ESPON

SIESTA

Spatial Indicators for a ‘Europe 2020 Strategy’ Territorial Analysis

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Annex B

Green economy, climate change and energy

EUROPEAN UNION
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INVESTING IN YOUR FUTURE

This report presents the final results of an Applied Research Project conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

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This basic report exists only in an electronic version.

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1. Introduction

The focus of this research paper is on climate change, green economy and energy at European level. More specifically, it first analyzes the meaning and the geographical patterns of sixteen maps based on different indicators quoted directly or indirectly in the document "Europe 2020"[1] and in the flagship initiative "Resource efficient in Europe". The majority of the maps (11) regard the achievement of one of the five headline targets that have been agreed for the European countries to measure progress in meeting the Europe 2020 goals. This target called "climate change/energy" is measured by three headline indicators focused on reduction of greenhouse gas emissions by at least 20% compared to 1990 (maps n.35/37/38); Increasing use of renewables to 20% of total final energy consumption (maps n.39/40/41/42); cutting energy consumption by 20% that means reducing the resource intensity of what we use and consume (maps n.43/44/45).

The other five maps are related to the indicators that serve to identify the new challenges of the green economy. These indicators are focused on industries with high energy spending (map n.46), commuting (maps n.47/48), municipal waste collection (map n.49), waste water treatment (map n.50), protected areas under Natura 2000 (map n.51). Finally, an additional map in this section is on eenvironmental pressures on the European coasts (Map 51b); this map has been included in this report following the suggestion of the ESPON CU after the revision of the Draft Final Scientific Report. All maps were designed by collecting data mostly at NUTS-2 (maps n.41/42/46/47/48/49/50) and NUTS-3 level (maps n.36/51/48 (actually the latter is at 'Large Urban Zones') even if the general lack of environmental data at regional level forced us to collect data also at NUTS-0 level (maps n.37/38/39/40/43/44/45).

Be that as it may, the maps regard themes that have assumed great significance in the last decade such as climate change, global warming, environment conservation, green economy, energy efficiency. They are environmental issues with strong "economic value" because it's increasingly clear the importance of the linkage between ecological and

[1] Europe 2020. *A strategy for smart, sustainable and inclusive growth*, COM(2010) 2020. Europe 2020, a strategy for jobs and smart, sustainable and inclusive growth, is based on five EU headline targets which are currently measured by eight headline indicators.

economic dimensions (as well as social) in the growing discussion in light of the environmental global crisis.

Regarding this point, Europe 2020 strategy actually has focused its pillar "sustainable growth" – that is the umbrella where our subsection houses – on economic growth rather than on an sustainability concept widely conceived. Even if the SIESTA Project does not have the aim to assess the EU2020S itself, but its territorial dimension and implementation, it is significant to note that the concept of sustainable growth by the EU2020S is far from conceptually clear. As you know, there are different academic perspectives about 'growth' and 'development' (Daly, 1996)[2] and usually 'sustainable' is referred to 'development' and not to 'growth' (Hopwood, Mellor, O'Brien, 2005). In any case, it may be noted that the concept of sustainable development has become an empty catch-phrase of contemporary environmentalism. Indeed, the sheer proliferation of definitions of sustainable development is evidence of its evanescence and contestability[3]. Several scholars argue that 'sustainable development' is a complex concept that indicates a lack of consistency in its interpretation, it is a contradiction in terms or an oxymoron that takes away from us any perspective of hope[4]. On the other hand, not even the concept of

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[2] Daly states that "development" means qualitative improvements, particularly in resource efficiency, so that economic activities do not exceed the regenerative and absorptive capacities of the ecosystem. "Growth" means quantitative increase in the amount of energy and materials taken from the earth and processed through the economy, returning to the earth usually in the form of waste. From: Daly, H.E. (1997): *Beyond growth: the economics of sustainable development*, Boston: Beacon Press (p.253).

[3] David Pearce, Anil Markandya and Edward Barbier provide a 'gallery' of over 40 definitions in their masterpiece on green economy. For further details see Pearce, D.; Markandya, A.; Barbier, E. (1989): *Blueprint for a Green Economy*, London: Earthscan Publications.

[4] Lele Sharachchandra asserts that "sustainable development is a 'metafix' that will unite everybody from the profit-minded industrialist and risk-minimising subsistence farmer to the equity-seeking social worker, the pollution-concerned or wildlife-loving First Worlder, the growth-maximising policy maker, the goal-oriented bureaucrat and, therefore, the vote-counting politician": from Sharachchandra M.L. (1991): "Sustainable development: A critical review", *World Development*, 19(6): 607–621; Meadows defines it as "an oxymoron, a term with nonsense meaning": from Meadows, D.; Meadows, D.; Randers, J. (1992): *Beyond the Limits*, London: Earthscan Publications; According S.Latouche, "the problem with sustainable development is not so much the word sustainable (it can even sound rather nice) as that of development. The association is explosive, toxic": from Latouche, S. (2004): *Survivre au développement : De la décolonisation de l'imaginaire économique à la construction d'une société alternative*, Paris: Mille et une nuits.

"sustainable growth" is so coherent for some scholars[5]. Actually in the current debate sustainable growth is often used by policy and decision makers as synonym for sustainable development. It is argued, however, that this is either a misunderstanding based on a superficial knowledge about the meaning of the sustainability concept or simply that it is cynically used to make the traditional growth philosophy more 'digestible' in an age of increasing environmental concern. It can be concluded by asserting that they are two different points on a conceptual plain (Ulhoi and Madsen, 1999).

In the context of this complicated scientific approach, therefore we have decided to stress also environmental and ecological aspects to better understand the drivers of competitiveness and change. Indeed, our starting point was that human activities which are consuming many natural resources need to be reconsidered in a way which will allow the regenerative capacity of these assets to function. It is important to understand that we must change the unequal and unsustainable development model which is now based only on consumption, reducing future energy needs and proposing a new growth paradigm based primarily on energy efficiency. Otherwise there will be economic, social and environmental consequences. Taken into account indicators on urban transport and commuting, main emission-intensive sectors, protected areas, resources consumption meant precisely to emphasize the bottom relationship between ecological, social and economic aspects.

Then the paper takes a look at the critical role that global warming, resource scarcity, biodiversity loss and a growing European population are playing to shift towards a lower emissions and environmental friendly economy. At this regard we have made a consistent geographical analysis with comments to explain how regions and cities are far or near the EU2020S targets as well as the geographical patterns of existing problems or key strengths and potentials. The goal was to take a "picture" of the current situation in Europe.

Finally, after having analyzed the geographical patterns expressed by the maps, this paper ends focusing on an explanation of some key concepts involved in our sub-section as well as providing some useful guidelines and policy recommendations for the European regional decision-makers.

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[5] Daly and Townsend have defined sustainable growth as an "impossibility theorem" that "when applied to the economy is a bad oxymoron—self-contradictory as prose, and unevocative as poetry". Daly, H.E.; Townsend, K.N. (1993): *Valuing the earth. Economics, Ecology, Ethics*, Cambridge MA: MIT Press (p.267).

2. List of maps and the studied indicators and general methodology

Here we thought to highlight some aspects of the general methodology of the SIESTA Project regarding to our subsection "climate change, green economy and energy" such as is reported exactly in the Inception Report (section 3.1).

The sustainable growth objective in the EU2020S documentation considers some of the typically associated notions to sustainable development (resource efficiency, renewable sources of energy, etc.), but in practice means primarily building a competitive economy. The strategy is that this competitive economy is based on green businesses, but the focus is clearly on competitiveness, and particularly in the manufacturing sector, as the flagship initiative An Industrial Policy for the Globalisation Era clearly indicates, by stating word for word, that "Europe needs industry" and that several manufacturing sectors are strategic, not only those which constitute the green economy. The section devoted to sustainable growth is consequently divided in two subsections: the first is dedicated to competitiveness and economic growth, while the second is focused on the green economy, particularly in climate change and clean and efficient energy issues.

This section on sustainable growth is the only one where the Atlas differs from the Specification. The latter proposed three sections: green economy; climate, energy and mobility; and competitiveness. But, taking into account the controversial use of 'sustainable growth' in the EU2020S as stated earlier (see point 3.1.3 of the Inception Report), the SIESTA Project simplifies this into two sections. The first one, devoted to competitiveness and economic growth, is related to the contents on economic growth of the EU2020S. The second one, devoted to green economy, embraces issues related to combating against climate change and moving towards a cleaner and more efficient energy consumption as it is understood that the green economy will be achieved through strategic decisions in energy and climate change. In addition, this two-fold division is consistent with the fact that this EU2020S pillar embraces two flagship initiatives on industry (thus, economic growth) and on resource-efficiency (thus, green economy).

Regarding the sustainable growth pillar, there were problems basically because of the general lack of environmental data at regional level (such as is confirmed by a recent specific EEA report[6]) and the controversial inclusion of aspects of economic growth under the umbrella of "sustainable growth". As it was explained in the previous "introduction", the pillar should be devoted apparently to a sustainability agenda as it is widely conceived, but it is clear from an in-depth analysis of the EU2020S, when referring to sustainable growth, that it is focused on economic growth. Be it as it may, there has been an effort to include specific indicators on green economy. Firstly, the screening of the OECD REGPAT has allowed us to identify types of patents at NUTS3 level, including green patents, which was a non-predicted indicator. Secondly, and as there is no data on renewable energies at the regional level, it has been thought as useful to consider the potentials of wind energy and solar energy, as they may offer "future possibilities" in this respect; these data has been downloaded through ESPON 2013 DB, coming from ReRisk Project. Thirdly, for measuring sustainable development in relation to curbing greenhouse gas emissions, it is essential to take into account the transport sector and in this respect, measurements on congestion have been introduced at NUTS2 level and a particular indicator available at URBAN AUDIT (EUROSTAT) on commuting.

SIESTA Project has systematically tried to develop the work at the larger scale, that is, NUTS 3 and urban areas, but only when this is possible in terms of data availability. This means that, when data is not available for NUTS3 or urban areas, then NUTS2 scale is used and, in some exceptional cases that will be justified in the following paragraphs, NUTS1 or NUTS0. It has to be said that a particular detail on the consideration of the urban area scale is developed in point 3.1.5 of the Inception Report.

If the basic aim of the Project is to obtain a territorial expression of the EU2020S, it is evident that the indicators to be mapped have to be based on the EU2020S documentation and directly related to it. As already said, this Project is qualitative driven. That means that the basic management strategy for indicators and map privileges the EU2020S rather than the available data itself. No maps have been produced if a clear link with the EU2020S is not obvious, as the maps have to make conceptual sense within the Project. The criteria to chose indicators was to get indicators directly considered as headline targets by the EU2020S, ones indirectly

[6] EEA (2010): *The Territorial Dimension of Environmental Sustainability. Potential Territorial Indicators to Support the Environmental Dimension of Territorial Cohesion*. Copenhagen: EEA.

linked to EU2020S and other documents, and other ones quoted by flagship initiative "Resource efficient in Europe".

The list of the indicators directly quoted in the EU2020 strategy is as follows:

[3] → @26 Variation of greenhouse gas emissions compared to 1990 levels.

[4] → @27 Share of renewable energy sources in final energy consumption.

[5] → @28 Energy efficiency.

@29 Employment in renewable energies industries.

[161] → @23 Employment in industries with high energy spending.

[69] Waste evolution → @24 Regional coverage rate of municipal waste collection.

[71] → @38 Protected areas included in Natura 2000 network, in percentage.

Here some explanations from the Inception Report:

@23 has been calculated following ReRisk methodology, explained in its Final Report but also kindly facilitated by email. ReRisk estimated this indicator for 2005 and the SIESTA Project has updated the indicator for 2010 amalgamating country by country the NACE codes identified by ReRisk.

@26, @27 and @28 are only available at member state level. Regarding @26, as is well known, currently a regionalisation of greenhouse gas emissions does not exist, being a quite controversial issue in several countries; it is true that some member states have internal surveys on this matter (i.e. Spain), but these calculations are not consistent in relation to international standards and differ one to the others, and some of them are not even official but academic approximations. Indeed, this evident lack of datasets on greenhouse gas emissions at the regional scale is remarked on by the ESPON Climate Project, but the team working on that Project established a methodology to estimate regional greenhouse gas emissions derived from the national standardized data provided by the UN databases; the SIESTA Project, following the methodology kindly provided by ESPON Climate, has estimated the regional greenhouse gas emissions at NUTS3 level (Map 3), but this is only an approximation based on the national greenhouse gas emissions and the raw data is really the national. Furthermore, following the precise statistical definitions

established by EUROSTAT, the data needed for making the calculations necessary to have @27 and @28 indicators at regional level have been intensively checked by partners, but unfortunately they are not available.

List of the maps:

3. Comments on maps

3.1. GHG emissions

3.1.1. Regional estimation of GHG emissions (map 36)

Definition of the indicator

The indicator under discussion (@26) derived from different sources or Eurostat "Greenhouse gas emission" and UNFCCC "National greenhouse gas inventory data for the period 1990-2009". Actually this indicator has been calculated by the SIESTA team using the methodology provided by the ESPON Climate team which allows the expression of regional GHG emissions from national level data using regional population and regional gross added value data from EUROSTAT. In this case @26 indicator shows the total value[7].

These indicators show annual total aggregate GHG emissions excluding emissions/removals from land use, land-use change and forestry (LULUCF) over the period 1990-2009. It does not include emissions from international aviation and international maritime transport. It is an indicator that shows a regional estimation of GHG emissions for EU-27 plus Turkey which data was available at NUTS2.

The GHG here considered are part of the so-called "Kyoto basket" which includes: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and the so-called F-gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (SF6)). These gases are aggregated into a single unit using gas-specific global warming potential (GWP) factors. The aggregated greenhouse gas emissions are expressed in Gg of CO2 equivalents. CO2 emissions from biomass with energy recovery are reported as a Memorandum item according to UNFCCC Guidelines and not included in national greenhouse gas totals.

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[7] In p. 171 of the ESPON Climate Final Scientific Report, available at:

<http://www.espon.eu/export/sites/default/Documents/Projects/AppliedResearch/CLIMATE/ESPON_Climate_Final_Report-Part_C-ScientificReport.pdf> (Access 2012-06-15), there is a map estimating regional GHG emissions derived from national level data that only shows if emissions are "low" or "high".

Relevance of the indicator

As you are aware, currently a regionalisation of greenhouse gas emissions does not exist, being a quite controversial issue in several countries; it is true that some Member States have internal surveys on this matter (i.e. Spain), but these calculations are not consistent in relation to international standards and differ one to the others, and some of them are not even official but academic approximations. Indeed, this evident lack of datasets on greenhouse gas emissions at the regional scale is remarked on by the ESPON Climate Project, but the team working on that Project established a methodology to estimate regional greenhouse gas emissions derived from the national standardized data provided by the UN databases.

As matter of interest, The SIESTA Project has decided to use this map following the methodology of ESPON Climate team for the relevance that this indicator has in the Europe 2020 Strategy. The indicator represented in the map 36 is a climate indicator of the headline Europe 2020 target "climate change/energy" that with other four targets measure progress in meeting the Europe 2020 goals[8]. The EU-27 has agreed to design its future "shape" by 2020 with the help of the eight key parameters. The target "climate change/energy" also contains the indicators "20% of energy from renewables" and "20% increase in energy efficiency" that are useful to measure the achievement of the sustainable growth pillar.

The targets of the three pillars of Europe 2020 Strategy on which The ESPON Siesta Project is based are interrelated and mutually reinforced as followed:

- educational improvements help employability and reduce poverty;
- more R&D/innovation in the economy, combined with more efficient resources, makes us more competitive and creates jobs;
- investing in cleaner technologies tackle the issue of the climate change while creating new business/job opportunities.

Regarding this indicator, the EU2020S aims to reduce GHG emissions by at least 20% (and 30%, if the conditions are right) compared to 1990, and to increase energy efficiency and the consumption of renewable

[8] To measure progress in meeting the Europe 2020 goals, 5 headline targets have been agreed for the whole EU. This limited set of EU-level targets is translated into national targets in each EU country, reflecting different situations and circumstances. The 5 targets for the EU in 2020 are about Employment; R&D/innovation; Climate change/energy; Education; Poverty/social exclusion.

energy both by 20%[9]. This decision unambiguously illustrates the role of the EU in leading the effort to create a climate-compatible energy system.

In the EU "Territorial Agenda" climate change and environmental risks are quite important issues related to the importance of developing the transregional and the integrated approaches and strategies[10].

Several scholars have pointed out that the achievement of sustainable economic growth is become a new strategic priority of the whole European area. The EU has already shown that progress on resource efficiency is possible, for instance because of the extension of recycling practices and overall greenhouse gas emissions reduction since 1990, while in parallel the economy has experimented growth in these two decades (-10% of greenhouse gas emissions while economy has grown by about +40%)[11].

In the context of the SIESTA Project as well as the EU2020S, GHG emissions is a quite important indicator because is directly related to energy efficiency which is perhaps the only domain of energy policy that contributes to all the fundamental goals of the EU. Reducing GHG emissions is a challenge included in the flagship initiative for a "Resource-efficient Europe" under the EU2020S that is focused on helping decouple economic growth from the use of resources, supporting the shift towards a low carbon economy, increasing the use of renewable energy sources, modernizing our transport sector and promoting energy efficiency[12].

Energy efficiency improves the competitiveness of European industry, as reported in the flagship initiative "An Industrial Policy for the Globalisation Era" and reduces the vulnerability of European infrastructure to sudden changes in weather or in energy prices. These two flagship initiatives structure the EU2020S pillar of the "sustainable growth" that is based on some of the typically associated notions to sustainable development like resource efficiency, renewable sources of energy, climate change, etc., but in practice means primarily building a competitive economy based on green businesses.

Explanation of the geographical pattern expressed by the map 36

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[9] Europe 2020. *A strategy for smart, sustainable and inclusive growth,* COM(2010) 2020.

http://ec.europa.eu/europe2020/documents/related-document-type/index_en.htm These measures known as the "20-20-20" targets are included in the "Climate and energy package" approved by the European Parliament and Council in December 2008 (Council Decision 2009/406/CE).

[10] All the documentation related with the Territorial Agenda is available at http://www.eu-territorialagenda.eu

[11] A resource-efficient Europe *ibidem*, pg.3

[12] A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy COM(2011) 21.

Introductory note: sustainable growth has an important urban and regional dimension

Regional estimates of GHG emissions at NUTS-2 and NUTS-3 level are becoming increasingly significant to understand the contribution of cities to global climate change. Regions have different opportunities to embed adaptation and mitigation into their strategies, decreasing greenhouse gas emissions and adjusting their socioeconomic systems to a low carbon economy. The analysis of the regional differences serve several purposes as to identify the greatest sources of emissions within a particular region; to provide a basis for developing specific tools; and to contribute to trend analyses in the establishment of future goals and targets.

Approximately in Europe 375 million people live in urban regions. Current trends suggest that these numbers are set to rise even further: by 2030, the European urban population is expected to account for almost 400 million or 80% of the total EU population by the same year. However, as only London and Paris feature on the list of the world's 26 "mega cities" – with a population of over 10 million inhabitants – the EU has a more polycentric structure than the USA or China for example, and is primarily made up of small and medium-sized cities. Around 56% of Europe's urban population – or 38% of Europe's population as a whole – live in cities and towns of between 5,000 and 100,000 inhabitants; 12.3% of Europeans live in cities with a population of over one million inhabitants, while 7% live in cities of over 5 million[13].

The city level has to be a major focus of attention if we want to address the problems of environmental deterioration, global warming and climate change seriously because, in the case of Europe, cities generate around 75% of all CO_2 emissions, which is why they need to be at the forefront of the fight against climate change (Register, 2006).

Yet at the same time, some scholars pointed out that detailed analyses of urban greenhouse gas emissions for individual cities suggest that – per capita – urban residents tend to generate a substantially smaller volume of greenhouse gas emissions than residents elsewhere in the same country (Dodman, 2009). Despite all, undoubtedly cities emit large level of GHG because population require electricity, transportation, and so on. So the challenge to fight climate change has to play in the urban areas.

[13] Committee of the Regions (2012): "The European urban fabric in the 21 st century", *Proceedings of the 5th European Summit of Regions and Cities*, 22-23 March 2012, Copenhagen.

Sustainable growth means to develop better and more intelligent energy networks as the key to ensuring the faster transportation of renewable energy across territories. Cities can reduce their greenhouse gas emissions by improving the energy performance of buildings, promoting cleaner modes of public transport and shifting to more sustainable means of transport. Such initiatives can help to achieve greener and healthier cities but clearly need to be tailored to local conditions, while EU funding must focus on the infrastructure in less developed cities and regions. The initiatives carried out by European Commission, and in general by local authorities, play a key role towards promoting and connecting relevant approaches across Europe.

The Europe 2020 Strategy has, among the others, the objective to enhance resource efficiency, to promote more water efficiency and the use of waste as a resource, to address combating climate change and strengthening the resilience of our territories to climate risks. Europe is moving to a low-carbon world and to a more competitive economy in which is paramount preventing environmental degradation and biodiversity loss. This includes the reduction of greenhouse gas emissions, the promotion of renewable energies and more efficient energy supply systems.

