are even more dangerous to human health since they penetrate deeper into the lungs.

28 Pollutant emissions: Directive 2010/75/EU on industrial emissions and Directive 2001/81/EC on national emission ceilings. Ambient air quality: mainly Directive 2008/50/EC.

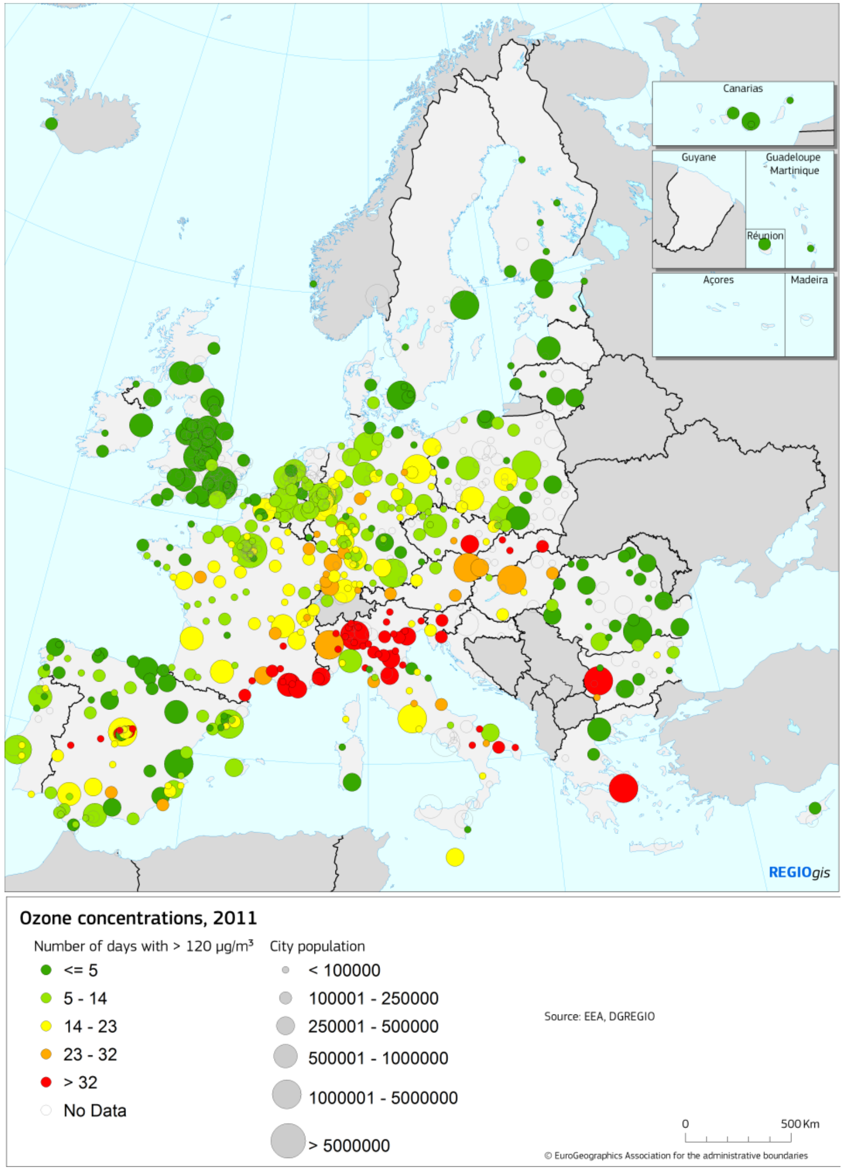
29 Nitrogen (N) compounds and ammonia (NH3) are now the principal acidifying components in the air. In addition to its acidifying effects, N also contributes to the excess supply of nutrients in terrestrial and aquatic ecosystems, leading to changes in biodiversity.

30 Crop losses and the associated economic loss were estimated for 23 horticultural and agricultural crops in 2000 to amount to the equivalent of to EUR 6.7 billion (see Holland et al., 2006, *Development of a framework for probabilistic assessment of the economic losses caused by ozone damage to crops in Europe.* CEH Project No. C02309NEW, Report to U.K. Department of Environment, Food and Rural affairs under contract 1/2/170 1/3/205).

## Map 4 Annual mean concentrations of PM10, 2011




## Map 5 Ozone concentration, 2011



Other sources of pollution are also monitored. In particular, the EU has tackled emissions of mercury which is a global pollutant (i.e. circulating between air, water, sediments, soil and living organisms) causing significant harm to human health, by launching a strategy in 2005 which included 20 measures to reduce emissions, cut supply and demand and protect against exposure, especially to methylmercury found in fish.

## 4. MAKING CITIES MORE ATTRACTIVE CAN BOOST EU RESOURCE EFFICIENCY

Cities are significantly more efficient in in terms of energy use and land use than other areas. Energy consumption by private households in cities tends to be lower because a larger proportion of people live in apartments or terraced housing which are more efficient in terms of heating than freestanding houses. For example, in the Netherlands, gas and electricity consumption per head is twice as high in freestanding houses than in apartments. The difference is big enough to show up even at the regional level. The NUTS-2 regions in which Amsterdam and Rotterdam are located accordingly have the lowest gas and electricity consumption per head in the Netherlands[31].

### 4.1. Cities use land more efficiently

An even stronger example of the efficiency of urban living is the impact on land use. On average, urban areas use only around a quarter of built-up land (i.e. land with a building on it) per person living there than rural or intermediate areas. This is shown by the JRC using high-resolution satellite imagery to detect built-up areas, whether the buildings in question are residential, commercial, industrial, agricultural or a mix of different types (Table 16 and Maps 64 and 65). This pronounced difference applies to both the EU-15 and the EU-13.

**Table 1 Built-up area per inhabitant, 2012 (in sq km per million inhabitants)**

| | Predominantly urban | Intermediate | Predominantly rural |
|---|---|---|---|
| EU-28 | 97 | 230 | 368 |
| EU-15 | 94 | 221 | 372 |
| EU-13 | 126 | 260 | 362 |

*Source: JRC and DG REGIO calculations*

[31] Unfortunately, such detailed data is not available for the entire EU.