Sustainable urban planning seeks to elaborate an inclusive, ecological and strategic city vision and to develop 'liveable communities' through active citizen participation. It explores the potential of architectural heritage and culture for forging a sense of identity, improving the "local milieu" and feeling of belonging to a city and encourages mixed-use, energy-saving development, which makes urban centres attractive to both commuters and residents alike. Such approaches harbour the potential to develop an integrated political vision of good governance at various levels.

The development and implementation of the European climate change adaptation strategy for 2013 offers a unique opportunity to create a joint approach and reflects efforts cities have made in recent years to be part of related EU policy. Prominent examples, in which the European Commission directly works with cities and city networks, are the "Sustainable Cities and Towns Campaign", "Smart Cities and Communities Initiative" and the "Covenant of Mayors" initiative[14] with which thousand of municipalities commit themselves to reduce their greenhouse gas emissions. Moreover, since 2010, the 'Green Capital Award' has sought to provide an incentive for cities to inspire each other and to share best practices in the area of sustainable urban development.

[14] http://www.eumayors.eu/index_en.html

In conclusion, GHG emissions are significant to study the impacts of climate change that vary considerably across Europe in terms of geographical regions with different types of impacts and different degrees of vulnerability. The increased risk of sea level rise, drought, desertification, floods and other natural hazards calls for territorially different responses.

Interpretation of the geographical pattern of the map 36

This map reflects a regional distribution of emissions across the EU Space that quite is heterogeneous. As shown on tables 1 and 2, there is a clear metropolitan and non-metropolitan areas division equally spread in the new and in the old EU Member States.

It is clearly evident that the concentration of greenhouse gases coincides with the major metropolitan areas of Europe as Madrid, Barcelona, Milan, Rome, Paris, Berlin, and Bucharest.

The Mediterranean regions have medium level of GHG emissions above all in the coastal areas of Spain, France, and Italy. Among the NUTS3, Istanbul is the major emitter of GHG, with the highest level of emissions. In other words, Turkey is the country with the highest level of emissions.

The two largest Spanish metropolitan areas of Madrid-Barcelona together with the Italian ones of Rome-Milan and Naples occupy the top five positioning for the highest level of emissions. Although the city's economy is primarily service based rather than manufacturing based, the electricity is mainly used for household air-conditioning systems.

In the Balcanic area, Poland, Czech Republic and Slovakia are the three regions that more emitted GHG in 2009. This is probably due to the fact that their economy is still developing. Further north, Finland and Sweden have the highest level of GHG with NUTS3 in the urban areas whereas it was found that those levels were lower in the rural and mountain areas.

Ireland has also medium to high levels of GHG mostly concentrated in the area of Dublin.

On the other hand, it is important to say that the lowest levels of emissions are mostly located in the Mediterranean islands and the small urban areas of Germany, Austria, UK and Denmark. This can be easily explained by saying that those are less dense populated areas.

MS code	*Region NUTS-3*	*Regional estimates GHG emissions (exc. LULUCF)*
TR100	Istanbul province	83261.52
ES300	Madrid	62774.90
ES511	Barcelona	51464.55
GR300	Αττική (Attiki)	50252.12
ITC45	Milan	43489.98
ITE43	RomE	41666.27
DE300	Berlin	37907.74
PL127	Miasto Warszawa	34778.67
FR101	Paris	33730.21
DE600	Hamburg	27507.19
TR510	Ankara	27192.39
CZ010	Hlavní město Praha	27085.04
RO321	Bucureşti	23806.07
ITF33	Naples	22969.91
FR105	Hauts-de-Seine	22651.20

Country Code: CZ *Czech Republic;* DE Germany; ES Spain; FR France; GR Greece; IT Italy; MT Malta; PL Poland; RO Romania; TR Turkey

Table 1 The 15 NUTS-3 Regions with the highest share of GHG emissions in 2009

MS code	*Region NUTS-3*	*Regional estimates GHG emissions (exc. LULUCF)*
ES703	El Hierro (Canarias)	81.69
ES706	La Gomera (Canarias)	176.32
AT321	Lungau	188.48
GR243	Ευρυτανία (Evrytania)	193.64
MT002	Gozo and Comino	214.61
UKM66	Shetland Islands	219.82
UKM64	Eilean Siar (Western Isles)	233.07
GR224	Λευκάδα (Lefkada)	243.62
PT166	Pinhal Interior Sul	246.56
PT167	Serra da Estrela	267.32
AT111	Mittelburgenland	305.29
GR131	Γρεβενά□(Grevena)	330.16
DK014	Bornholm	337.32
HR032	Licko-senjska zupanija	339.71
SE214	Gotlands län	342.95

Country Code: AT Austria; DK Denmark; ES Spain; GR Greece; HR Croatia; MT Malta; PT Portugal; SE Sweden; UK United Kingdom

Table 2 The 15 NUTS-3 Regions with the lowest share of GHG emissions in 2009

MS code	*Region NUTS-3*	*Regional estimates GHG emissions (exc. LULUCF)*
DE922	Diepholz	2290.18
RO317	Teleorman	2292.05
ITD37	Rovigo	2292.60
AT122	Niederösterreich-Süd	2293.66
UKK14	Swindon	2307.13
DE803	Rostock, Kreisfreie Stadt	2307.21
HR031	Primorsko-goranska zupanija	2310.24
HU213	Veszprém	2311.50
UKD53	Sefton	2313.62
RO216	Vaslui	2317.09
ITE15	Prato	2318.06
FI185	Päijät-Häme	2327.18
DE933	Harburg	2329.36
GR242	Εὐβοια□(Evvoia)	2333.01
UKJ32	Southampton	2341.98

Country Code: AT Austria; DE Germany; FI Finland; GR Greece; HR Croatia; HU Hungary; IT Italy; RO Romania; UK United Kingdom

Table 3 The 15 NUTS-3 Regions with or close to the median value (2312.56)

Conclusions: urban adaptation to climate change as a priority policy

Cities are dynamic and diverse places that drive and push the social, economic and technologic growth. Considering that around 75% of Europeans live in cities and towns covering about 4% of the continent's land area, cities face specific climate change challenges because they are big consumers of natural resources in absolute terms, using for instance 69% of Europe's primary energy, and are also growing faster than the continent's total population[15]. It is important to underline that European cities tend to use less energy per capita that American or Chinese cities, because of higher population densities, more extensive urban public transport systems, more compact shape and more district heating.

[15] World Energy Outlook 2008, OECD/IEA, 2008 (p.182).

Nevertheless, the resource-efficiency of cities should be further enhanced because undoubtedly cities are large emitters of CO_2 because they host a high share of the population and an even higher share of economic activities. In addition they are particularly sensitive to climate change. On the other hand, working and living in cities is more resource efficient[16] not only because people living in cities take shorter trips to get to work and are more likely to walk, cycle or take public transport but also the majority of households living in European urban areas tends to live in flats or townhouses which require less energy to heat and cool. In addition, district heating systems are more efficient in dense/compact urban neighbourhoods. This context demonstrates that global warming and climate change are intensely interrelated to various socio-economic changes (EEA Report n.2/2012). Consequently it is evident that sustainable growth and climate change have a strongly urban characterization because just here in the cities it is actually most apparent in everyday life with stark impacts involving health, job, infrastructure, business, food. In this sense cities are competing with each other because depend highly on other regions in Europe and beyond.

It is therefore essential to make cities (and people) an integral part of the solution in the fight against climate change. In this sense, world needs cultural revolution: achieving the reduction of GHG emissions and building a better urban environment need also to think green supporting the shift towards a more consciousness use of the natural resources and a change of the habits of the global society (Owen, 2010).

A compact urban model – exactly how the European city is – helps promoting the efforts towards a more sustainable urban society. From an environmental perspective, economics of scale and reduced distances give the compact city many advantages compared to an urban sprawl, such as reduced car dependency, lower emissions, decreased energy consumption, better public transport services and a new lease of life for infrastructure. For policymakers, a compact and dense city can be a way of improving the quality of life for citizens, reducing distances to services and utilities, and preventing social segregation and urban decline.

Regions can play a prominent role in fostering energy efficiency. This is particularly true as regards buildings, where actions must adapt to the local context and climate. These actions are likely to be different between

[16] In the EU, final energy demand per capita was 40 % higher in rural areas than in urban areas (World Energy Outlook 2008). A large share of that difference is due to the higher efficiency of cities. From an energy efficiency point of view, policies that enhance the appeal of urban living and working should be promoted. See: Roadmap to a Resource Efficient Europe COM(2011)571.

urban and rural areas or between places with old versus more recent buildings.

Policies should aim to reduce congestion, promote non-motorized transport and improve the energy performance of buildings. This would also improve air quality, which is lower in cities, and increase the health of city dwellers. However, care should be taken on that these measures do not lead to urban sprawl by shifting jobs and residents to the outskirts of the city. Initiatives to promote cleaner and more efficient transport have to adapt to the local context, focusing on the infrastructure in regions where it is still lacking while targeting the attractiveness of sustainable transport modes and demand management in other regions.

At city level, urban adaptation to climate change represents a challenging new issue for urban policy makers. It could be considered as a priority policy.

Adaptation to climate change offers the opportunity for developing new jobs and promoting innovation and, at the same time, for implementing the profound changes needed in managing the Europe's cities and regions. This will lead the way to a more sustainable and resilient future for people, for the economy and for nature. Some cities are already very ambitious in working on climate policies and many adaptive actions have emerged without guidance or support from higher levels of government (Mickwitz, 2009; Keskitalo, 2010).

In existing urban areas the most appropriate measures involve adaptation at the scale of individual buildings or streets such as insulation, green roofs and modifying street paving for water retention. In new urban developments and restructuring projects, cities can implement structural measures such as the construction of parks, canals, ponds, thermal energy storage and modified sewerage systems. The key players at neighbourhood or city scales are municipal councils and real estate developers with the partnership of housing corporations, companies and private property owners.

In conclusion, public bodies are the best suited to play a leading role in coordinating and managing these adaption efforts. If municipal authorities, developers, housing corporations and private owners consistently incorporate climate resilience into their investments in the urban environment they can minimise the additional costs of climate adaptation.

References

Dodman, D. (2009): "Blaming cities for climate change? An analysis of urban greenhouse gas emissions inventories", *Environment and Urbanization* 2009 21: 185

European Environment Agency, *Greenhouse gas emission trends and projections in Europe 2011. Tracking progress towards Kyoto and 2020 targets*, EEA Report, n.4/2011

European Environment Agency, *Environmental indicator report 2012. Ecosystem Resilience and Resource Efficiency in a Green Economy in Europe*, EEA Report, 2012

European Environment Agency, *Urban adaptation to climate change in Europe. Challenges and opportunities for cities together with supportive national and European policies*, EEA Report, n.2/2012

European Environment Agency, *Annual European Union greenhouse gas inventory 1990–2010 and inventory report 2012. Submission to the UNFCCC Secretariat*, EEA Report, 2012

European Environment Agency, *Resource efficiency in Europe Policies and approaches in 31 EEA member and cooperating countries*, EEA Report, n.05/2011

IPCC (2007). *Fourth Assessment Report Climate Change 2007: Synthesis Report*, Intergovernmental Panel on Climate Change.

Keskitalo, E. C. H. (2010): *Developing Adaptation Policy and Practice in Europe: Multi-level Governance of Climate Change*, New York: Springer

Mickwitz, P. et al (2009): Climate policy integration, coherence and governance, Helsinky: Partnership for European Environmental Research

Owen, D. (2010): Green Metropolis: Why Living Smaller, Living Closer, and Driving Less Are the Keys to Sustainability, New York: Penguin

Register, R. (2006): *EcoCities. Rebuilding Cities in Balance with Nature*, Gabriola Island (Canada): New Society Publishers

3.1.2. Variation of GHG emissions compared to 1990 levels (map 37) and Distance to national 2020 targets in GHG emissions outside the ETS (map 38)

Definition of the indicators

Map 37 refers to the European Environmental Agency EEA's indicator "Total GHG emissions in the EU 1990-2010" that presents anthropogenic greenhouse gas emissions[17] in Europe from 1990 (Kyoto base year) onwards for many sectors such as energy supply and use (including energy industry, fugitive emissions, energy use by industry and by other sectors, excluding the transport sector); transport; industry; agriculture; waste; other non-energy[18]. The indicator does not cover emissions from international bunkers (international aviation[19] and maritime transport), which are not covered by the Kyoto Protocol[20.] In particular, these emissions are not taken into account in the total greenhouse gas emissions reported at national and EU levels. Emissions from land use, land-use change and forestry (LULUCF) are not included in total greenhouse gas emissions. In general terms, GHG emissions are calculated as the product of an emission producing activity and an associated emission factor (expressed as emissions per unit of activity). The aggregated GHG emissions are estimated and reported in units of CO2 equivalents[21]. This is done by multiplying the estimated quantity of a GHG by its Global Warming Potential (GWP).

Data used to prepare the map 37 are consistent with the latest European Community (EC) greenhouse gas inventory report and are referred to EU-

17 Under the UNFCCC and Kyoto accounting and reporting framework six direct greenhouse gases (GHGs) or groups of GHGs compose the so-called "Kyoto basket": carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and the F-gases as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphurhexafluoride(SF6). These are the gases against which emission reduction targets were agreed under the Kyoto Protocol.

18 These sectors are fully consistent with the common reporting format (CRF) set in the guidelines developed by the Intergovernmental panel on climate change (IPCC).

19 Aviation emission will be included in the ETS Phase III from 2013.

20 The Kyoto Protocol (KP) entered into force in February 2005, and to date, has been ratified by 165 countries. These include both industralised and developing countries. According to the KP, the EU-15 agreed (Council Decision 2002/358/EC) to reduce greenhouse gas emissions of each Member state in aggregate by 8% below 1990 levels during the first commitment period of 2008-2012. This agreement sets the contribution of each individual EU-15 Member State towards reaching the common EU Kyoto target. Eastern European Member States have individual targets under the KP, with reduction requirements ranging from 6 % to 8 %. These targets, which range from –8% to +10%, represent either an outright cut in emissions levels for industralised countries, or a lower level increase from current levels compared to an expected 'business as usual' scenario for less developed countries.

21 For example: 1 kg of N2O is equivalent to 310 kg of CO2 in terms of global warming effect.

27 (including the EU-15 country group aggregations) and EU Candidate countries.

Map 38 is based on an EEA's indicator about the share of total man-made emissions of greenhouse gases by sectors included in the so-called "Effort Sharing Decision" such as transport, buildings, agriculture and waste. It's important to stress that these sectors are outside the EU Emission Trading Scheme (ETS)[22]. In particular this indicator was elaborated to show the distance to reduction EU2020 national targets in the GHG emissions for each EU Member State. This indicator has been developed by the European Commission and was included in the Seventh Progress Report on economic, social and territorial cohesion[23].

The EU as a whole is committed to achieving at least a 20 % reduction of its greenhouse gas emissions by 2020 compared to 1990. The total effort for greenhouse gas reductions has been divided between the EU ETS and non-ETS sectors. This objective implies a 21 % reduction in emissions from sectors covered by the EU ETS compared to 2005 by 2020[24]; and a reduction of 10 % in emissions for sectors outside the EU ETS. To achieve this 10 % overall target each Member State has agreed country-specific greenhouse gas emission reduction or limits for 2020 compared to 2005 from sectors included in the 'Effort Sharing Decision' (Decision 2009/406/EC)[25]. GDP per capita was used as the main criterion when setting the targets for Member States. All this is part of a package of policies and measures on climate change and energy that will help transform Europe into a low-carbon economy and increase its energy security. Data used to prepare the map 38 are consistent with the latest European Community (EC) greenhouse gas inventory report and are referred to EU-27 (including the EU-15 country group aggregations).

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22 The share of GHG emissions outside ETS was based on data on the total emissions and emissions within ETS from the EEA.

23 European Commission (2011): The Urban and Regional Dimension of Europe 2020. Seventh Progress Report on Economic, Social and Territorial Cohesion. Luxembourg: Publications Office of the

European Union.

24 The EU emissions trading scheme (ETS) has been operating since 2005 and is now in its final year of its second phase (2008-2012). The annual cap will decrease along a linear trend line which will continue beyond the end of the third trading period (2013 – 2020). Consequently, there are no specific national emissions targets for emissions from ETS sectors in 2020.

25 The "EU 2020 Climate and Energy Package" (Council Decision 2009/406/EC) establishes that the overall emission reduction goal will be accomplished through the EU Emissions Trading System (ETS) and the 'Effort Sharing Decision'. This last decision establishes for the period 2013-2020 annual binding national greenhouse gas emission targets with 2005 as a base year from sectors not included in the ETS – such as transport, buildings, agriculture and waste. This measure creates pressure to improve energy efficiency but does not address it directly. This is being done through the EU's energy efficiency action plan. For further details on this plan, see: Action Plan for Energy Efficiency. Realising the Potential COM(2006)545 final.

Relevance of the indicators

For both maps, this "output" climate indicator is one of the eight headline indicators of the EU2020 Strategy and forms part of the headline target (the EU's so-called 20/20/20 strategy) which indicates the achievement of the sustainable growth pillar26. Indeed, the Europe 2020 strategy aims to reduce GHG emissions by at least 20% (and 30%, if the conditions are right) compared to 1990, and to increase energy efficiency and the consumption of renewable energy both by 20%[27]. This decision unambiguously illustrates the role of the EU in leading the effort to create a climate-compatible energy system.

In the context of the SIESTA Project as well as the EU2020S, GHG emissions is a quite important indicator because is directly related to energy efficiency which is perhaps the only domain of energy policy that contributes to all the fundamental goals of the EU. Reducing GHG emissions is a challenge included in the flagship initiative for a "Resource-efficient Europe" under the EU2020S that is focused on helping decouple economic growth from the use of resources, supporting the shift towards a low carbon economy, increasing the use of renewable energy sources, modernizing our transport sector and promoting energy efficiency[28].

The energy efficiency improves the competitiveness of the European industry, as reported in the flagship initiative "An Industrial Policy for the Globalisation Era" and reduces the vulnerability of European infrastructure to sudden changes in weather or in energy prices.

These two flagship initiatives structure the EU2020S pillar of the "sustainable growth" that is based on some of the typically associated notions to sustainable development like resource efficiency, renewable sources of energy, climate change, etc., but in practice it means primarily building a competitive economy based on green businesses.

In the EU "Territorial Agenda" the reduction and mitigation of greenhouse gas emissions and the climate change's issue are related to the

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26 To measure progress in meeting the Europe 2020 goals, 5 headline targets have been agreed for the whole EU. This limited set of EU-level targets is translated into national targets in each EU country, reflecting different situations and circumstances. The 5 targets for the EU in 2020 are about Employment; R&D/innovation; Climate change/energy; Education; Poverty/social exclusion.

27 A strategy for smart, sustainable and inclusive growth, COM(2010) 2020.

http://ec.europa.eu/europe2020/documents/related-document-type/index_en.htm

These measures known as the "20-20-20" targets are included in the "Climate and energy package" approved by the European Parliament and Council in December 2008 (Council Decision 2009/406/CE).

28 A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy COM(2011) 21.

importance to develop transregional and integrated approaches and strategies[29].

In other words, as several scholars outline as well as different official communications, the achievement of sustainable economic growth has become a (new) strategic priority of the whole European area. The EU has already shown that progress on resource efficiency is possible, for instance because of the extension of recycling practices and overall greenhouse gas emissions reduction since 1990, while in parallel the economy has experimented growth in these two decades (-10% of greenhouse gas emissions while economy has grown by about +40%)[30]. The EU needs more secure energy sources. Reducing GHG means also to think green supporting the shift towards a more consciousness use of the natural resources and a change of the habits of the global society.

Discussion of the geographical patterns expressed by the map 37 and map 38

Introductory notes: reduction of GHG emissions as a European priority

The reduction of GHG emissions is clearly the most important environmental issue intrinsically linked with the way we live. Climate change is very high on the international political agenda as the scientific proof of the human impact on climate change becomes stronger (IPCC, 2007) and as society is becoming aware of the potential consequences of climate change. Human activities and natural events have contributed for a long time to an increase in average global temperatures actually caused primarily by increases in greenhouse gases such as CO2. One of the biggest challenges related to global warming is due to the fact that greenhouse gases are produced, directly or indirectly, for almost all major industries and human activities. This means that it is an environmental issue with a strong "economic value".

For the reasons mentioned above, the energy and the climate change have become a strategic priority for European Commission that is elaborating many decisions and directives.

Climate change and global warming are ones of the great challenges facing European community (and more in general humanity) directly

29 All the documentation related with the Territorial Agenda is available at http://www.eu-territorialagenda.eu

30 A resource-efficient Europe ibidem, pg.3.

related to the capability to achieve sustainable growth and economic progress without damaging our environment.

The sustainable growth objective aims to enhance resource efficiency, to promote more water efficiency and the use of waste as a resource, to address the issue of climate change and strengthening the resilience of our territories to climate risks. Then the major goal is to help the EU prosper in a low-carbon world and in a more competitive economy, preventing environmental degradation and biodiversity loss. This includes the reduction of greenhouse gas emissions, the promotion of renewable energies and more efficient energy supply systems.

Consequentially, the green economy and renewable energy are an ever more important issue in our lives. The Siesta Project recognized a great importance to this rationale thinking a subsection for "climate change, green economy and energy". The focus of EU2020 Strategy and Siesta Project on these issues reflects their importance as a key environmental priority, and the need to provide a path to renewed economic growth and job creation in response to the current severe economic crises facing Europe. Increasing the resource efficiency is the key to securing growth and jobs for Europe. It will bring major economic opportunities, improve productivity, drive down costs and boost competitiveness.

Interpreting the map 37

The map 37 reflects the level of greenhouse gas emissions for each EU Member State for the year 2009, the most recent available year, in comparison to 1990 (Kyoto base year). The description of the geographical patterns, as pictured on map 37, is fully based on the analysis of the data collected by Siesta Project Partners from EEA source.

As table 4 shows, among the Member States greenhouse gas emissions are dominated by the largest emitter, namely Germany that produces about 20 % of the EU-27 total or 919.6 million tones of CO2 equivalents in 2009. Germany is followed by the only three countries that have double-digit shares or United Kingdom (12.2 %), France (11.2 %), Italy (10.6 %). EU-15 MS accounted for 80.6 % of total GHG emissions within the EU-27 in 2009, some 4.3 percentage points above their corresponding share of 1990 base year.

GHG gas emissions were approximately halved between 1990 and 2009 in each of the Baltic Sea regions, where Latvia and Estonia have recorded the largest decrease respectively -59.6 % and -58.9 %. There were also

significant reductions in Lithuania, Romania, Bulgaria and Slovakia. According to the EEA, the main reason for these great reductions in the Baltic and Danube regions was a decline in emissions from heavy manufacturing industries that were either closed or modernised as a result of restructuring measures.

Although they are not parties to the Kyoto Protocol, Cyprus and Malta recorded significant increases in their emission levels. The candidate country Turkey is recorded the largest variation of GHG emission for 2009 compared to 1990 (see Table 7). The Iberian Peninsula (Spain and Portugal) and Iceland are the other countries where was recorded a important increases in GHG emissions.

Among EU-15 MS, Germany (-26.3%) and United Kingdom (-27%) reduced their GHG emissions massively recording the biggest reductions in absolute and relative terms. One reason may be that the UK benefited by switching from coal to natural gas which is now largely in place while Germany has certainly invested in GHG emission reductions, but has been helped in large part because of the reunification (East Germany, like much of eastern Europe and former Soviet states had economic problems, hence less emissions at the time).

MS	*Region*	*GHG emissions in 2009*
DK	Germany	919.6
UK	United Kingdom	566.2
FR	France	517.2
IT	Italy	491.1
PL	Poland	376.6
	EU-27	*4614.5*
	EU-15	*3723.7*

Table 4 This table shows the five EU-27 countries with the highest GHG emissions in 2009 (unit: million tonnes of CO2-equivalents)

MS	Region	Variation of GHG emissions. % change 1990-2009
LV	Latvia	-59.6
EE	Estonia	-58.9
LT	Lithuania	-56.3
RO	Romania	-47.6
BG	Bulgaria	-46.6

Table 5 This table shows the five EU-27 countries with the highest percentage change of GHG emissions reduction compared to 1990

MS	Region	Variation of GHG emissions. Net change 1990-2009
LV	Latvia	40.35
EE	Estonia	41.01
LT	Lithuania	43.60
RO	Romania	52.31
BG	Bulgaria	53.40

Table 6 This table shows the five countries with the lowest GHG emissions compared to 1990

MS	Region	Variation of GHG emissions. Net change 1990-2009
TR	Turkey	197.64
CY	Cyprus	178.29
MT	Malta	138.78
IS	Iceland	135.23
ES	Spain	129.80

Table 7 This table shows the five countries with the highest GHG emissions compared to 1990

Interpreting the map 38

Map 38 reflects for each EU 27 Member States the distance to the national headline 2020 targets in the GHG emissions by sectors outside the ETS in 2009 compared to 200531. Under the Effort Sharing Scheme, Member States have adopted a mix of emission reduction targets and limits on emission increases between -20% to +20%32. Indeed, the distance to the target to which Member States have committed also strongly varies from one country to the other. Each target has been set taking into account the short/medium/large-term development scenario of each national economy.

The 2009 data collected for the findings of the Siesta Project suggest that the EU-wide emission reduction target will be reached by the EU as a whole in 2020. Some countries have already reached their target and only need to maintain this lower level of emissions. Regarding the countries that had committed to limit the increase in emissions like Latvia, Lithuania, Poland, Slovakia, Estonia, Hungary, Czech republic, Malta, Slovenia and Portugal, actually have all reduced them. The majority of these MS are eastern countries located in the Danube and Baltic Sea regions. Among these a number of countries are way ahead of their target, like for instance Hungary and Slovakia which agreed to limit their emissions to no more than 10 % and 13 % respectively and where emissions actually decreased significantly (Hungary actually reduced emissions by 16.9% and Slovakia by 12 %). Moving toward the west United-Kingdom achieved the highest GHG emissions reduction (-18.2 %). Also Portugal the coastal Espon type achieved a good result reducing 6.5% its GHG emissions. In the south of Europe, Greece committed to reducing the emissions by 4 % compared to the 2005 levels and had alread cut them by almost 7 % in 2009. Cyprus has also reduced emissions by 10.5 %.

On the other hand, some Member States will have to reduce their greenhouse gas emissions significantly. For instance Ireland, Denmark and Luxembourg still need to cut their emissions by more than 10 % to reach their target. In other countries, the target for emission reduction is not yet reached but the emissions have started to reduce, for instance in Sweden where the target was set to a reduction of 17 % and the emissions decreased by 11.8 % compared to the levels of 2005. Among the Member States which have not reached their target, as mentioned,

[31] The 2005 is the most recent year for which emissions data are available for each global gas industry.

[32] No data available for Romania and Bulgaria.

the distance to target is the highest in Ireland, Denmark and Luxemburg. It is the lowest in Italy, Spain and Belgium where additional reduction of 0.7 %, 2.2 % and 4.5 % are required to meet the objectives.

The reduction of GHG emissions has been very high in some Member States. In the United-Kingdom emissions were reduced by 18.2 % while in Hungary, they fell by almost 17 %. For most new Member States, the decrease is more modest which reflects the very high level of economic growth these countries are experiencing. Emissions even increased in some countries, like for instance in Malta (+1.4 %) or Poland (+0.3 %).

Geographically, the potential for further emission reductions is proportionally higher in poorer Member States. Most MS are unlikely to reach their national 2020 climate target only with existing measures. EU's cohesion policy can be an important instrument to mobilise the necessary public and private finance.

MS	*Region*	*Distance to the national targets. Percentage point*
IE	Ireland	16.58
DK	Denmark	15.6
LU	Luxembourg	10.08
DE	Germany	7.66
FR	France	6.79

Table 8 This table shows the five countries that are most distant to their national target in 2009

MS	*Region*	*Distance to the national targets. Percentage point*
UK	United Kingdom	-18.2
HU	Hungary	-16.9
SK	Slovakia	-12.3
IT	Italy	-12.2
SE	Slovenia	-11.8

Table 9 This table shows the five countries with the highest GHG emissions reduction outside ETS in 2009

Conclusions: transition towards a low-emissions economy

The climate challenge has emerged as the main pillar of EU policies aimed at accelerating the transition to sustainable energy. As the world's leader on energy and climate policy, the EU faces the twin challenge of living up to its ambitions, while at the same time aiming to stimulate global markets towards a sustainable energy future. Europe as a whole is doing its part to reduce greenhouse gas emissions by pursuing different actions. Indeed, the EU has international commitments in this respect that are understood to be substantial in global environmental terms but also relevant for the economy. To reduce greenhouse gas emissions globally, advancement will also be needed in government policy and programs. Many countries are developing plans to reduce their emissions and are working to build consensus for the next phase of action under the United Nations Framework Convention on Climate Change.

It is clear that is also a problem of competitiveness which is strongly linked in the EU2020S documentation to the development of an economy combating against climate change (low-carbon) and tending to achieve energy efficiency. As reported, these two directions are the main aspirations of the flagship initiative "A Resource-Efficient Europe" and obviously comprised in the idea of implementing a green economy.

Energy efficiency is often seen as the easy place to start in considering GHG mitigation, but exploiting the energy efficiency agenda is not easy. Energy efficiency reduces GHG emissions, addresses energy security, lowers the cost of energy services for consumers, and improves economic competitiveness. Energy efficiency has a great potential of innovation that contributes to create new jobs and new interfaces within the knowledge-based economy.

It is often seen as a 'win-win' option, with benefits realized relatively quickly and lower upfront costs[33]. Yet much of energy efficiency potential remains untapped because of the many obstacles to investments in energy efficiency: inadequate domestic energy prices and lack of payment discipline, insufficient information on suitable technologies, too few contractors and service companies, and financing constraints. Effective energy efficiency interventions combine market-based approaches (which send correct price signals) with regulations (which support changes in

33 "Win-win" options are measures that contribute to both climate change mitigation and adaptation and wider development objectives, e.g., business opportunities from energy efficiency measures, sustainable soil and water management, etc. That is, they constitute adaptation measures that would be justifiable even in the absence of climate change. For example, many measures that deal with climate variability (e.g., long-term weather forecasting and early warning systems) may fall into this category.

practices and behaviors of economic agents). The two components operate coherently only in tandem because regulations will not bring results without adequate energy pricing policy.

Further work is required to develop and intensify territorial cohesion policy, particularly with respect to the consequences of territorially differentiated adaptation strategies. Although EU-27 is doing a lot on the reduction of GHG emissions (-17% for 2009 compared to 1990 levels)[34], it is passing through difficult and troubled times, and we live in a rapidly changing economy. The Climate and Energy Package was expected to be a key driver for GHG emission reductions triggering innovation, and growth and job creation in the low carbon technology industries. As the recent Commission Staff Working Paper[35] "Analysis of options beyond 20% GHG emission reductions: Member State results" states, the ongoing economic crisis has highlighted some limits and costs that the policymakers must take into account. Firstly, the effect of the EU's climate change policies and measures in the period 2005-2008, together with higher energy prices, already resulted in faster emissions reductions than originally expected when the Package was proposed. Secondly, the economic and financial crisis that started in 2008 resulted in further significant emissions reductions and a build up of a large buffer of banked allowances and unused international emission reduction credits in the EU emissions trading system (ETS) – potentially representing the equivalent of 2.4 billion allowances by 2020. This surplus will have a negative effect on the price of allowances in the ETS for years to come, even when taking into account the partial recovery in industrial production in the past two years and further projected economic growth to 2020. Many Member States will achieve their target in the sectors by far outside the ETS under the Effort Sharing Decision.

Thank to these factors, the 2020 GHG emission target is already within reach today. In 2010, EU-27 GHG emissions were 14% below the 1990 level (Including CO2 emissions from aviation). Consequently the low-carbon transformation and innovation effect has been compromised (SWD(2012) 5 final, pag.5).

The Kyoto Protocol is only a first step in addressing the serious global threat of climate change. The ultimate goal of the UNFCCC is to stabilise atmospheric concentrations of greenhouse gases at a level that prevents dangerous human interference with the climate system. Therefore, in

34 http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer.

35 COMMISSION STAFF WORKING PAPER "Analysis of options beyond 20% GHG emission reductions: Member State results", SWD(2012) 5 final (available on http://ec.europa.eu/clima/policies/package/docs/swd_2012_5_en.pdf)

January 2008 the EU Commission put forward a package of proposals that will deliver on the European Union's commitments to fight climate change and promote renewable energy up to 2020 and beyond. The package seeks to deliver a 20% reduction in total EU greenhouse gas emissions by 2020 (relative to 1990 levels) and at the same time increase to 20% the share of renewable energies in energy consumption. The emissions reduction will be increased to 30% by 2020 when a new global climate change agreement is reached.

The EU targets are more ambitious than Kyoto targets and, therefore, likely to require more efforts, sectoral adjustments, and resources from EU members to achieve. In contrast to Kyoto, there are no overall country targets. The national targets are only for non-ETS sectors, while the reduction target for ETS sectors is EU-wide. In the most important ETS sector—power—auctions will be phased in gradually from 2013, and full auctioning of ETS permits is to be in place by 2020.

Other industrial ETS sectors will step up to full auctioning by 2020, while sectors particularly vulnerable to competition from producers in countries without comparable carbon constraints (carbon leakage) will have until 2027 to be phased in. In addition, auctions will be open. Thus, any EU operator will be able to buy allowances in any member state. The EU 20-20-20 package contains both an EU-wide cap-and-trade approach and possible national carbon taxes.

The EU Emissions Trading Scheme for energy-intensive large installations is a cap-and-trade mechanism—policymakers set quantities and the market determines the price. The abatement target for the ETS sectors is EU-wide, and emissions in the EU in 2020 will have to be 21 percent lower than in 2005. For smaller installations and those in less energy-intensive sectors, each member state may specify additional domestic abatement policies to comply with their country-specific targets, and many may consider introducing carbon taxes in these sectors—that is, setting prices instead of quantities. Policymakers can choose between controlling price and controlling quantity, taking into consideration aspects such as transparency, operating (or transaction) costs, public acceptability, dynamic efficiency, revenue and distributional issues, and international harmonization.

A transition towards a low-emissions economy may also present opportunities to the Europe as a whole. As more regions and countries adopt abatement targets, the demand for products and processes with lower greenhouse gas emissions will accelerate. Innovation will be critical in this growing market for clean technology—the expertise and equipment related to new developments in areas such as renewable energy (in

particular, wind power, solar power, biomass, hydropower, and biofuels), electric motors and low emission transportation, energy efficient lighting and appliances, and green buildings.

The energy sector, the dominant source of today's emissions, is also the focus of much clean technology—clean energy. Given the well-established fact that the private sector acting alone will tend to underinvest in research and development (R&D), governments who are moving early towards abatement, such as Poland's, need to consider whether active support to clean technology R&D is an important complementary policy measure.

References

Europe 2020. A strategy for smart, sustainable and inclusive growth, COM(2010) 2020. http://ec.europa.eu/europe2020/documents/related-document-type/index_en.htm

Blakely, E.J. (2007): *Urban Planning for Climate Change*, New Orleans: Lincoln Institute of Land Policy

Corfee-Morlot, J.; Kamal-Chaoui L.; Donovan M.G.; Cochran I.; Robert A.; Teasdale P.J. (2009): "Cities, Climate Change and Multilevel Governance", *OECD Environmental Working Papers* n. 14, 2009

Energy 2020. A Strategy for Competitive, Sustainable and Secure Energy – COM(2010) 639 final

ESPON Climate (2011) "Climate Change and Territorial Effects on Regions and Local Economies in Europe" Final Report

ESPON INTERCO (2012) "Indicators of Territorial Cohesion" Draft Final Report

European Commission (2011): *The Urban and Regional Dimension of Europe 2020. Seventh Progress Report on Economic, Social and Territorial Cohesion*. Luxembourg: Publications Office of the European Union

Greiving S.; Fleischhauer M. (2012): "National Climate Change Adaptation Strategies of European States from a Spatial Planning and Development Perspective", *European Planning Studies*, Volume 20, Issue 1, 2012

Stern N. (2006): *Stern Review on the Economics of Climate Change*. London: HM Treasury

European Environment Agency, *Greenhouse gas emission trends and projections in Europe 2011. Tracking progress towards Kyoto and 2020 targets*, EEA Report, n.4/2011

3.2. Renewables

3.2.1. Share of renewable energy in gross final energy consumption (map 39) and Share of renewable energy in gross final energy consumption. Distance to national targets (map 40)

Definition of the indicator

The *Share of renewable energy in gross final energy consumption* indicator is derived from Eurostat's "Share of renewable energy in gross final energy consumption" at Member State level.

This indicator is calculated on the basis of energy statistics covered by the Energy Statistics Regulation. It may be considered an estimate of the indicator described in Directive 2009/28/EC, as the statistical system for some renewable energy technologies is not yet fully developed to meet the requirements of this Directive. However, the contribution of these technologies is rather marginal for the time being[36]. This indicator is one of the eight headline indicators of the EU2020S and forms part of the headline target which indicates the achievement of the sustainable growth pillar.

The Directive set individual targets for all Member States with a view to reaching an overall EU target of a 20 % share of total energy consumption from renewables by 2020. The targets take into account the different starting points of the Member States, the renewable energy potential and economic performance.

Renewable energy is any energy source that derives directly or indirectly from natural processes related to sunlight, heat stored in the earth or gravitational forces and that is constantly, naturally replenished (IEA, 2011). Renewable energy includes hydroelectricity, biomass, wind, solar, tidal and geothermal energies.

Gross final consumption of energy is defined in Directive 2009/28/EC on renewable sources as energy commodities delivered for energy purposes to final consumers (industry, transport, households, services, agriculture, forestry and fisheries), including the consumption of electricity and heat by the energy branch for electricity and heat production and including

36 More information about the renewable energy shares calculation methodology and Eurostat's annual energy statistics can be found in the Renewable Energy Directive 2009/28/EC, the Energy Statistics Regulation 1099/2008 and in DG ENERGY transparency platform.

losses of electricity and heat in distribution and transmission (Eurostat, 2010).

The gross final consumption of energy from renewable sources is calculated as the sum of: (a) gross final consumption of electricity from renewable energy sources; (b) gross final consumption of energy from renewable sources for heating and cooling; and (c) final consumption of energy from renewable sources in transport (EEA).

In gross final energy consumption the transformation output (electricity or heat produced from other energy sources) is included. Therefore, gross energy consumption is a product specific consumption and does not reflect the demand for primary energy.

The indicator is therefore expressed in % and it has been calculated for 2009 for each EU-Member State plus Norway.

Relevance of the indicator

Share of renewable energy in gross final energy consumption shows the promotion of the use of energy from renewable sources. It is a fundamental indicator because an increased share of renewable energy sources in final energy consumption is thus likely to reduce pressures on the environment and human health resulting from energy production.

The Renewable Energy Directive (Directive 2009/28/EC), part of the climate-energy legislative package adopted in April 2009 by the European Parliament and the Council, sets a target for at least a 20% share of energy that should come from renewable sources in the Community's gross final consumption of energy in 2020. Moreover the directive sets a target of a 10% share of renewable energy specifically in the transport sector.

The strategy must provide a framework at EU level which, while respecting national differences, would not only allow the Member States to outperform their respective targets, but also ensure that the renewable energy sources and technologies are economically competitive by 2020.

Towards 2020 the EU Member States, that must take the decision on what kind of technologies to utilize in order to reach the national targets, will be required to submit policies and plans to promote renewable energy (EU, 2011).

National Renewable Energy Action Plans (NRAPs) will have to establish a clear plan as to how every Member State intends to achieve his target for renewable energy and for renewable energy in transport. Member States will have to explain how they intend to reform building codes and planning

regimes to increase the use of renewable energy and to improve access conditions to the electricity grid.

The use of renewable sources of energy reduces greenhouse gas emissions and diversifies the energy supply. The growth of renewable energy sources also stimulates employment in Europe, the creation of new technologies and increased trade. The introduction of renewable energy will contribute as such to a necessary energy source shift towards a less carbon-dependent economy.

The importance of this indicator is found within the flagship "*Resource-efficient Europe"* which aim is "to support the shift towards a resource efficient and low carbon economy" (p. 3).

MS	***Region NUTS0***	***Share of renewable energy in gross final energy consumption (Year 2009) [%]***
NO	Norway	64.9
SE	Sweden	47.3
LV	Latvia	34.3
FI	Finland	30.3
AT	Austria	29.7

Table 10 This table shows the five countries with the highest share

MS	***Region NUTS0***	***Share of renewable energy in gross final energy consumption (Year 2009) [%]***
MT	Malta	0.2
LU	Luxembourg	2.7
UK	United Kingdom	2.9
NL	Netherlands	4.1
BE	Belgium	4.6
CY	Cyprus	4.6

Table 11 This table shows the five countries with the lowest share

MS	Region NUTS0	Share of renewable energy in gross final energy consumption (Year 2009) [%]
PL	Poland	8.9
DE	Germany	9.8
SK	Slovakia	10.3
BG	Bulgaria	11.6
FR	France	12.3

Table 12 This table shows the five countries close to the median share (i.e. 10.95%)

MS	Region NUTS0	Share of renewable energy in gross final energy consumption (Year 2009) [distance to the national target] [percentage points]
RO	Romania	1.6
SE	Sweden	1.7
EE	Estonia	2.2
SK	Slovakia	3.7
AT	Austria	4.3

Table 13 This table shows the five countries with less distance to the national target

MS	Region NUTS0	Share of renewable energy in gross final energy consumption (Year 2009) [distance to the national target] [percentage points]
UK	United Kingdom	12.1
IE	Ireland	11
FR	France	10.7
DK	Denmark	10.1
NL	Netherlands	9.9

Table 14 This table shows the five countries with more distance to the national target

MS	Region NUTS0	Share of renewable energy in gross final energy consumption (Year 2009) [distance to the national target] [percentage points]
ES	Spain	6.7
HU	Hungary	6.9
FI	Finland	**7.7**
IT	Italy	8.1
SI	Slovenia	8.1

Table 15 This table shows the five countries with or close to the median value (i.e. 7,7)

Explanation of the geographical pattern expressed by the map 39 and by the map 40

Introductory notes: renewable energy as crucial sector to any move towards a low carbon economy and as an opportunity of economic development.

If the current energy supply is structured in such a way that it is rapidly using up resources that cannot be renewed, renewable energy can contribute to the transition from an unsustainable energy path to a sustainable one. Renewable energy is a crucial sector to any move towards a low carbon economy and the use of renewable energy sources is a key element in energy policy, reducing the dependence on fuel, reducing emissions from carbon sources, and decoupling energy costs from oil prices.

Therefore renewable energy is also a sector which offers interesting perspective for the development of new technologies and of new employment opportunities. As the *Energy 2020 strategy for competitive, sustainable and secure energy* point out it is estimated that achieving the EU target of renewable energy contributing 20% of final energy consumption by 2020 could provide about 410 000 additional jobs. Many of these will be close to where the investments are made. (EC, 2010: 9). In this framework regions and cities should accelerate investments in renewable energies and energy efficiency, according to their local energy potential (EC, 2010: 8).

Despite accounting for one-fifth of the world's energy use, the EU continues to have less influence on international energy markets than its

economic weight would suggest. Global energy markets are becoming tighter, with developing Asian countries and the Middle East accounting for most of the growth in global demand (IEA, 2010).

The independent 2010 Renewable Energy Attractiveness Index indicates that US and China cites are at this moment as the best investment opportunities for renewable energy. New stimulus is needed; more than ever EU leadership is called upon to address these challenges (EC, 2010).

Commission's Energy 2020 Strategy highlights how EU infrastructure and innovation policies are supporting the renewable energy sector's development and invites Member States to implement the National Renewable Energy Action Plans, streamline infrastructure planning regimes while respecting existing EU environmental legislation, make faster progress in developing the electricity grid, start integrating renewable energy into the European market and ensure that any reforms of existing national support schemes will guarantee the stability for investors, avoiding retroactive changes (EC, 2011c).

Existing patterns and comparison with ESPON regions: About Map 39

The Map 39 shows that the North of Baltic Sea Region is the geographical area that has the greatest development of renewable energy sources.

In 2009, energy from renewable sources contributed 11.7 % of EU-27 gross final energy consumption.

The highest share of consumption from renewable sources was recorded in Norway that has a share of 64,9%, though outside the EU-27.

Sweden presents a share of 47,3 %, Latvia of 34,3% and Finland of 30,3 %. Austria, as one of the five countries with the highest share, has 29,7 %. Lowest share was recorded in Malta (0.2 %), Luxembourg (2.7 %), the United Kingdom (2.9 %), Netherlands (4,1%), Belgium and Cyprus (4,6 %).

In other words, in Member States the share of renewable energy in gross final energy consumption varies from 47% in Sweden to 0.2 % in Malta.

In Sweden National Renewable Energy Action Plan the Swedish Parliament has developed a prediction that shows that the proportion of renewable energy in relation to the total final energy consumption is expected to be 50.2% in 2020. Sweden will have a surplus of approximately 1.2% in 2020 but the surplus does lie within an uncertainty interval. In energy terms, this surplus corresponds to approximately 5.6 TWh (486 ktoe).

In order to achieve the target of at least 50% renewable energy by 2020, the Government has put forward a number of proposals, including the further development of the electricity certificate scheme for renewable electricity generation. The previous target for new renewable electricity (i.e. to effect an increase of 17 TWh between 2002 and 2016) has been revised and a new target for an increase of 25 TWh by 2020 has been decided on by the Swedish Parliament.

In Malta the penetration of renewable energy is still very low. Malta is dependent on imported fuels and its primary energy supply needs are met by crude oil and oil products. The proportion of oil in the country's balance of total primary energy supply is nearly 100%. To promote renewable energy sources (RES) Malta currently is using a combination of capital grants and net metering for PV and micro-wind, provided that the electricity production from the renewable source is lower than the total consumption within an accounting period of one year.

The differences among member states in respect of the targets and current achievements in the spread of renewable energy reflect different geographical endowments, but depend also on the ambitions of their policy framework.

Sweden, for instance, while having an ambitious policy framework, benefits also from the high share of hydro energy and biomass use in its energy generation.

Latvia, on the other hand, benefits considerably from a high level of biomass use linked to its wood industry.

The geographical pattern designs a division between North-east and South-west of Europe. This division is determined by a north-south axis with lowest share rates that involves the Mediterranean Basin to the North West Europe region.

Countries of Baltic Sea and Danube Space macro regions and Atlantic Axis recorded a higher share in first two areas and medium share in the second.

Existing patterns and comparison with ESPON regions: About Map 39

The Map 40 shows progress made by Member States towards achieving their 2020 targets for renewable energy sources. The situation of Member States also widely varies regarding the distance to the target they have committed.

Some Member States are close to the target they set under the Climate and Energy Package. For instance Romania has to increase the share of renewables by another 1.6 pp to reach it target of 24 % by 2020.

Sweden has to increase the share of renewables by another 1.7 pp to reach it target of 49 % by 2020. And other countries are already close to their 2020 objective, like for instance Estonia, Slovakia and Austria which must respectively add another 2.2, 3.7 and 4.3 percentage points of renewables into final energy consumption for reaching their targets.

For some, the distance to the target is far greater and additional efforts will be required to reach it on time. For example, the United Kingdom and Ireland want to increase their share of renewables by 12 and 11 pp by 2020. And other countries like the France, Denmark and Netherlands must increase the use of renewables by more than 9-10 percentage points to reach their targets. The geographical pattern design a division of European macro-region. The Baltic Sea region the Mediterranean Basin and the Danube Space have countries with less distance to the national target (with few exception for Netherlands, France, Denmark). The arc that involve the North west Europe region to France have more distance to the national target.

Conclusions: to move from policy design to implementation at national level

The theoretically informed study of map 39 proved that there is a remarkable division in European countries in share of renewable energy in gross final energy consumption. If North and Atlantic Axis of Europe have a higher share rates, the South and the Core have lower rates.

Significant development and deployment of renewable energy have been generated by technological progress and policy support. Despite progress, a number of challenges still need to be overcome in order to foster the necessary growth of renewables.

The EU introduced a comprehensive and robust supportive legislative framework but the challenge is now to move from policy design to implementation at national level, with concrete action on the ground. (EC, 2011c).

As IEA report outcomes (IEA, 2011) point out well-known barriers to deployment of renewable energy consist of:

- **economic barriers** such as high upfront capital costs, unknown savings over time due to fluctuating fossil fuel prices, and competition from other well-established technologies that enjoy economies of scale;
- **technical barriers** such as improved storage technology;

- **market and institutional barriers** such as permitting procedures.

In the IEA publication *Deploying Renewables: Principles for Effective Policies* (IEA, 2008), that provides an analysis of policy tools to support renewables, main objectives identified are an integrated approach able to achieve a smooth transition towards mass market integration of renewables, to improve policy and market functioning, maximising long-term cost efficiency while having regard to national circumstances. (IEA, 2008: 180-181).

For this "maintaining a policy framework for renewables — for as long as necessary to bridge the competitiveness gap between renewables and traditional alternative energy technologies — will be crucial." (IEA, 2011: 27)

It is necessary to develop a strategy that will enable renewables to for large-scale use in the decades beyond 2020.

For instance, Europe is "still lacking the grid infrastructure which will enable renewables to develop and compete on an equal footing with traditional sources, to increase the flexibility of electricity systems and allow the integration of larger portions of variable renewable electricity" (IEA 2011: 8).

It is necessary to ensure that the legislation is fully implemented and legal framework must be properly enforced to give investors the confidence to invest in renewable sources.

On other hand, also spatial planning, construction permits and environmental impact assessment procedures are key problems for regulators. In the RES-E sector, one may need to wait for years, especially in countries where the authorities take into account the opinion of many stakeholders that are hard to harmonize. Since RES-E development is not taken into consideration in the spatial planning, every project and project variants have to be evaluated on an individual basis. The number of the often long lasting appeal procedures could be effectively decreased by including RES-E development plans in local and regional spatial planning.

Finally, it will also be important to continue and to sustain effort in research, development and deployment (RD&D) for renewable energy technologies in order to increase productivity and reduce costs (IEA 2011: 8).

References

DG ENERGY transparency platform. Available at:

http://ec.europa.eu/energy/renewables/index_en.htm).

Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF)

European Environment Agency (EEA) website at http://eea.europa.eu

European Commission (2010), Energy 2020. A strategy for competitive, sustainable and secure energy (available at http://ec.europa.eu/energy/publications/doc/2011_energy2020_en.pdf)

European Commission (2011a), Energy Statistics Regulation 1099/2008 (available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:304:0001:0001:EN:PDF)

European Commission (2011b), The flagship "A Resource-efficient Europe" – COM (2011) 21 final (available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0021:FIN:EN:PDF)

European Commission (2011c), Renewable Energy: Progressing towards the 2020 target COM (2011) 31 final (available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0031:FIN:EN:PDF9)

Eurostat, Environment and energy, Statistics in focus (2010), (Authors: Nikolaos ROUBANIS, Carola DAHLSTRÖM, Patricia NOIZETTE) (available at http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-10-056/EN/KS-SF-10-056-EN.PDF)

IEA, International Energy Agency, Co-Generation and Renewables: Solutions for a Low-Carbon Energy Future (2011), (available at http://www.iea.org/papers/2011/CHP_Renewables.pdf)

IEA, International Energy Agency (2010), World Energy Outlook 2010.

IEA, International Energy Agency (2008), Deploying Renewables: Principles for Effective Policies (available at: www.iea.org/textbase/nppdf/free/2008/DeployingRenewables2008.pdf)

Regional policy contributing to sustainable growth in Europe 2020 COM (2011) 17 final (available at http://ec.europa.eu/regional_policy/information/pdf/brochures/rfec/2011_sustainable_growth_en.pdf)

The independent 2010 Renewable Energy Attractiveness Index, Issue 26, August 2010.

3.2.2. Production potential of wind power stations (map 41) and Potential for electricity production from PV panels (map 42)

Definition of the indicator "Production potential of wind power station" (map 41)

The indicator under discussion is derived from by ESPON ReRisk final report's "Production potential of wind power station among NUTS level 2 regions". This indicator identifies those regions in Europe, which have the highest potential for producing electricity from on-shore wind power. The European Environmental Agency [EEA 2009] has introduced some restrictions when calculating the maximum potential, mainly due to environmental reasons.

Wind power potential is mostly measured in m/s, but evidently, raw potential is only part of the story. Policymakers need to know how much wind energy is feasible in practical terms and that calls for the integration of other factors into the analysis. ReRisk has followed these recommendations, using the "restrained" wind potential for the regional analysis, and, as we can see in the map reported, the used indicator in 'restrained' by accounting for the area size of the regions (km2), so the used indicator is defined by the ratio of wind speeds in each region, measured in m/s, between their total areas.

Definition of the indicator "Potential for electricity production from PV panels" (map 42)

The indicator under discussion is derived from ESPON database's "Potential for electricity production from PV panels among NUTS level 2 regions". It is the value of potential for electricity production from PV panels in each region, measured in kwh.

The data refers to the yearly total yield of estimated solar electricity generation (for horizontal, vertical, optimally-inclined planes) [kWh] within the built environment. These types of installations will be the first to become competitive at end-use level with electricity obtained from the central grid, with estimates from the International Energy Agency [IEA 2010] pointing to 2020 as break-even point in the regions with the highest PV potential.

Relevance of both indicators

The Communication "Regional Policy Contributing to Sustainable Growth in Europe 2020" – COM(2011) sets out the role for Regional Policy in contributing to the implementation of the EU2020S, particularly the flagship "Resource efficient Europe", acknowledging that it is delivered in the middle of the cohesion funds' 2007-13 programming period, but urging "to act without delay, invest more in sustainable growth, and use funds more effectively". Encouraging greater strategic focus in investments on sustainable growth with an emphasis on the direction of a transition to a low-carbon economy and the need to accelerate investments in renewable energies is one of the strategies mentioned.

The development of renewable sources of energy is understood to be a way to contribute to curb greenhouse gas emissions but it is also as a smart strategy with a high potential to create job opportunities. Those maps are very illustrative of opportunities for further developments in renewable sources, because highlight the regions with the greatest wind power potential, with high wind speeds and large area size and the regions with the greatest solar power potential, but we realize this map is not the best one to show the regional dimension of green economy but unfortunately data on environment and energy are scarce at regional level. It would probably be useful to collect some data defining indicators that better describe the geographical distribution of successful development in energy production.

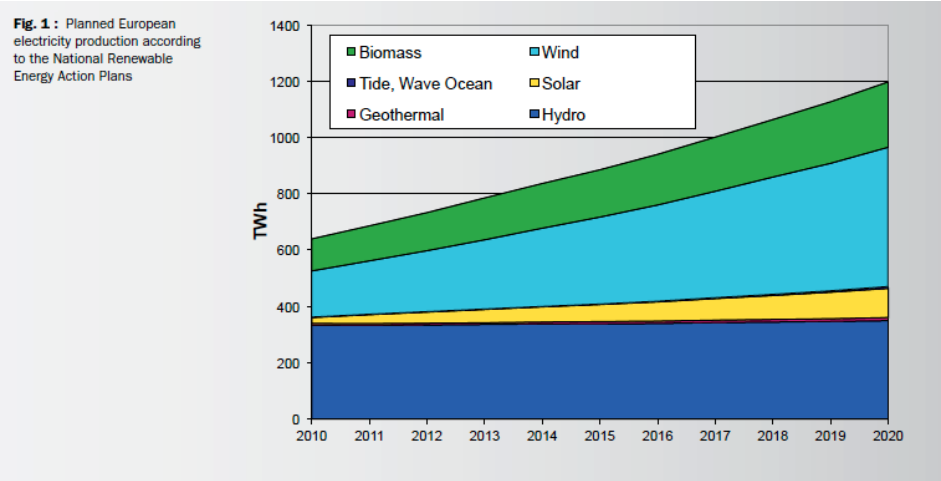

Figure 1 Source: Joint Research Centre's Sunbird data base - 2011

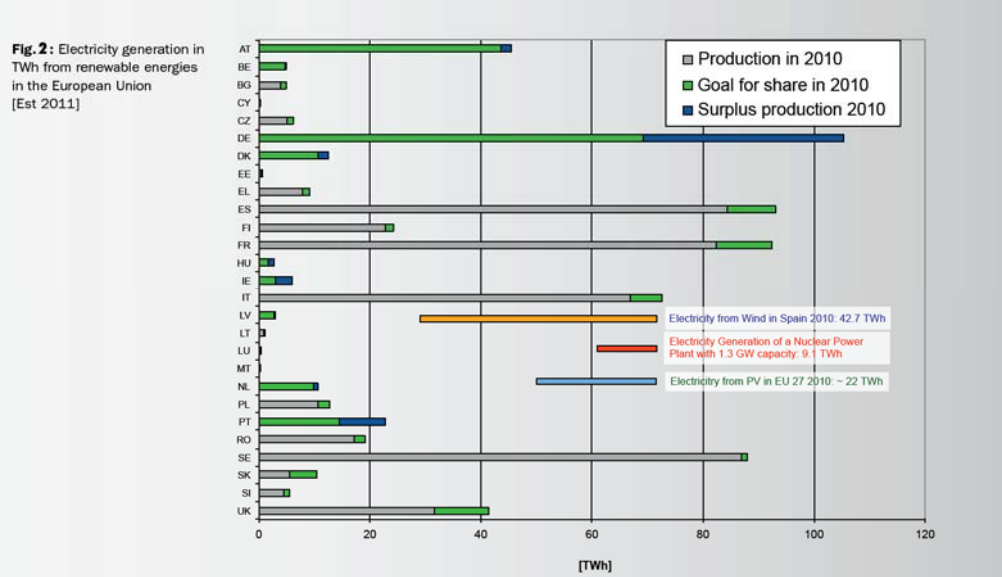

Figure 2 Source: Joint Research Centre's Sunbird data base - 2011

EU2020 targets on renewable energies

The Commission communication of 10 January 2007 entitled "Renewable Energy Roadmap — Renewable energies in the 21st century: building a more sustainable future" demonstrated that a 20% target for the overall share of energy from renewable sources would be appropriate and achievable objectives, and that a framework that includes mandatory targets should provide the business community with the long-term stability it needs to make rational, sustainable investments in the renewable energy sector which are capable of reducing dependence on imported fossil fuels and boosting the use of new energy technologies.

Those targets exist in the context of the 20% improvement in energy efficiency by 2020 set out in the Commission communication of 19 October 2006 entitled "Action Plan for Energy Efficiency: Realising the Potential", which was endorsed by the European Council of March 2007, and by the European Parliament in its resolution of 31 January 2008 on that Action Plan.

The control of European energy consumption and the increased use of energy from renewable sources, together with energy savings and increased energy efficiency, constitute important parts of the package of measures needed to reduce greenhouse gas emissions and comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change, and with further Community and international greenhouse gas emission reduction commitments beyond 2012. Those

factors also have an important part to play in promoting the security of energy supply, promoting technological development and innovation and providing opportunities for employment and regional development, especially in rural and isolated areas.

Renewable energy is crucial to any move towards a low carbon economy. It is also a key component of the EU energy strategy. The European industry leads global renewable energy technology development employs 1.5 million people and by 2020 could employ a further 3 million37. The promotion of renewable energy also develops a diverse range of mostly indigenous energy resources. EU renewable energy policy is relatively young, having started with the adoption of the 1997 White Paper. It has been driven by the need to de-carbonise the energy sector and address growing dependency on fossil fuel imports from politically unstable regions outside the EU. Over that period the focus has shifted from the promotion of renewable energy through indicative targets for the electricity and transport sectors to the definition of legally binding targets supported by a comprehensive legislative framework, and most recently, by a reorientation of European energy infrastructure policy that facilitates renewable energy growth. The new Renewable Energy Directive provides a strong and stable regulatory framework for the development of the renewable energy in Europe. With the transposition of the directive by all Member States by the deadline of 5th December 2010 and the adoption of National Renewable Energy Action Plans, the foundations for determined EU action on renewable energy have been laid.

The political structure of the European Union, with 27 Member States, is quite diverse and there is no unified approach towards renewable energies yet. However, during the European Council Meeting in Brussels on 8-9 March 2007, the Council endorsed a binding target of a 20% share of renewable energies in the overall EU energy consumption by 2020, and a 10% binding minimum target to be achieved by all Member States for the share of biofuels in overall EU transport petrol and diesel consumption [CEU 2007].

In order to meet the new targets, the European Council called for an overall coherent framework for renewable energies, which resulted in the Directive on the "Promotion of the Use of Energy from Renewable Sources" [EC 2009].

37 Commission (ECOFYS) EmployRES study, gross employment effects.

The Directive 2009/28/EC, which went into force on 25 June 2009, amends and subsequently repeals the Directives 2001/77/EC and 2003/30/EC [EC 2001, EC 2003].

The main points of the Directive are:

- Mandatory national overall targets and measures for the use of energy from renewable sources, as well as an indicative trajectory how to reach the targets;
- National Action Plans containing targets for transport, electricity and heating and cooling in 2020;
- Member States shall provide for either priority access or guaranteed access to the grid-system for electricity produced from renewable energy sources;
- Each Member State has to submit a report to the Commission on progress in the promotion and use of energy from renewable energy sources by 31 December 2011, and every two years thereafter. The sixth report to be delivered on 31 December 2021;
- Criteria and provisions to ensure sustainable production and use of bioenergy and to avoid conflicts between different uses of biomass.

This Directive exceeds the targets set within the White Paper "Energy for the Future: Renewable Sources of Energy" [EC 1997] and the Green Paper "Towards a European Strategy for the Security of Energy Supply" [EC 2000]. The goals were that renewable energies should provide 12% of the total and 21% of electric energy in the European Union by 2010, in order to meet the obligations of CO2-reductions pledged in the Kyoto Protocol and to lower the dependence on energy imports.

The White Paper target for the cumulative photovoltaic systems capacity installed in the European Union by 2010 was 3,000 MW or a 100-fold increase of the capacity in 1995. It was assumed that electricity generation from these PV systems would then be in the order of 2.4 to 3.5 TWh, depending under which climatic conditions these systems are installed. The target was already achieved in 2006 and the cumulative installed capacity at the end of 2010 was over 29 GW, almost ten times the original target. As depicted in Figure 2, the overall progress of the European Union towards the 2010 targets was very positive, with about 20% of the Union's total net electricity generation coming from renewable energy sources. However, it should be noted that this development fell short of the 21% needed, and after a 5% decrease of the electricity demand in 2009 compared to 2008, due to the economic crisis, electricity consumption in 2010 increased by 3.2% again. In addition, the

development in the different Member States is quite diverse, as nine Member States have exceeded their targets, whereas some others are lagging behind.

The 2009 Directive indicates the overall percentage of renewable energies for the different Member States, as well as the indicative trajectory how to reach it [EC 2009]. The decision on what kind of technologies to utilise in order to reach the national targets, is left to the Member States. By 30 June 2010, the Member States had to notify the Commission about their National Renewable Energy Action Plans (NRAPs). As stated in the Directive, the aim of these plans is that all Member States, including those which so far have made very limited progress towards agreed EU objectives, will have to establish a clear plan as to how they intend to achieve their targets for renewable energy and for renewable energy in transport. They will have to explain how they intend to reform building codes and planning regimes to increase the use of renewable energy and to improve access conditions to the electricity grid. They will have to set out national sectoral targets, the measures and support schemes to be used to reach the targets, the specific measures for the promotion of the use of energy from biomass, the intended use of (statistical) transfers of renewable energy from other Member States and their assessment of the role different technologies will play in reaching the targets. Moreover, they will have to implement and monitor biofuel sustainability criteria to ensure biofuels clearly contribute to our environmental objectives.

In January 2011, the European Commission published a Communication to the European Parliament and the Council entitled "Renewable Energy: Progressing towards the 2020 target" [EC 2011]. In this Communication the progress of the Member States towards achieving the Renewable Electricity Directive 2001/77/EC was cited as: Only a few Member States, namely Denmark, Germany, Hungary, Ireland, Lithuania, Poland and Portugal expect to achieve their 2010 targets for renewable energy in electricity generation.

The communication further pointed out: Based on Member States' plans, renewable energy should constitute 37% of Europe's electricity mix by 2020. The Energy 2020 Strategy highlighted how the rise of electricity produced from renewable sources also has implications for the electricity market as a whole. Multiple, flexible, smaller scale distributed forms of electricity generation need different grid and market design rules compared to traditional large, centralized power sources.

As a consequence, the Communication calls for a new priority in renewable energy: As the new EU Energy Strategy notes, priority should be given to renewable electricity investments – achieving levels higher

than the 62% of all new power installations in 2009. Further analysis undertaken for the Commission suggests that whilst annual capital investment in renewable energy today averages €35bn, this would need to rapidly double to €70bn to ensure we achieve our goals. Such outlays must be funded, as they are today, chiefly through private sector investment, financed finally by energy consumers.

The Commission's Energy 2020 Strategy38 highlights how EU infrastructure and innovation policies are supporting the renewable energy sector's development, ensuring that renewable energy sources and technologies become economically competitive as soon as possible, thus supporting the growth of renewable energy to achieve our goals. However, as a young and developing industry, these important challenges as well as the dimension of financing will have to be addressed in the coming years.

Until 2008, the development of renewable energy was driven by a loose legislative framework, which set non-binding targets. The "Renewable Electricity Directive" and the "Biofuels Directive" set national indicative targets such that the EU would reach a share of renewable energy in electricity generation of 21% by 2010 and a share of renewable energy replacing petrol and diesel in transport of 5,75% by 2010.

Based on Member States' plans, renewable energy should constitute 37% of Europe's electricity mix by 2020. The projected expansion of electricity from renewable sources carries a number of implications. First, it highlights the need to accelerate the modernisation of the electricity grid. The Communication on Energy infrastructure highlighted that urgent action is necessary to prepare the grid for the integration of significant volumes of electricity produced from renewable sources, facilitating grid balancing, flexibility and distributed generation. Electricity systems have to become more interconnected and flexible, and new infrastructure development and reinforcement will be necessary, including the deployment of smart grid technologies. One of the greatest challenges regarding the grid infrastructure is to connect the offshore potentials, mainly wind, foreseen in the Northern Seas of Europe, developing the electricity network both off- and onshore.

The Energy 2020 Strategy highlighted how the rise of electricity produced from renewable sources also has implications for the electricity market as a whole. Multiple, flexible, smaller scale distributed forms of electricity generation need different grid and market design rules compared to

38 COM(2010)639/3 Energy 2020: A strategy for competitive, sustainable and secure energy.

traditional large, centralised power sources. The market integration of renewable energy should ideally occur in a manner that ensures resources are developed where it makes most economic and environmental sense. Factors such as distance to consumption centres, implied grid needs and issues related to public acceptance and job creation clearly also play a role and cannot be ignored. In any event, support schemes should be adapted over time to apply best practice so as to avoid undue market distortions and excessive costs.

The opportunities for establishing economic growth through innovation and a sustainable competitive energy policy have been recognised. Production of energy from renewable sources often depends on local or regional small and medium-sized enterprises (SMEs). The opportunities for growth and employment that investment in regional and local production of energy from renewable sources bring about in the Member States and their regions are important. The Commission and the Member States should therefore support national and regional development measures in those areas, encourage the exchange of best practices in production of energy from renewable sources between local and regional development initiatives and promote the use of structural funding in this area.

It is appropriate to support the demonstration and commercialisation phase of decentralised renewable energy technologies. The move towards decentralised energy production has many benefits, including the utilisation of local energy sources, increased local security of energy supply, shorter transport distances and reduced energy transmission losses. Such decentralisation also fosters community development and cohesion by providing income sources and creating jobs locally.

The starting point, the renewable energy potential and the energy mix of each Member State vary. It is therefore necessary to translate the Community 20 % target into individual targets for each Member State, with due regard to a fair and adequate allocation taking account of Member States' different starting points and potentials, including the existing level of energy from renewable sources and the energy mix. It is appropriate to do this by sharing the required total increase in the use of energy from renewable sources between Member States on the basis of an equal increase in each Member State's share weighted by their GDP, modulated to reflect their starting points, and by accounting in terms of gross final consumption of energy, with account being taken of Member States' past efforts with regard to the use of energy from renewable sources.

Member States have different renewable energy potentials and operate different schemes of support for energy from renewable sources at the national level. The majority of Member States apply support schemes that grant benefits solely to energy from renewable sources that is produced on their territory. For the proper functioning of national support schemes it is vital that Member States can control the effect and costs of their national support schemes according to their different potentials.

MS code	***Region NUTS-2***	***Production potential of wind power station***
FI1A	Pohjois-Suomi	1795410
SE33	Övre Norrland	1245320
FI13	Itä-Suomi	1031080
FI19	Länsi-Suomi	890264
LV00	Latvia	855688
SE31	Norra Mellansverige	792620
LT00	Lithuania	756792
UKM6	Highlands and Islands	712224
IE01	Border, Midlands and Western	704832
IE02	Southern and Eastern	698516

Table 16 This table shows the ten regions with the highest share (map 41)

MS code	***Region NUTS-2***	***Production potential of wind power station.***
ITC4	Lombardia	1756.52
CH01	Région lémanique	1724.09
AT34	Vorarlberg	1343.85
ITC1	Piemonte	1306.95
CH06	Zentralschweiz	184.158
ITC2	Valle d'Aosta/Vallée d'Aoste	18.4988
CH07	Ticino	8.9732
LI00	Liechtenstein	2.9164
ES63	Ciudad Autónoma de Ceuta	0
ES64	Ciudad Autónoma de Melilla	0

Table 17 This table shows the ten regions with the lowest share (map 41)

MS code	*Region NUTS-2*	*Production potential of wind power station.*
DED2	Dresden	82100.4
UKK3	Cornwall and Isles of Scilly	79180.4
UKJ3	Hampshire and Isle of Wight	78774.8
BG32	Severen tsentralen	77092.8
SK04	Východné Slovensko	76645.6
RO11	Nord-Vest	76352
RO41	Sud-Vest Oltenia	75199.2
ES12	Principado de Asturias	73938.8
HU32	Észak-Alföld	73933.2
DE24	Oberfranken	69864.8

Table 18 This table shows the ten regions with or close to the median share (map 41)

MS code	*Region NUTS-2*	*Potential for electricity production from PV panels.*
PT15	Algarve	1506.24
PT18	Alentejo	1484.34
ES62	Región de Murcia	1464.84
ES61	Andalucia	1453.35
ES43	Extremadura	1450.19
ITG1	Sicilia	1448.35
ES42	Castilla-la Mancha	1429.28
ES30	Comunidad de Madrid	1404.98
PT17	Lisboa	1394.87
GR42	Notio Aigaio	1388.88

Table 19 This table shows the ten regions with the highest share (map 42)

MS code	Region NUTS-2	Potential for electricity production from PV panels.
UKM2	Eastern Scotland	769.709
UKM3	South Western Scotland	764.846
NO01	Oslo og Akershus	750.461
NO03	Sør-Østlandet	744.325
NO06	Trøndelag	743.359
NO04	Agder og Rogaland	741.688
UKM6	Highlands and Islands	741.592
NO02	Hedmark og Oppland	734.945
NO07	Nord-Norge	683.162
NO05	Vestlandet	676.146

Table 20 This table shows the ten regions with the lowest share (map 42)

MS code	NUTS-2 Name	Potential for electricity production from PV panels.
DE25	Mittelfranken	900.935
FR22	Picardie	893.775
CZ07	Střední Morava	893.206
DE12	Karlsruhe	892.656
DE23	Oberpfalz	892.531
DEC0	Saarland	890.082
UKJ3	Hampshire and Isle of Wight	887.156
DEB3	Rheinhessen-Pfalz	884.129
PL42	Zachodniopomorskie	883.897
FI20	Åland	879.359

Table 21 This table shows the ten regions with or close to the median share (map 42)

Explanation of the geographical pattern expressed by the maps 41/42

Introduction notes: from potential to real development

Those maps highlight the regions with the greatest removable energies power potential and we realize that describing the geographical patterns and comparison with ESPON regions of energy power potential it could be irrelevant for the research purposes. Anyway few simple observations could be done, for example, as regards the production potential of wind

power stations, the regions with the highest potential are undoubtedly those that are primarily rural and low population density, while it may be considered irrelevant the contribution that could provide the urban and metropolitan areas and all regions interested in biodiversity conservation policies, this is essentially caused by high levels of environmental impact that wind turbines are still engaging in the concerned territories.

The maximum potential for electricity production from PV panels is instead concentrated on the southern coastal regions, which have varying levels of urbanization enabling the creation of large production facilities in rural areas, since the installation of small plants can ensure in urban areas, substantial amounts of savings on energy consumption of buildings.

These considerations on the potential expressed by the maps in question tell us little about the real development of renewable energies, so we have researched for specific EU2020S documentation, elements from previous ESPON Projects and Scholars' contributions that had processed those indicators or that report renewable energy production development in Europe aware of the risk of straying from the aim of describing the maps geographical meaning.

Existing studies about patterns and comparison with ESPON regions

ESPON ReRisk project focuses on energy prices, energy savings and the development of renewable energies are some of the issues contemplated in this project about regions at risk of energy poverty. On one hand, the Project focuses on new possibilities to support competitive and clean energy in Europe. On the other hand, the Project seeks to generate sustainable energy sources.

Rerisk indicators used for describing different features of energy poverty in the European regions have been submitted to a clustering process in order to identify groups of regions with similar characteristics, which could be addressed by policy initiatives. This process allowed to define the characteristics of Region Typology in relation of own potential production of renewables:

Typology 1a - "With Problems and Potentials"

In relation to the option of renewable energy generation, the medium-high wind power potential as well as a generally very high PV-potential provides an excellent basis for a shift towards alternative energy supplies.

However, the high summer temperatures in combination with moderate winter temperatures make cooling during summer inevitable, while heating requirements during winter are rather limited.

Typology 1b - "Well-off with Troubles Ahead"

In relation to the options of alternative energy resources, this type of region is characterized by both low wind power and low PV potential. The typology includes regions with rural and semi-rural characteristics both in relation to coastal and mountain areas, whose closeness to major urban centres provide them with potential for developing both tourism and second homes. The combination of medium level maximum summer temperature and relatively warm mean temperatures in winter limits the requirement for cooling and heating.

Typology 2 - "Struggling, but Looking for Jobs and a Brighter Future"

With regard to access to renewable energy sources, the typology shows a rather diverse structure. The wind power potential of this group of regions is the second highest in Europe, due to the inclusion of several coastal regions and others with open plains and mountain ridges, providing good opportunities for wind power generation.

Tipology 3 – "Wealthy and Commuting"

In relation to renewable energy sources, the major part of this group of regions is, however, characterized by low potential both for wind power and PV, so these regions should look to other renewable sources to develop, for example energy from waste. The medium level maximum summer temperature in combination with moderate mean minimum temperature limits the need of both cooling in summer and heating in winter.

Typology 4 - "Cool and Windy – but Working"

Three components are characterizing this "cool and windy – but working" typology. Firstly, the general rural characteristics of the regions, with sparsely populated areas. Secondly, this group of regions shows a general pattern of relatively large-sized regions and consequently marked distances between urban centres. And thirdly, these regions have a very high potential of wind power. With regard to energy production and demand, the typology 4 regions are characterized by a very high wind power potential, but also a very low PV potential. Biomass is another renewable energy resource exploited in the regions, and, although it has not been included as an indicator in the general analysis, the fact that

several renewable resources are available at the same time adds to the likelihood that through "learning by interaction" processes and increasing political awareness of the potential economic role of renewable energy, new sources of energy supplies will be tapped. On the negative side, the extremely low maximum July temperatures and very low mean minimum January temperatures create the need of heating during winter – and some times also during summer, and the extreme peripheral location of the regions could pose a problem in view of rising transport costs.

- Specific data on PV development in the regions are available and commented at Joint Research Centre's Sunbird data base, which forms part of the SOLAREC action at the JRC Renewable Energies Unit. This is the source of the analisys about market condition of PV technologies reported below.

The market conditions for photovoltaics differ substantially from country to country. This is due to different energy policies and public support programmes for renewable energies and especially photovoltaics, as well as the varying grades of liberalisation of domestic electricity markets. The legal framework for the overall increase of renewable energy sources was set with the Directive 2009/28/EC, and in their National Renewable Energy Action Plans (NREAPs), 26 Member States have set specific photovoltaic solar energy targets, adding up to 84.5 GW in 2020 (Fig. 1). However, 51.7 GW will come from Germany alone, which makes the balance even more uneven. Especially the sunrich Mediterranean countries only pledged 24.6 GW (8.4 GW Spain, 8 GW Italy, 4.8 GW France, 2.2 GW Greece, 1.0 GW Portugal, and Cyprus and Malta together 220 MW) is far below (factor 2 to 6) the anticipated contribution of these sun-rich countries in order to reach 6% of solar electricity by 2020, where a cumulative installed capacity of about 200 GW in Europe would be needed [Epi 2009]. However, the latest development in Italy, where a limit of support for 23 GW of PV installations by the end of 2017 was given in the 4th Conto Energia [Gaz 2011], indicates that the targets set in the NREAPs should be seen as the guaranteed minimum and not the overall goal. The tremendous growth of the European PV Market to 5.8 GW in 2009, and 13.6 GW in 2010, did not result in a similar growth of the European PV solar cell production, which reached about 3 GW. Further capacity expansions and technology progress are necessary to change this in the future and to secure a leading role of the European PV solar cell industry. However, looking only at the cell production does not grasp the whole picture of the whole PV value chain. Besides the manufacturing of solar cells, the whole upstream industry (e.g. materials, polysilicon

production, equipment manufacturing), as well as the downstream industry (e.g. inverters, BOS components, system development, installations) has to be looked at as well. It is worthwhile remembering that despite the fact that more than two-thirds of the solar cells which are installed in Germany are not produced there, about 60% of the added value remains within the German economy. The dominating support measures for photovoltaics in the European Union Member States and Switzerland are feed in tariffs. The rapid decrease of photovoltaic system prices led to a number of sometimes drastic revisions in the feed-in schemes.

- Directive 28/2009/EC on the promotion of the use of energy from renewable sources requires each Member State to submit a National Renewable Energy Action Plan (NREAP) detailing all legislation affecting renewables (from spatial planning to grids and support mechanisms) and explain what measures will be taken to streamline procedures and generally promote energy from renewable energy sources.

The NREAPs, which follow a binding template, also indicate separate or 'sectoral' targets for electricity, heating, and cooling and transport. Within these sectoral targets, Member States are required to indicate the contribution of each renewable energy (RES) technology and its share of consumption estimated using a high energy efficiency scenario. The EWEA's "EU Energy Policy to 2050" gives a brief overview of the 27 NREAPs and how Member States' targets for wind compare with EWEA's 2009 forecast39. The 27 NREAPs differ significantly in quality and level of detail. However, it remains to be seen how Member States implement the planned measures to increase installed renewable energy capacity and whether they will exceed, reach or fall short of their targets. Nevertheless, analysing the action plans, it is clear the EU-wide ambition for wind energy in 2020 is to reach over 213 GW cumulative capacity (of which 43 GW offshore), producing 495 TWh and meeting 14% of the EU's power consumption. Given the weaknesses identified in the national actions plans concerning potential wind power installations, in particular onshore, EWEA maintains its baseline scenario of 230 GW, and its high scenario of 265 GW. The 27 NREAPs sintesys are reported below:

- With large hydro resources, Austria intends to meet its overall 34% renewables (RES) target largely through the increase of renewables in the power mix. As such, Austria has set itself the highest target of electricity from renewables (RES-E) of any EU Member State: 71% in 2020. Overall,

[39] EWEA, The European Wind Initiative. Wind power research and development for the next ten years. A European Wind Energy Association briefing - June 2010

the Austrian National Renewable Energy Action Plan expects to slightly exceed its 2020 target. However, as the authors of the document have increased the 2005 baseline by over 1 percentage point, the established indicative trajectory has become significantly easier to follow. The authors of the plan expect Austria to exceed 30% RES as early as 2010. The document does not foresee any use of cooperation mechanisms with other Member States. According to the plan, with a cumulative installed capacity of 2.6 GW, wind should represent less than 10% of the RES-E target, covering just below 7% of total electricity consumption in 2020. This is significantly below EWEA's 2009 scenario, which put Austria's 2020 wind potential between 3.5 GW and 4 GW, meeting 9.5% to 11% of electricity consumption. After several years of stagnation in the Austrian wind power market, the action plan expects a handful of new wind power megawatts to come online in 2010, increasing to over 220 MW by 2011. From 2012 onwards, the increase in net annual capacity is expected to diminish by 10 MW to 20 MW per year, reaching 107 MW annually in 2020.

- Belgium has an overall 13% RES target from 2020, up from just over 2% in 2005, the directive's base year. The National Renewable Energy Action Plan indicates that Belgium expects to be slightly above its indicative trajectory throughout, and end in 2020 producing a small excess of 5.4 Kilotonne Oil Equivalent (Ktoe). The Belgian authorities forecast that renewable electricity (RES-E) will represent the largest share of RES in 2020 (20.9%). With an annual production in 2020 estimated at 10.5 TWh, wind energy will cover 9.5% of all electricity consumption. RES in the heating and cooling sector (RES-H) is forecast at 11.9% and renewables in transport (RES-T) at 10.1%. The NREAP does not respect the Commission's binding template and does not present an onshore/offshore breakdown for either installed capacity or power production. However, information obtained by EWEA suggests that Belgium's offshore wind target will be 2 GW by 2020. Nevertheless, net annual wind installations are forecast to grow steadily from just over 200 MW in 2012 to over 480 MW in 2018, 2019 and 2020. It is estimated that by 2020, cumulative capacity will be 4,320 MW, matching EWEA's 2009 forecast. In terms of legislative framework at both regional and national level, the NREAP does not announce significant changes with some new measures foreseen at regional level. Given the recent growth in the wind energy sector, the NREAP's target seems easily achievable.

- Bulgaria's action plan highlights the country's desire to exceed its indicative trajectory and binding target by almost three percentage points - the biggest excess of any EU Member State. The Bulgarian authorities have clearly earmarked this excess for use in co-operation mechanisms with other Member States. It may be difficult for Bulgaria to achieve its

targets in the power sector (21% RES-E up from 11% in 2005), however, given the power mix forecast in the plan. According to the NREAP, more hydro capacity will be installed throughout the ten year period, yet it will apparently produce less electricity than before. Wind power will be the main new RES technology in the power mix, yet its capacity increase is unambitious - from just over 330 MW at end 2010 to 1,250 MW in 2020 (2.3 TWh) - and little solar and biomass capacity is planned. Furthermore, the action plan forecasts virtually no increase in energy consumption from 2005 to 2020, and does not indicate whether the current feed-in system for RES will be extended beyond the current 2015 deadline. With this in mind, the implementation of the Bulgarian National Renewable Energy Action Plan will need further development. Moreover, EWEA considers that by 2020, a cumulative wind capacity of 3,000 MW to 3,500 MW should be achieved.

- In Cyprus with the introduction of a feed-in tariff for large wind power plants, the National Renewable Energy Action Plan expects the largest contribution to the renewable electricity target to come from wind power in 2020. The plan estimates that in 2020, 300 MW of new onshore wind power, producing 0.5 TWh, will cover 6.8% of total electricity consumption. In terms of installed capacity, the targets are in line with EWEA's 2009 scenario. However, the low capacity factors in the Cypriot document (averaging around 20%) may be underestimating wind's electricity production and share of the power mix. Overall, the Cypriot action plan expects the country to meet its 13% RES target in 2020, with 16% RES in the power sector. The plan does not expect Cyprus to participate in co-operation mechanisms with other Member States.

- In Czech Republic the National Renewable Energy Action Plan forecasts that the country will exceed its 2020 13% RES target by half a percentage point. Electricity from renewables should represent 14.3% of consumption by then according to the plan, despite an almost 20% increase in electricity consumption from 2010. The action plan banks on a net growth in wind capacity of 50 MW per year to 2020. Whereas such a capacity increase is consistent with past net average annual growth rates, it would result in an un-ambitious 2020 cumulative capacity of 743 MW; less than half of EWEA's scenario of 1,600 to 1,800 MW. Consequently, the NREAP estimates that wind power will cover less than 2% of gross electricity consumption, well below EWEA's 3.4% to 3.8% estimate. Although the NREAP is lower than EWEA's estimate, even its unambitious targets will be difficult to meet with the changes in the support mechanism and the insufficient simplification of the long authorization procedures outlined in the plan. Finally, the authors do not expect the Czech Republic to

participate in co-operation mechanisms with other Member States or third countries.

- In Denmark, the Renewable Energy Action Plan expects almost 52% of total electricity consumption to be met by renewables in 2020. Almost 60% of this will be wind, with biomass, essentially, making up the rest. The NREAP thus indicates that Denmark is on track to meet and, indeed, exceed its 30% RES target by 0.4 percentage points. In the long term, Danish plans are for 100% renewables. The document indicates that the excess RES is available for use in co-operation mechanisms with other Member States. Denmark's action plan focuses to a large extent on managing consumption, and only a very slight increase in electricity demand is expected between 2010 and 2020. Moreover, the plan indicates that future policies aim to reduce energy consumption in 2020 by 4% compared to 2006. However, the Danish action plan forecasts a decrease in total installed onshore capacity from over 2,800 MW in 2009 to around 2,600 in 2020. This decrease is barely offset by the expected increase in offshore capacity which is forecast at 1,339 MW in 2020, up from 854 MW cumulative capacity at end 2010. Consequently, overall capacity increases are forecast up to 2013; beyond that, apart from small net capacity additions in 2016 and 2017, all other years see more capacity being decommissioned than put online. The plan contrasts with EWEA's scenario, where capacity is expected to reach between 6 and 6.5 GW by 2020. The Danish action plan does not fully exploit the country's re-powering opportunities onshore and downplays the offshore potential. With over 850 MW of offshore capacity online at end 2010, a net capacity increase of less than 500 MW is foreseen. In February 2011, the Danish government published a more ambitious new energy strategy, which aims at meeting 40% of Denmark's 2020 electricity demand with wind.

- Estonia has a 2020 RES target of 25%. The National Renewable Energy Action Plan indicates that in the electricity sector renewables should reach 17.6%. Onshore and offshore wind are the main renewable energy technologies that will contribute to the target, and are forecast to cover 14% of total electricity consumption by 2020 (9% and 5% respectively). With 400 MW of onshore wind power and 250 MW offshore planned for 2020, the Estonian NREAP is above EWEA's forecast of 500 MW. However, EWEA's scenario did not take into account offshore capacity in Estonia. Whereas it should not be problematic for Estonia to reach its onshore target, the offshore target seems more challenging, but feasible. The build-out rates for wind energy are, on the other hand, uneven across the period with new annual capacity onshore peaking in 2012 at over 130 MW and subsequently dropping to less than 40 MW in 2013. No new onshore capacity is foreseen in the action plan after 2014. The first 100 MW of

offshore capacity are programmed to come online in 2016. The uneven onshore growth rate and the sudden stop foreseen in just four years' time do not ensure long term stability in the wind energy sector.

- In Finland the authorities submitted an incomplete National Renewable Energy Action Plan to the European Commission. Nevertheless, the document indicates that Finland expects to meet its 2020 target of 38% RES. The power sector is forecast to meet 33% of electricity consumption from RES. To achieve this, a target of 2,500 MW of wind capacity is set, producing 6.1 TWh or 6% of total electricity consumption. From 2011 to 2015, installed onshore wind power capacity is expected to grow by about 100 MW a year net. In the five subsequent years, net annual increase in wind capacity is forecast to be between 300 and 400 MW. The action plan does not expect any offshore wind installations by 2020 although some 26 MW of near-shore shallow water offshore capacity is currently grid connected in Finland. The wind power target is consistent with EWEA's overall 2020 scenario for Finland of 1,900 to 3,000 MW. The action plan, however, does not take Finland's offshore potential into account in contrast to EWEA's scenario, which includes 400 MW to 1,000 MW of offshore wind capacity.

- In France the National Renewable Energy Action Plan expects around 11% of all electricity consumption in 2020 to be met by onshore and offshore wind power. With regards to France's overall 23% RES target for 2020, 27% of power consumption is planned to be met by renewables. After hydro, with a planned 25 GW, of which 6 GW offshore, wind power is the main renewable technology in the NREAP. The NREAP foresees net annual installations of onshore wind power remaining over the 1 GW mark in 2010 and reaching almost 1.3 GW in 2011. These installation rates are consistent with 2008 and 2009 growth. Net increase in onshore wind power subsequently drops to around 770 MW in 2012 and then grows in a linear fashion to 2020. With a first offshore wind call for tender already announced in early 2011, the French NREAP expects offshore wind build-out to start as early as 2012. Although such timing is necessary to reach the 6 GW offshore wind objective by 2020, it seems overly optimistic considering that there are currently no offshore turbines in French waters. Moreover, a five wind turbine minimum size for onshore wind farms has been introduced and an obligation for wind turbines to be classified under rules governing dangerous industries (ICPE) could jeopardise the development of wind power in the more densely populated areas of the country, characterised to date by small wind projects, and increase administrative burdens. Overall, the French NREAP's projections for wind development are in line with EWEA's 2009 scenario of 23 GW to 26 GW of installed wind capacity, of which 4 GW to 6 GW offshore. However,

without improvements to administrative procedures, and given the late start in developing offshore, achieving the targets could be a challenge.

- In Germany, the National Renewable Energy Action Plan was published before the authorities had completed discussions on the national energy strategy to 2050 (Energiekonzept). Therefore, the document indicates that changes in some of the future activities or the figures could occur. Nevertheless, the NREAP indicates that Germany will meet its binding 2020 target of 18% RES domestically and, moreover, exceed it by 1.6 percentage points. However, the authors of the document increased the 2005 baseline figure by 0.7 percentage points for statistical reasons, consequently making it easier to follow the outlined trajectory and meet the end target. The document underlines the authorities' intention to use the excess in co-operation mechanisms with other Member States. Energy efficiency is highlighted as a key factor in the plan with consumption set to decrease. Renewables in the power sector play a dominant role in the action plan with 38.6% of electricity demand expected to be met by RES in 2020. Wind has the largest share with onshore and offshore capacity accounting for 52% of the target, or almost 20% of all electricity consumption. In terms of build-out, the action plan expects new net annual onshore capacity to decrease steadily from over 1.6 GW in 2011 to less than 300 MW in 2020. Conversely, new offshore capacity increases steadily from under 300 MW in 2010 to over 1,700 MW in 2020. Overall the plan forecasts 45,750 MW in 2020, 10,000 MW of which offshore. Consequently the onshore ambition is lower than in EWEA's scenario,

Achieving 80-95% emissions reductions whilst offshore is in line with the scenario's higher end. The action plan, therefore, seems to under-estimate Germany's onshore wind development potential and the effects of re-powering.

- Greece has a binding RES target of 18% by 2020, up from 6.9% in 2005. The Greek authorities have planned to overshoot the target by over two percentage points. To reach the overall target, the National Renewable Energy Action Plan focuses on the power sector. Almost 40% of electricity consumption is forecast to be met by RES in 2020. Onshore and offshore wind power should represent the lion's share of the renewable power market and are forecast to meet 24.5% of the country's electricity consumption in 2020. To achieve this, the action plan banks on reaching 7.5 GW of total installed wind capacity, of which 300 MW from offshore installations, by 2020. The net annual increase in wind power capacity is expected to be constant at around 600 MW. Offshore deployment is not expected to start before 2016 and is projected to grow consistently by 50 MW a year. In 2020, offshore build-out is expected to

increase to 100 MW. The Greek action plan's forecasts for wind capacity and share of the power mix are in line with EWEA's scenarios.

- In Hungary the authors of the National Renewable Energy Action Plan forecast that the country can reach 14.7% renewables in gross energy consumption by 2020, exceeding their 13% binding target by 1.7 percentage points. The heating and cooling sector is seen in the NREAP as the biggest contributor (18.9% RES in consumption), with the electricity sector meeting just under 11% of consumption with renewables. Biomass and wind are the two main renewable technologies in the electricity sector, with wind scheduled to meet over 3% of total consumption. The build-out rate for new wind power throughout the period is, however, extremely uneven with new annual capacities peaking in 2013 and 2017 at over 100 MW and with troughs in 2015 and 2016 of around 10 MW. The action plan forecasts that cumulative capacity for wind power will reach 750 MW in 2020. This is an unambitious target that suggests that only around 400 MW of new wind capacity will be built between 2010 and 2020. EWEA's 2009 forecast expects Hungary to reach 1.2 GW of installed wind capacity in the same timeframe.

- The Ireland's National Renewable Energy Action Plan banks on the power sector to meet its binding target. The plan aims to meet 42.5% of electricity consumption from RES. Wind is the technology of choice in the plan, accounting for 86% of the RES-E target and some 35% of total electricity consumption. Over 4.6 GW of installed wind capacity are forecast in the Irish plan, of which 555 MW from new offshore installations, which is lower than in EWEA's scenario. Both the onshore and offshore build-out rates vary significantly from one year to the next, following no particular growth pattern. Net capacity increase oscillates year on year from 240 MW to 40 MW in the period between 2011 and 2015. Subsequently, there is a two-year lull with 31 MW and 41 MW net capacity increase in 2016 and 2017 respectively. This is followed by a considerable increase in 2018, a further slump with net capacity increasing by 25 MW in 2019, and a 740 MW net peak in 2020. Indeed, the build-out will be continuously stopping and starting, an issue that should be addressed in order to provide the industry with greater stability.

- Italy is one of the two Member States to indicate inits National Renewable Energy Action Plan that it will not meet its 17% RES target domestically, forecasting a shortfall of 0.85 percentage points in 2020. Consequently, the Italian authorities intend to turn to the co-operation mechanisms, indicating a preference for physically imported RES from countries outside the EU. Nevertheless, the Italian action plan intends to meet some 27% of the country's electricity consumption with renewables

by 2020, with onshore and offshore wind power providing just over 5% of total electricity consumption, requiring a cumulative capacity of just below 13 GW, of which 680 MW from offshore installations. The onshore target is significantly (3 GW to 5 GW) lower than what EWEA considers the Italian market can deliver and, indeed, the action plan suggests an annual build-out rate greatly inferior to that which the Italian market has delivered for the past four consecutive years. However, the NREAP highlights delays in the authorization procedures for new RES plants and grid development without offering a solution to end them. Moreover, the document announces revisions of the support scheme which may result in an undermining of investor confidence. These weaknesses in the plan could result in investor caution unless improved with the introduction of future policies.

- The Latvian National Renewable Energy Action Plan expects Latvia to reach its overall 2020 target of 40% RES with almost 60% RES in the power mix. The plan sets ambitious targets for both on- and offshore wind energy - to meet 6% and 4% of total electricity consumption respectively. With over 230 MW of cumulative onshore wind capacity and 180 MW of offshore capacity foreseen by 2020, Latvia is above EWEA's scenario of 200 MW to 300 MW. Onshore build-out is expected to remain steady until 2015 then drop dramatically. In 2017, annual capacity increase is expected to pick up again. Offshore, the first megawatts are expected in 2016 following a steady annual build-out to 2020.

- The Lithuanian National Renewable Energy Action Plan aims to exceed the Lithuania's binding 23% RES target in 2020 by one percentage point. The 2020 target should be met as early as 2017. Electricity from renewables is expected to reach 21% of total consumption. The technology of choice is wind power, which, according to the projections, would produce 1.3 TWh a year and contribute to almost half the renewable electricity target or 9.4% of gross electricity consumption. The plan expects installed wind power capacity to reach 500 MW by 2016. No increase in wind power capacity is forecast from then on. In terms of buildout, installed capacity is expected to double in 2010 to reach almost 180 MW. 2011 is expected to deliver significantly less new wind capacity whereas the subsequent three years would see a steady annual build-out of 50 MW net. Following a slight slow-down in 2015, a new boom of over 110 MW is expected in 2016. The action plan's projections for wind capacity are half of EWEA's scenario, an indication that wind power's full potential may not have been taken into account. The Lithuanian NREAP indicates, finally, that the country is willing to use its projected surplus RES production in co-operation mechanisms with other Member States.

- Luxembourg, according to its National Renewable Energy Action Plan, will not meet its 11% RES target by 2020 due to lack of resources in the country. Consequently, the Luxembourgish authorities are looking into co-operation mechanisms with other EU Member States to set up joint projects in order to make up a forecast 2.1 percentage point shortfall. Nevertheless, wind power is considered in the action plan as a key technology for increasing RES penetration. Almost 100 MW of new capacity are forecast, bringing cumulative capacity in 2020 to 131 MW. Wind power is forecast to cover 3.6% of electricity consumption, a third of all electricity from renewables. According to EWEA's scenario, on the other hand, 300 MW of installed wind capacity in Luxembourg could cover up to 14% of the country's electricity consumption, more than the sum of all the RES-E technologies in the NREAP.

- In Malta, starting from no renewable energy at all in 2005, the Maltese National Renewable Energy Action Plan aims to slightly exceed the country's 2020 target of 10% RES. The power sector is due to play the most significant role, achieving 13.8% of consumption covered by RES. Offshore wind is the technology of choice, planned to meet 7% of total electricity consumption. The Maltese NREAP highlights three planned government calls for tender for 110 MW of installed wind power capacity. There is one tender for a 95 MW offshore project, and two onshore tenders totalling 14.5 MW. The planned onshore wind capacity is scheduled to be built between 2012 and 2015, whereas offshore build-out is scheduled for 2016 and 2017. Malta's overall installed capacity target is similar to EWEA's scenario (100 MW to 200 MW) although EWEA considers that Malta could develop its onshore potential more thoroughly than planned in the NREAP.

- The Netherlands intends to exceed its 2020 RES target by half a percentage point to reach 14.5% RES in energy consumption. The National Renewable Energy Action Plan, furthermore, indicates that this surplus is not intended for co-operation mechanisms with other Member States as it is a first step to setting a more ambitious national target. To reach the overall target, the Dutch plan estimates that 37% of renewable electricity is required. Two-thirds of this sectoral target is to be met by onshore and offshore wind power, which will supply 10% and 14% of total electricity consumption respectively, according to the plan. Two offshore licensing phases are scheduled to deliver almost 6 GW of new offshore capacity, 5,178 MW of which to be operational by 2020. Onshore, the action plan aims to triple installed capacity to 6 GW. The document, however, does not indicate any new capacity in 2010 or 2011. Onshore build-out is scheduled to pick up from 2012 to 2015 with net annual additions varying between 415 MW and 800 MW. From 2016, new onshore

additions are forecast to stabilise at 320 MW net per year. New offshore capacity is expected by 2013, with annual build-out reaching its cruising speed at 800 MW net from 2016 onwards. The Dutch NREAP's forecasts for wind energy broadly match EWEA's high scenario.

- Poland, according to the Polish National Renewable Energy Action Plan, will exceed the RES penetration trajectory set by the EU directive and exceed its 2020 binding 15% target by 0.5 percentage points. Renewable electricity will account for over 19% of all electricity consumption according to the document, meaning that the sector will have a larger contribution to the overall target than renewables in heating and cooling (17%) and renewables in transport (10.1%). Wind will be the technology of choice, with onshore generation meeting 8% of total electricity consumption and offshore generation covering a further 1%. Biomass is forecast to meet 8% of gross electricity consumption. Other technologies such as hydro and solar PV will play a more marginal role. However, with a cumulative capacity target of 6.7 GW, up from over 1 GW in 2010, the Polish NREAP lacks ambition for wind. EWEA's 2009 forecast suggests that installed wind capacity in Poland could reach between 10 GW and 12 GW in the same time frame. Build-out rates for new onshore wind capacity are forecast as stable between 450 MW and 520 MW per year, only slightly above the 382 MW installed in 2010. The first 500 MW of offshore capacity should come online in 2020 - in line with EWEA's forecast.

- Portugal's binding 2020 RES target is 31% up from 20.5% in 2005, although the authors of the National Renewable Energy Action Plan have reduced the 2005 starting point to 19.8%. The overall target has been split into 55.3% electricity from RES, 30.6% heating and cooling from RES and 10% RES in transport. According to the plan, with an annual production of 14.6 TWh, wind power should be the country's leading RES technology covering almost 23% of electricity consumption with a cumulative installed capacity of 6,800 MW onshore and 75 MW offshore by 2020. These targets are below EWEA's scenario whereas wind's share of the power mix is similar in the two forecasts, although the NREAP indicates a 17% increase in electricity consumption between 2010 and 2020. The forecast build-out rates in 2011 and 2012 are similar to recent developments in the Portuguese market (around 670 MW net annual increase). Subsequently there is a two year lull in new wind build-out, with a further 500 MW net capacity coming online in 2015. 2016 and 2017 are also forecast by the plan to be quieter years. Offshore build-out is seen as starting in 2015, with the first 25 MW installed and the remaining 50 MW all being installed in 2020. Furthermore, capacity factors for wind turbines seem to have been underestimated in the document. Therefore, production could be above what is projected and could lead to a future re-

think of RES-E targets. The NREAP indicates that more RES-E production could be achieved with improved cross-border interconnection. Consequently no excess RES for use in co-operation mechanisms with other Member States is currently envisaged in the plan. Should interconnectivity with the rest of Europe be increased, the Portuguese authorities could review their position and exceed their trajectory and 2020 targets.

- The National Renewable Energy Action Plan for Romania expects the RES share to increase but stay below the trajectory determined by the RES directive. The "indicative trajectory" is a series of target average levels of renewable energy production over two-year periods up to 2020. As Romania intends to reach its target level only in the second year of the two-year periods, its averages will be below target. Nevertheless, the final 2020 target of 24% RES is considered achievable. The Romanian NREAP, however, makes no mention resorting to the flexibility mechanisms to compensate for the forecast deficit. Wind power is expected to benefit from a spectacular growth rate up to 2013, adding over 600 MW net a year. The net annual increase slows down from 2014 onwards, especially from 2016 as the support mechanism is scheduled to be discontinued. Overall, however, the Romanian action plan expects some 4,000 MW of capacity to be installed by 2020. This would cover almost 11.5% of total electricity consumption and position wind as the main RES power technology after hydro. The Romanian NREAP's projections for wind power are above EWEA's scenario, which estimates 3,000 MW to 3,500 MW of cumulative capacity meeting 7.7% to 9% of electricity consumption by 2020. However, considering the wind and land resources, investor interest and banking on the final adoption of the emissions reductions new RES law early in 2011, the action plan's targets do not appear overly ambitious. The Romanian Wind Energy Association has a more ambitious scenario for 2020, reaching 5 GW of installed wind capacity.

- Slovakia's National Renewable Energy Action Plan indicates that the country could exceed its 2020 RES target of 14% by 1.3 percentage points. The power sector is expected to contribute the most to the overall target by increasing the share of renewables from around 16% in 2005 (mainly hydro) to 24% in 2020. After hydro and biomass, wind is forecast to make the biggest contribution to the renewable power mix in 2020, with a planned 350 MW which would feed 600 GWh into the grid and cover around 2% of total electricity consumption. Slovakia's ambitions fall short of EWEA's scenario. EWEA's scenario estimates that 800 MW to 1.000 MW of wind power could be installed by 2020, meeting up to 5% of the country's electricity demand. Moreover, the build-out of wind power set out in the action plan is irregular, with two large chunks of around 150

MW net expected to come online in 2012 and 2015, and a further 50 MW net in 2018. Exceeding its indicative trajectory and binding 2020 target, the action plan indicates that some excess RES is available for use in co-operation mechanisms with other Member States.

- Slovenia is set to meet its 25% 2020 RES target and, indeed, slightly exceed it according to its National Renewable Energy Action Plan. In the power sector, renewables are forecast to meet almost 40% of the country's electricity consumption, with onshore wind meeting an un-ambitious 1.3% of overall electricity demand. In all, the plan indicates just over 106 MW of installed wind capacity in 2020, a fifth of EWEA's scenario. EWEA's calculations show that by 2020 wind could cover between 6% and 9% of electricity demand. Build-out of wind projects is not expected to be constant, rather the action plan indicates that new wind capacity will be installed in 2010, 2013, 2015 and 2019. The newly adopted feed-in tariff limiting support to projects of 5 MW and under may be hindering perspectives for wind power development. The action plan indicates that Slovenia is not planning to participate in co-operation mechanisms with other EU Member States. However, rules on how such co-operation should be envisaged are being drafted.

- Spain's National Renewable Energy Action Plan aims to exceed the country's binding 20% target by almost three percentage points. The authorities clearly intend to use the excess in co-operation mechanisms with other Member States. The document emphasises the role of the power sector in reaching the overall target and forecasts that 41% of all electricity consumption will be met by RES in 2020, with wind power alone expected to meet half this amount. Surprisingly, however, the action plan has reduced wind power capacity ambitions to 35 GW onshore, with build-out rates below what the Spanish market has delivered in recent years. This is 4-5 GW less than in EWEA's scenario. The 3 GW offshore target, on the other hand, is more ambitious than expected, with first capacity scheduled to come online in 2014. The feasibility of this amount of offshore in a six-year time frame – two to three times higher than in EWEA's scenario – remains to be verified.

- Sweden has the highest RES target of any EU Member State, set at 49%, up from 39.8% in 2005. The Swedish National Renewable energy Action Plan, furthermore, raises the country's RES ambitions to 50.2% RES in final energy consumption with 63% RES in electricity consumption. With a forecast cumulative wind power capacity of just over 4.5 GW in 2020, wind should cover 8% of final electricity consumption. Onshore build-out is forecast as being stable at just under 260 MW net a year. With no offshore-specific support mechanism foreseen in the action plan, little

increase in offshore capacity is forecast. In fact, the Swedish NREAP indicates that in 2010 there will be 76 MW of offshore wind capacity, growing by 10–11 MW net per year up to 2020 to reach a cumulative capacity of 182 MW. According to EWEA, at the end of 2010, there were already 164 MW of offshore wind capacity in five wind farms: Bockstigen, Utgrunden 1, Yttre Stengrund, Lillgrund and Gässlingegrund (an inland lake). Moreover, the projected build-out rate of 10/11 MW per year seems unlikely considering the average size of offshore wind projects. Concerning offshore, therefore, the Swedish action plan looks inaccurate. Overall, EWEA's scenario put wind capacity in Sweden at around 6 GW to 8 GW onshore in 2020, with a further 3 GW offshore.

- The United Kingdom has an overall 15% RES target for 2020, up from just over 1% in 2005 and its National Renewable Energy Action Plan expects the target to be met. The largest contribution to the overall target is expected from the power sector (30% of total electricity consumption). The document forecasts that around 70% RES-E in consumption will come from onshore and offshore wind, with onshore wind representing 9% of total electricity consumption and offshore wind 12%. To achieve this, the NREAP foresees an increasing build-out of onshore projects from the beginning of the period until 2018, followed by a slightly smaller – yet still over 1 GW net - onshore market for 2019 and 2020. Cumulative capacity in 2020 is estimated at almost 15 GW. For offshore, on the other hand, the NREAP assumes a constant increase in the annual market from just under 600 MW net in 2011 to almost 1,700 MW net annually in 2020, to reach a cumulative target of 13 GW. The NREAP, therefore, seems to lack offshore ambition, where the national wind industry body, Renewable UK, considers 20 GW of offshore capacity an achievable target for 2020.

References

EWEA, "EU Energy Policy to 2050" - March 2011

Huld, T. et al. (2011): *A Database of Direct Normal Irradiation for Predicting Long-Term Performance of Concentrating PV Systems in Europe and Africa*, European Commission DG JRC, Ispra (Italy)

Polverini, D. et al. (2011): *Effects of Operating Conditions on Thin Film Amorphous and Microcrystalline Silicon Module Performance*, European Commission DG JRC, Ispra (Italy)

Polverini, D. et al. (2011): *A Validation Study on Series Resistance Calculation According to IEC60891, ED 2.0*, European Commission DG JRC, Ispra (Italy)

Sample T. et al. (2011): *Results of the International PV Module Quality Assurance Forum and the Road Ahead*, European Commission DG JRC, Ispra (Italy)

Jaeger-Waldau, A. (2011): *PV Status Report 2011: Research, Solar Cell Production and Market Implementation of Photovoltaics*, European Commission DG JRC, Ispra (Italy)

Communication from the commission to the European Parliament and the Council. *Renewable Energy: Progressing towards the 2020 target*. Bruxelles, 31.1.2011 - COM(2011) 31 final
ReRisk (Regions at Risk of Energy Poverty) project (2010), Final Report (v. 5/11/2010) (available at http://www.espon.eu).

COM(2010) 677 Energy infrastructure priorities for 2020 and beyond - A Blueprint for an integrated European energy network.

COM(2010)639/3 Energy 2020: A strategy for competitive, sustainable and secure energy

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 and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources.

3.3. Energy efficiency

3.3.1. Energy intensity of the economy (map 43)

Definition of the indicator

The energy intensity indicator is derived from Eurostat's "Energy intensity of the economy" at Member State level. This indicator is one of the eight headline indicators of the EU2020S and forms part of the headline target which indicates the achievement of the sustainable growth pillar. As defined by Eurostat, the energy intensity indicator measures the gross inland consumption of energy per unit of GDP. The indicator is therefore expressed in kilograms of oil equivalent per 1000 EUR of GDP. Five energy sectors are taken into consideration for the calculation of the indicator: coal, electricity, oil, natural gas and renewable energy sources. The indicator has been calculated annually for the period 1990 – 2010 for each EU-27 Member State, Candidate Country except Montenegro, Iceland and Norway.

Relevance of the indicator

Energy intensity of the economy is a fundamental indicator which is able to point out the progresses, if any, made towards the reduction of energy consumption. Energy related targets within the Union are of paramount importance and underpin strategies and programmes undertaken and issued over time by the EU. The Europe 2020 Strategy underlines the importance of achieving a low-carbon society and economy through increased energy efficiency and greater use of renewable energy sources as well as the need to tackle climate change by reducing greenhouse gas (GHG) emissions. The proposal for a new Energy Efficiency Directive earlier in April 2012 highlighted the need to put into effect new measures if the 20% energy efficiency target is to be achieved.

The importance of this indicator is found within the two flagships "*Resource-efficient Europe"* and "*An industrial policy for the globalisation era"* where recommendations are made including technological improvements and innovations in industrial, agriculture and transport systems as well as a change in behaviours.

The five MS with the lower ratio	
Member State	**Ratio**
DK	105.19
UK	112.39
IE	112.65
IT	140.84
AT	142.41

Table 22 This table shows the 5 EU-27 Member States (MS) which show the lower ratios of energy intensity of the economy for the year 2010. The ratio is expressed in Kilograms per 1000 EUR of GDP.

The five MS closer to the median value	
Member State	**Ratio**
PT	179.73
MT	181.24
NL	**181.52**
CY	207.15
BE	212.16

Table 23 This table shows the 5 EU-27 Member States (MS) which show the closer-to-median ratios of energy intensity of the economy for the year 2010. The ratio is expressed in Kilograms per 1000 EUR of GDP.

The five MS with the higher ratio	
Member State	**Ratio**
SK	502.01
CZ	503.08
RO	588.04
EE	701.33
BG	853.77

Table 24 This table shows the 5 EU-27 Member States (MS) which show the higher ratios of energy intensity of the economy for the year 2010. The ratio is expressed in Kilograms per 1000 EUR of GDP.

Discussion of the geographical pattern of map 43

Introductory notes: the pattern of energy intensity is split in two

The energy intensity of the economy is a fundamental indicator which shows the energy efficiency of a country's economy. A reduced and efficient consumption of energy is of paramount importance to achieve climate change targets and lower impacts on the environment. However, the stress the EU places on the achievement of an energy efficient economy is within the National Reform Programmes where national targets are for the most part considerably lower than the EU 20% objective. As the Annual Growth Survey 2011 in its Annex 1 points out that, in order to achieve a more energy efficient economy, there is a need for improved and less energy-consuming technologies within all sectors of the economy, especially supporting manufacturing and SMEs, and for a change in households behaviours and by assisting consumers to value resource efficiency (EC, 2011a) The Europe 2020 strategy underlines that "m*eeting our energy goals could result in € 60 billion less in oil and gas imports by 2020"* and that renewable energy sources targets coupled with energy efficiency targets could result in over 1 million new jobs (EC, 2010a: 13).

The geographical pattern of the energy intensity indicator shows characteristics which are not surprising, highlighting a marked division between advanced and less developed economies. In fact, all EU-15 Member States show an energy intensity ratio below 300 and only Malta, Cyprus and Slovenia of the larger EU-27 fall below this ratio though Malta has a 0.2% share of renewable energy in the gross final energy consumption (EC, 2011b). Very interestingly, only six countries belong to the lowest category with a ratio below 150 including Austria, Denmark, Germany, Ireland, Italy and UK. These countries are the nearest to Japan's ratio which falls in the region of 90 and to which recommendations from the EC should aim. The only European country, though outside the EU-27, which performs as well as Japan is Switzerland which has a ratio of 90 as well.

However, it is interesting to notice that in 2008 Ireland, Germany and Denmark were among the five countries that were most distant to their national targets of reduction of GHG emissions. Nevertheless, this should not be misleading of the efforts that Germany and UK have put into effect to reduce their GHG emissions which show the highest reductions in absolute and relative terms for the period 1990 - 2007 together with the

countries of the Baltic Sea region (Lithuania, Latvia, Estonia and Poland)[40] and Romania, Bulgaria, Hungary and Slovakia[41] (EC, 2010b:29). For the latter countries reductions are mainly due to modernisation or closure of 'heavy' manufacturing industries.

Moreover, Ireland, Denmark and UK were among the countries most distant to their national targets of share of renewable energy in gross final energy consumption. This shows that, apart from Denmark which set an ambitious goal and it is currently near a share of 20%, also Ireland and UK share the same vision to considerably improve their energy intensity.

Map 43 also shows that the EU-27 new member countries in the Black Sea, the Baltic Sea and the Danube River regions show higher energy intensity ratios. This is very interesting considering the efforts of such countries in reducing their GHG emissions. The two countries with the highest ratios are Estonia and Bulgaria with respectively 701 and 853 kilograms of oil equivalent per 1000 EUR of GDP and are the only two countries with a ratio above 600. High figure are also shown by Romania, Czech Republic and Slovakia, just below 600 for the first one and in the region of 500 for the second and third, for which however the 7th cohesion progress report shows important progresses towards a reduction of GHG emissions and a significant share of renewable energy consumption. In the Black Sea and in the Danube River regions there are also two candidate countries which perform well in terms of energy intensity. Turkey and Croatia in fact present ratios below 300.

Table 25 below shows the comparison between the EU-15 Member States and the rest of EU-27 Member States. This points out that important actions need to be taken in the new Member States in order to achieve the EU 20% energy efficiency target.

[40] GHG emissions for the period 1990-2007 decreased respectively by -50.3%,, -51.8%, -49.1, -35.8%.

[41] Such countries exhibit reductions of GHG emissions respectively by -51.8%, -48.3%, -39.8%, 34.3%.

EU-15 Energy intensity ratio		*Rest of EU-27 Energy intensity ratio*	
Member State	Ratio	Member State	Ratio
DK	105,199	MT	181,243
UK	112,397	CY	207,155
IE	112,657	SI	258,401
IT	140,845	LT	360,113
AT	142,414	PL	373,563
DE	149,629	LV	375,103
SE	156,299	HU	424,917
LU	161,841	SK	502,006
FR	166,663	CZ	503,08
ES	168,472	RO	588,039
GR	169,32	EE	701,329
PT	179,734	BG	853,767
NL	181,522		
BE	212,169		
FI	234,274		

Table 25 This table shows the Comparison between the EU-15 Member States and the rest of the EU-27 Member States.

Conclusion: promoting renewable energy sources and energy efficiency as a means to reduce the energy intensity of the economy

The energy intensity of the economy shows a geographical pattern split into two: EU-15 Member States with a lower energy intensity economy and the rest of EU-27 Member States with higher energy intensity ratios, apart from a few exceptions. Such indicator within the EU climate, environmental and energy policies and targets is fundamental to understand the achievement of emission reduction objectives and the delivery of a low-carbon economy centred around the objectives laid down in the Lisbon Treaty of security of supply, competitiveness ad sustainability. Energy related emissions in fact account for almost 80% of the EU's total GHG emissions, hence firm and decided actions need to be undertaken.

The stress of the Union on energy efficiency measures is great and it is understood to be one of the main and direct actions which is to be

implemented being able to both reduce households' energy bills and increase industry competitiveness thanks to reduction of costs against competitors like USA where the cost of energy is lower. Member States though are not following this path. The EC Communication "Energy 2020 : A strategy for competitive, sustainable and secure energy" in effect highlights that the quality of National Energy Efficiency Action Plans is poor and that the energy efficiency objective is a long way away (EC, 2010c).

The Energy Efficiency Plan and the proposal for a Directive on Energy Efficiency emphasise the need for different actions which should be put in place embracing investment in the following sectors: energy infrastructure, energy transmission networks, renewable energies and energy efficiency of buildings (EC, 2011c). In particular, among other actions, the Directive proposal requires MS to establish national energy efficiency obligation schemes and adopt national heating and cooling plans making sure that spatial planning regulations at the local level are in live with these plans (EC, 2011d).

References

European Commission (2010a) Europe 2020. A strategy for smart, sustainable and inclusive growth. Available at: http://ec.europa.eu/europe2020/documents/documents-and-reports/type/latest-documents/index_en.htm#top.

European Commission (2010b) Using official statistics to calculate greenhouse gas emissions. A statistical Guide. Eurostat. Luxemburg: Publications Office of the European Union (doi 10.2785/3842).

European Commission (2010c) Energy 2020 : A strategy for competitive, sustainable and secure energy. Available at:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52010DC0639:EN:HTML:NOT

European Commission (2011a) Annual Growth Survey, Annex 1. Progress report on Europe 2020. Available at:

http://ec.europa.eu/economy_finance/articles/eu_economic_situation/2011-01-annual-growth-survey_en.htm

European Commission (2011b) The urban and regional dimension of Europe 2020. Seventh progress report on economic, social and territorial cohesion. Available at:

http://ec.europa.eu/regional_policy/newsroom/detail.cfm?id=151.

European Commission (2011c) Energy Efficiency Plan. Available at:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011DC0109:EN:HTML:NOT

European Commission (2011d) Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC . Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011PC0370:EN:NOT

3.3.2. Energy intensity of the economy. Distance to the national targets (map 44)

Definition of the indicator

This indicator is derived from Eurostat's "Energy intensity of the economy" available at NUTS0 regions level. This indicator is one of the eight headline indicators of the EU2020S and shows the percentage of Mtoe to be reduced from 2010 to 2020. As such it is of great importance within the EU energy policy. The distance to the national target is calculated with 2010 as a base year in terms of percentage points to be reduced in order to achieve the target of reduction of Mtoe consumption. Energy consumption in Mtoe is available for the period 1990 - 2010 and the target is set for 2020 by most Member States. In fact, no target has been set by Czech Republic, Netherlands, Slovenia and UK for the Member States, and by Croatia and Turkey for the Candidate Countries.

Relevance of the indicator

The distance to the national target, expressed in terms of Mtoe to be reduced by 2020, underlines the scope and extent of actions to be undertaken by single Member States to achieve the objective set and improve the energy intensity of the economy so as to increase competitiveness. In this respect, the Council has issued on 30 May 2012 country-specific recommendations to each of the Member States whose currency is the euro for the delivery of stability and growth targets.

Energy intensity of the economy is one of the headline indicators which is able to point out the progresses towards the reduction of energy consumption. The Europe 2020 Strategy underlines the importance of achieving a low-carbon society and economy through increased energy

efficiency and greater use of renewable energy sources as well as the need to tackle climate change by reducing greenhouse gas (GHG) emissions. The proposal for a new Energy Efficiency Directive earlier in April 2012 highlighted the need to put into effect new measures if the EU-27 20% energy efficiency target is to be achieved.

The reduction of energy consumption is strictly related to the competitiveness of the national economy in all its sectors. The flagship "*An industrial policy for the globalisation era*" stresses the need for "*more efficient European transport, energy and communication infrastructure and services to serve European industry*" as a key action for European industrial competitiveness. The connection with smart growth and ICT is straightforward.

However, the reduction of Mtoe by means of efficiency measures does not seem to take an important role within National Reform Programmes. The average value of national targets accounts for a 10% overall reduction compared to the 20% objective at the EU-27 level (EC, 2011a). National objectives are reported in Table 26 and show that only in five cases (Malta, Portugal, Austria, Romania, and Sweden) the target is higher than 20% or as in the case of Spain just below 20%.

Member State	2010 Consumption Mtoe	Target Mtoe	Target %
LU	4.658	0.2	4.3
MT	0.911	0.24	26.3
CY	2.717	0.46	16.9
LV	4.538	0.67	14.8
EE	6.101	0.71	11.6
DK	19.321	0.83	4.3
LT	6.864	1.14	16.6
SK	17.67	1.65	9.3
GR	28.841	2.7	9.4
IE	15.1	2.75	18.2
HU	25.978	2.96	11.4
BG	17.831	3.2	17.9
FI	36.978	4.21	11.4
PT	24.374	6	24.6
AT	34.618	7.16	20.7
BE	61.503	9.8	15.9
RO	35.708	10	28.0
SE	51.352	11.99	23.3
PL	101.704	14	13.8
ES	130.224	25.2	19.4
IT	175.515	27.9	15.9
FR	268.576	34	12.7
DE	336.095	38.3	11.4
CZ	44.771	No target	No target
NL	86.924	No target	No target
SI	7.264	No target	No target
UK	212.629	No target	No target

Table 26 This table shows the EU-27 Member States (MS) sorted in ascending order by target of reduction of energy consumption in Mtoe. It shows at the same time their 2010 inland energy consumption and the 2020 target as percentage points.

Discussion of the geographical pattern of map 44

Introductory notes: the geographical pattern of the distance to national target of energy intensity indicator

The reduction of energy consumption by a country's economy is a fundamental step towards a low carbon economy and the achievement of energy efficiency and other climate targets. Actions in different directions could be taken involving the transport sector as well as renewable energy sources and energy efficiency measures. The EC underlines the importance of actions to be undertaken in the latter of the few sectors cited and set an EU-27 target in line with the reduction of GHG emissions

and share of energy produced by RES. Single MS targets however are generally lower than 20% and this is jeopardizing the achievement of the EU2020S objectives.

The gap between the EU energy efficiency headline target and the estimated EU reduction in Mtoe is striking. Data collected in the context of this research show that the sum of the EU-27 MS targets is 206.07 Mtoe which is about 56% of the 368 Mtoe needed to achieve the headline target. As a result, the estimate is about half of the target set showing a general reduction by 2020 of just above 11%. Important measures need to be set out in nearly all of the MS if the EU wants to keep on track with the EU2020S.

Map 44 shows no precisely identifiable geographical pattern. The five MS with the lower distance ratio to the national targets are reported in Table 27 below and range from Baltic Sea Member States to Mediterranean States such as Greece. Denmark and Luxembourg have the lower distance to the national target of 4.3 percentage points, the only MS below 5%, and also show one of the lower distances to the national targets in absolute terms (Mtoe). The other three MS with the lower distances to their national targets (Slovakia, Greece and Finland) show ratios respectively of 9.3, 9.4 and 11.4%.

The five MS with the lower distance to the national target

Member State	Ratio %
LU	4.3
DK	4.3
SK	9.3
GR	9.4
FI	11.4

Table 27 This table shows the five EU-27 Member States with the lower distance to the national target of energy consumption reduction in Mtoe.

Table 28 shows the five Member States with a ratio closer to the median value. Such ratios range from 13.8% of Poland to 16.6% of Lithuania with the median value being 15.9% of Italy. In absolute terms these closer-to-median Member States show extremely different values. Latvia should reduce its emissions by 0.67 Mtoe whilst Italy, which shows the median value, has the third highest reduction in absolute terms that is equal to 27.9 Mtoe just after France and Germany (cf. Table 28). It is clear

therefore that the reduction in absolute terms is strictly related to the total population and energy consumption of the MS. Germany, France and Italy in fact come 1st, 2nd and 4th both in population size and gross inland energy consumption. Latvia shows a very low absolute reduction whilst Poland in absolute terms comes soon after the largest states in population size so highlighting the strict relationship that exists.

The five MS closer to the median value	
Member State	***Ratio %***
PL	13.8
LV	14.8
IT	**15.9**
BE	15.9
LT	16.6

Table 28 This table shows the five EU-27 Member States with the closer-to-median values to the national target of energy consumption reduction in Mtoe

Table 29 below reports the five Member States with the higher distance to the national target. These are the five States that would contribute the most to the delivery of the EU headline target. Interestingly, very ambitious goals have been set by Romania, Malta and Portugal which intend to considerably increase the energy efficiency of their economies and therefore are the most distant to the national targets. The other two States, Austria and Sweden, even though already present better performances in terms of greenhouse gas emissions and share of renewable energy have set ambitious efficiency target in order to further reduce greenhouse gas emissions.

The five MS with the higher distance to the national target	
Member State	***Ratio %***
AT	20.7
SE	23.3
PT	24.6
MT	26.3
RO	28.0

Table 29 This table shows the five EU-27 Member States with the closer-to-median values to the national target of energy consumption reduction in Mtoe

As seen there is no identifiable geographical pattern but an interpretation effort can highlight the way the EU is somehow split into two parts. The northern Europe States with lower distances to the national target, since in most of the cases they have set lower targets, and the southern and eastern Europe States where the distances to the national targets are higher. However, some exceptions exist such as Sweden and Greece.

Table 30 below shows a comparison between the EU-15 States and the rest of the EU-27 States so as to emphasize the differences in terms of energy efficiency targets and policies between old MS and new MS. Old EU-15 MS targets are on average 2 Mtoe lower than new MS.

EU-15		Rest of EU-27	
LU	4.3	SK	9.3
DK	4.3	HU	11.4
GR	9.4	EE	11.6
FI	11.4	PL	13.8
DE	11.4	LV	14.8
FR	12.7	LT	16.6
IT	15.9	CY	16.9
BE	15.9	BG	17.9
IE	18.2	MT	26.3
ES	19.4	RO	28.0
AT	20.7	SI	No target
SE	23.3	CZ	No target
PT	24.6		
UK	No target		
NL	No target		

Table 30 National targets for EU-15 MS and Rest of EU-27 MS sorted in ascending order.

Conclusions: the need for considerable efforts to achieve the EU headline target

The energy intensity of the economy is a fundamental indicator which shows the energy efficiency of a country's economy. As the Annual Growth Survey 2011 points out, in order to achieve a more energy efficient economy, there is a need for improved and less energy-consuming technologies within all sectors of the economy, especially supporting innovation in industry and SMEs and encouraging change in households behaviours by assisting consumers to value resource efficiency (EC, 2011b).

The Europe 2020 strategy underlines that "m*eeting our energy goals could result in € 60 billion less in oil and gas imports by 2020"* and that renewable energy sources targets coupled with energy efficiency targets could result in over 1 million new jobs (EC, 2010a: 13). It derives that the energy sector could contribute substantially to economic growth and job creation while at the same time reducing the impact on the environment.

New member countries in the Black sea, the Baltic sea and the Danube river regions show greater potential for the reduction of Mtoe since they show higher ratios of energy intensity of the economy (cf. Map 43). Modernization and efficiency measures in these countries to the level of the most developed economies will generate greater benefits for the whole EU and allow an easier achievement of the target. However, most developed countries could act on citizens' behaviours and lifestyles in order to guarantee a reduction in energy consumption due to increased efficiency.

The stress of the Union on energy efficiency measures is great and it is understood to be one of the main and direct actions which is to be implemented being able to increase industry competitiveness. However, as highlight above Member States are not following this path. The EC Communication "Energy 2020: A strategy for competitive, sustainable and secure energy" emphasises that National Energy Efficiency Action Plans are poor quality (EC, 2010b).

The Energy Efficiency Plan and the proposal for a Directive on Energy Efficiency underline the need for different actions embracing investment in the following sectors: energy infrastructure, energy transmission networks, renewable energies and energy efficiency of buildings (EC, 2011c). In particular, among other actions, the Directive proposal requires MS to establish national energy efficiency obligation schemes and adopt national heating and cooling plans making sure that spatial planning regulations at the local level are in live with these plans (EC, 2011d).

References

European Commission (2010a) Europe 2020. A strategy for smart, sustainable and inclusive growth. Available at:

http://ec.europa.eu/europe2020/documents/documents-and-reports/type/latest-documents/index_en.htm#top.

European Commission (2010c) Energy 2020 : A strategy for competitive, sustainable and secure energy. Available at:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52010DC0639:EN:HTML:NOT

European Commission (2011a) Annual Growth Survey 2012. Progress report on Europe 2020 . Available at: http://ec.europa.eu/europe2020/reaching-the-goals/monitoring-progress/annual-growth-surveys/index_en.htm

European Commission (2011b) The urban and regional dimension of Europe 2020. Seventh progress report on economic, social and territorial cohesion . Available at: http://ec.europa.eu/regional_policy/newsroom/detail.cfm?id=151.

European Commission (2011c) Energy Efficiency Plan. Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011DC0109:EN:HTML:NOT

European Commission (2011d) Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC . Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011PC0370:EN:NOT

3.3.3. Change in Energy intensity of the economy. 2000-2010 (map 45)

Definition of the indicator

The change in energy intensity of the economy indicator is derived from Eurostat's "Energy intensity of the economy" at NUTS0 Member State level. Energy intensity of the economy is one of the eight headline indicators of the EU2020S and forms part of the headline target which indicates the achievement of the sustainable growth pillar. Reduction in energy intensity of the economy indicates a lower level of GHG emissions by the energy sector and a greater efficiency of the system and competitiveness of the economy. Because of this, the EU emphasises the importance of such indicator for the achievement of economic growth objectives. As defined by Eurostat, the energy intensity of the economy indicator measures the gross inland consumption of energy per unit of GDP. The indicator is therefore expressed in kilograms of oil equivalent per 1000 EUR of GDP including five energy sectors for the calculation of the indicator itself: coal, electricity, oil, natural gas and renewable energy sources. The indicator has been calculated annually for the period 1990–2010 for each EU-27 Member State, Candidate Countries except Montenegro, Iceland and Norway and the variation is calculated at 2010 levels with 2000 as a base year.

Relevance of the indicator

The change in energy intensity of the economy is a fundamental indicator which is able to point out the progresses, if any, made towards the reduction of energy consumption from any form of energy. Energy related targets within the Union are of paramount importance and underpin strategies and programmes undertaken and issued over time by the EU. The Europe 2020 Strategy underlines the importance of achieving a low-carbon society and economy through increased energy efficiency and greater use of renewable energy sources as well as the need to tackle climate change by reducing greenhouse gas (GHG) emissions. The proposal for a new Energy Efficiency Directive earlier in April 2012 highlighted the need to put into effect new measures if the 20% energy efficiency target is to be achieved. The EC in its Annual Growth Surveys for the years 2011 and 2012 (EC, 2011a and 2011b) underlines the need to undertake effective actions to increase the efficiency of the energy sector and points out the lack of commitment by Member States towards an increased efficiency.

The importance of this indicator is found within the two flagships "Resource-efficient Europe" and "An industrial policy for the globalisation era" where recommendations are made including technological improvements and innovations in industrial, agriculture and transport systems as well as a change in households behaviours.

The reduction of energy consumption is strictly related to the competitiveness of the national economy in all its sectors. The flagship "An industrial policy for the globalisation era" stresses the need for "more efficient European transport, energy and communication infrastructure and services to serve European industry" as a key action for European industrial competitiveness. The connection with smart growth and ICT is straightforward.

Moreover, as the Annual Growth Survey 2012 points out, in order to achieve a lower energy intensity of the economy so reducing emissions of GHG, there is a need for technological innovation with the introduction of less energy-consuming technologies supporting SMEs and manufacturing (EC, 2011b). The Commission in 2011 launched the SILC I Scheme (Sustainable Industry Low Carbon Scheme) for the two year period 2011-2013 to support energy-intensive process and manufacturing industries in both developing and deploying technological and non-technological measures. The main objective of the Scheme is the promotion of ultra-low carbon production technologies to stimulate innovation in the energy-intensive industries (EC, 2011c SILC)[42].

Discussion of the geographical pattern of map 45

Introductory notes: change in energy intensity of the economy is generally higher in new Member States.

As can be seen in Table 31 below the change occurred in new MS is on average far higher than that occurred in old Member States. This is sign of the greater innovation and modernisation processes the new MS have gone through over the last decade and it does not surprise that new Member States have delivered greater reduction (EC, 2010b).

[42] SILC II is intended to cover the period 2014-2020 in line with Horizon 2020 which is the new programme for the programming period 2014-2020.

EU-15 Energy intensity ratio		*Rest of EU-27 Energy intensity ratio*	
Member State	Ratio	Member State	Ratio
UK	-22,3	SK	-38,4
GR	-17,4	LT	-37,4
IE	-16,3	BG	-35,9
ES	-14,4	RO	-35,1
SE	-12,0	PL	-22,8
DE	-10,8	CZ	-22,3
BE	-9,5	HU	-15,5
PT	-8,9	LV	-15,5
DK	-7,7	CY	-13,9
FR	-6,9	SI	-13,4
FI	-5,9	EE	-13,0
IT	-4,0	MT	-2,7
LU	-1,8		
NL	-0,9		
AT	1,7		

Table 31 This table shows the change in energy intensity of the economy occurred in old MS and new MS. The reduction occurred in new MS is far greater than that in new MS.

It is interesting to notice that among the old MS the UK has experienced a higher reduction in energy intensity of the economy. It is not clear where this outcome comes from, but it is certainly a consequence of the important results achieved in the battle for reducing greenhouse gas emissions (EC, 2010b:29) from buildings through efficiency measures though no target was set at the national level (cf. Map 44). In fact, the UK is one of the MS, together with Denmark, Finland, Germany and the Netherlands, to have introduced more stringent requirements for new buildings (EC, year unknown).

As pointed out in the discussion of Map 44 the gap between the EU energy efficiency headline target and the estimated 2020 EU-27 reduction of energy consumption in Mtoe is striking. The estimate covers about 56% of the overall reduction of Mtoe needed to achieve the 20% target. Map 45 underlines very well the outcomes that have been achieved by each MS in terms of energy intensity reduction from 2000 to 2010, highlighting that more should be done by old MS to deliver the target set.

The overall geographical pattern identified shows that there are four main groups of countries: MS with a change over 25%, MS with a change between 25% and 15%, MS with a change between 15% and 5%, and MS with a change lower than 5%. It is soon understood that the change in energy intensity achieved strongly depends on the 2000 levels of Mtoe. In fact, of the five countries listed in Table 32 all of them, with the only exception of Poland, had an energy intensity of the economy in 2000 above 500 kilograms of oil equivalent per 1000 euros (Kgoe) and all have

achieved a reduction higher than 35%. The only three MS which had a 2000 energy consumption above 500 Kgoe to have reduced their energy intensity by less than 25% are Estonia, Czech Republic and Hungary[43]. Table 32 shows the five Member States which, in the decade 2000-2010, have achieved the greater reduction in energy intensity of the economy. As highlighted above these are all new MS of the Baltic Sea region and Danube River region.

The five MS with the higher change	
Member State	***Ratio***
SK	-38.4
LT	-37.4
BG	-35.9
RO	-35.1
PL	-22.8

Table 32 This table shows the 5 EU-27 Member States (MS) which show the higher change in energy intensity of the economy for the period 2000- 2010. The ratio is expressed in percentage points.

Table 33 shows the five MS which have obtained a change in energy intensity of the economy close to the median value. All these MS, with the only exception of Estonia, performed well in terms of energy intensity already in 2000. In fact all had energy intensity lower than 300 Kgoe (the second lowest category of Map 43) and have continued on this path achieving reductions between 12 and 14.4%.

[43] Estonia, Czech Republic and Hungary had a 2000 level of Mtoe respectively of 806, 647 and 502 and attained reductions respectively by 13%, 22.3% and 15.5%.

The five MS closer to the median change	
Member State	***Ratio***
ES	-14.4
CY	-13.9
SI	**-13.4**
EE	-13.0
SE	-12.0

Table 33 This table shows the 5 EU-27 Member States (MS) which show the closer-to-median change in energy intensity of the economy for the period 2000-2010. The ratio is expressed in percentage points

The relationship between levels of energy intensity and change achieved is confirmed in Table 34. The five MS with the lower changes were in fact in 2000 among the 11 MS with the lower energy intensity and only two of these (Malta and the Netherlands) have fallen outside this chart whilst the other nine States[44] still show the nine lowest values of energy intensity in 2010. Of these nine in fact only the UK and Ireland have been able to deliver a change over 15% as can be seen in table 31. It is also very worthy discussing the position of Austria which is the only MS to have delivered a negative change by increasing its energy intensity by 1.7%. Only Norway within Europe shows a worse change since it has increased its energy intensity by 9.8%.

With regard to the candidate countries data are available for Turkey, Croatia and Macedonia. While Turkey and Croatia perform quite well with respectively 2009 and 2010 levels of 247 and 283 Kgoe, Macedonia has a 2010 energy intensity of 578 Kgoe but has reduced its levels by 16.3% in line with Croatia that has achieved a 16% reduction. Turkey is the country which has attained the lowest reduction by only 2.6%.

[44] Such States are: Denmark, UK, Ireland, Italy, Austria, Germany, Sweden, Luxembourg and France.

The five MS with the lower change	
Member State	***Ratio***
IT	-4.0
MT	-2.7
LU	-1.8
NL	-0.9
AT	1.7

Table 34 This table shows the 5 EU-27 Member States (MS) which show the lower change in energy intensity of the economy for the period 2000-2010. The ratio is expressed in percentage points.

Conclusion: greater action needed to further reduce the energy intensity of the economy

Energy efficiency is one of the sectors within which actions should be undertaken in order to reduce final gross energy consumption. The energy intensity of the economy shows the efficiency of a country's main production sectors. The lower the energy intensity indicator the higher the efficiency of the economy. The importance of such measure is matched within the EU policies which strongly encourage interventions and new initiatives in this sector in order to contribute to the delivery of the 20-20-20 objectives.

The Europe 2020 strategy underlines that "m*eeting our energy goals could result in € 60 billion less in oil and gas imports by 2020"* and that renewable energy sources targets coupled with energy efficiency targets could result in over 1 million new jobs (EC, 2010a: 13). Because of this and because of the contribution that the sector could give to economic growth and industry competitiveness, various initiatives have been set out by the EC so as to encourage Member States take actions towards a greater efficiency.

The Energy Efficiency Plan and the proposal for a Directive on Energy Efficiency emphasise the need for different actions which should be put in place embracing investment in the following sectors: energy

infrastructure, energy transmission networks, renewable energies and energy efficiency of buildings (EC, 2011d). In particular, among other actions, the Directive proposal requires MS to establish national energy efficiency obligation schemes and adopt national heating and cooling plans making sure that spatial planning regulations at the local level are in live with these plans (EC, 2011e). Moreover, the SILC Schemes I and II (Sustainable Industry Low Carbon Scheme) for the period 2011-2013 and 2014-2020 have been set out to support innovation in energy-intensive industries and low-carbon technologies both technological and non-technological (EC, 2011c).

References

European Commission (2010a) Europe 2020. A strategy for smart, sustainable and inclusive growth. Available at: http://ec.europa.eu/europe2020/documents/documents-and-reports/type/latest-documents/index_en.htm#top

European Commission (2010b) Using official statistics to calculate greenhouse gas emissions. A statistical Guide. Eurostat. Luxemburg: Publications Office of the European Union (doi 10.2785/3842).

European Commission (2011a) Annual Growth Survey 2011, Annex 1. Progress report on Europe 2020 . Available at: http://ec.europa.eu/economy_finance/articles/eu_economic_situation/2011-01-annual-growth-survey_en.htm

European Commission (2011a) Annual Growth Survey 2012. Progress report on Europe 2020 . Available at: http://ec.europa.eu/europe2020/reaching-the-goals/monitoring-progress/annual-growth-surveys/index_en.htm

European Commission (2011c) Sustainable Industry Low Carbon Scheme (SILC) I. Call for Proposals. Grant Programme 2011. Available at: http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=6540

European Commission (2011d) Energy Efficiency Plan. *Available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011DC0109:EN:HTML:NOT

European Commission (2011e) Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC . *Available at:* http://eur-

lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011PC0370:EN:NOT

European Commission (year unknown) Energy and Climate Targets. *Commission's staff working documents. Key area: Promoting growth and competitiveness. Available at: http://ec.europa.eu/europe2020/making-it-happen/key-areas/index_en.htm*

3.3.4. Industrial employment dependent in sectors with high energy purchases, 2009 (map 46)

Definition of the indicator

The indicator under discussion (@23) has been calculated following ReRisk methodology[45] that estimated this indicator for 2005 while the SIESTA Project has updated the indicator for 2009 amalgamating country by country the NACE codes identified by ReRisk project. This is a project focused on new possibilities to support competitive and clean energy in Europe and to generate sustainable energy sources. Indeed ReRisk has developed a methodology to consider employment in industries with high energy purchases in the EU regions ([161]=@23) and this has been used for SIESTA[46].

This indicator shows regional energy vulnerability to rising energy prices. At the same time it is focused on identifying EU regions in which large part of the industrial employment and gross value added depends on sectors with high energy spending (measured in employment share).

ReRisk calculated the ratio between "total purchases of goods and services" and the energy purchase in each sector (down to NACE 4 digit) for those EU countries for which complete data sets are available for both categories. This made it possible to identify the subsectors and processes with the highest energy purchases, and also to determine the relative position of each EU country in terms of energy spending.

The map is based on NUTS-2 data. No data are available for France, Switzerland, Turkey and Balkan countries.

Relevance of the indicator

45 SIESTA Calculations using EUROSTAT data and the methodology proposed by ReRisk Espon Project explained in its Final Report but also kindly facilitated by email. (Last access 2012-7-12)

46 See point 3.1.2.2. of the Inception Report.

Energy is becoming Europe's number one problem as it is in the world. As one of the world's largest importers of oil, gas and coal, the EU is a major player on the international energy market. However, it remains a dwarf on the political stage as member states keep the upper hand on foreign policy (Youngs, 2007). With external dependence on imports forecast to grow steadily, the EU has started to integrate energy aspects in relations with third countries. In the coming two decades, the global demand for energy will have the tendency of a global crisis that will be more difficult and more complex that today's global financial crisis[47].

Many countries have an industrial economy that depends largely on the consumption of energy. These aspects are very important geopolitical implications considering that the EU is heavily dependent on Russia to meet its vast and growing demand for oil and gas supplies (Bahgat, 2010). So geopolitical relations also depend on energy potential and impacts on the existing oil and gas strategy, as well as on the range of renewable energy sources. Indeed, oil and gas reserves are unevenly distributed around the globe, and the largest reserves are situated in politically or economically insecure regions (Middle-East, Russia). North Sea oil and gas fields have already been exploited beyond their peak, leaving Europe dependent on non-EU countries for future supply.

It is clear that companies need a great amount of energy which is one of the main cost factors in the production process and therefore the amount companies spend on purchasing energy is more relevant in terms of competitiveness than their actual energy consumption. According to this approach, there are some sectors and regions most vulnerable to increases in energy price. In the EU-27, the sectors with the highest spending on energy products on NACE 2 digit level are: Manufacture of food products (C10), Manufacture of beverages (C11), Manufacture of paper and paper products (C17), Manufacture of chemicals and chemical products (C20), Manufacture of other non-metallic mineral products (C23), Manufacture of basic metals (C24), Manufacture of fabricated metal products, except machinery and equipment (C 25). All those sectors combined represent 63% of industrial energy spending.

During the last decade the EU has agreed a series of policy papers and new strategies in the field of energy security. European governments and European Commissioners routinely stress their belief that Europe's energy predicament is acute and cite energy security as a priority issue for the Common Foreign and Security Policy. Policy commitments stress that

[47] The Commission Green Paper on security of energy supply (November 2000) drew a clear picture of the EU's energy situation. If no action is taken, it predicted, the EU's energy dependency will climb from 50% in 2000 to 70% in 2030.

energy strategy is to move beyond the internal sphere and become systematically a part of EU external relations (Youngs, 2007). The Commission's pivotal 2006 Energy Green Paper promised "a better integration of energy objectives into broader relations with third countries"[48].

While showing regional energy vulnerability to rising energy prices, this indicator also provides information about regional specialisation in industries with high energy spending (measured in employment share). Industries with high energy spending are an important indicator of sustainability in climate change and green economy. This map is quite important because it offers part of the current obstacles to the development of energy efficiency and curbing greenhouse gas emissions.

It is clear that there is a significant correlation between industrial energy spending in the regions and their energy consumption, using actual consumption data from Member States. This aspect is taken perfectly into account by Europe 2020 Strategy and its flagship initiative "Resource efficiency in Europe" as well as other research projects such as ESPON ReRisk which contains indicators relevant for the SIESTA Project in relation to employment, industrial activity, energy and climate.

Explanation of the geographical pattern expressed by the map 46

Introductory note: regional energy vulnerability

The increase in world energy price has a negative economic impact: higher energy prices lead to higher costs, and hence, to reduced competition of European industries in the global market for goods and services. The global price increase effect is generally led by the increase of oil prices followed closely by that of natural gas. The direct impact of oil price increases on European economy depends on a number of factors, among which: the level and duration of the price increase; the response of oil markets; the proportion of energy in GDP; the flexibility of energy markets; and the exchange rate.

The current low level rate of EURO is penalising European exports of goods and oil importers. In other words, an increase in the world fuel price has three major effects, namely: a direct effect on revenue by spending more on the energy bill; a financial effect through the rise of inflation and interest rates; a trade effect through the increase in import bill, which aggravates the trade balance.

48 Green paper – A European Strategy for Sustainable, Competitive and Secure energy.

In Europe there are many differences in regional vulnerability that derive mainly from climate conditions, the economic and transport structure and the social situation in regions and cities. It is important to distinguish energy vulnerability from energy dependency, as it is possible to be dependent without being vulnerable. A country that imports the majority of its energy at a sustainable cost and ensures the security of its supply by means of well-diversified sources will be dependent but not vulnerable. While a country which produces the majority of its energy at a prohibitive cost or uses obsolete technologies will be vulnerable, even if independent of external suppliers.

On the demand side, responses to increasing energy prices in the short term have proven to be very limited. Price increases in the past have generally been too minor and too slow to have provoked changes in consumption patterns. However, adjustments to demand in the medium and longer term can be accelerated with the right policy measures and with investments in energy efficiency, thus mitigating the expected negative impact of rising energy prices on the main economic variables and the most vulnerable population. So, it would be quite important to know better the possible impacts of rising energy prices in the regions. The impacts in economic terms can be estimated by identifying the industries with the highest energy spending and by determining which regions are specialised in these economic activities. Since 1972, energy intensity in Western European economies has been declining, and with the new EU-Green Paper (2007) a new decrease of 20% on average is expected for all EU-members, by 2020. Total energy demand is likely to decline in a number of industrial sectors, in the steel industry for example, the expected decline rate is 0.8% p/a over the next 25 years, despite a small increase in steel production.

The five sectors which, together, represent more than 60 % of industrial energy purchases in the EU 27, are the manufacturing of chemicals, basic metals, foods and beverages, pulp and paper and "other non-metallic minerals". While in the cases of chemicals and food and beverages energy purchases do not represent a major cost item for industry, with regard to the total amount of purchases it is relevant for the manufacture of basic metals and other non-metallic minerals as well as for the paper industry. Mining is also very energy-intensive but, as in the case of pulp and paper production, activity in this sector is limited to a few Member States. Within the mining sector, the subsectors which spend most on energy purchases are the quarrying of stone and "other mining and quarrying". Analysing total energy spending by sector ReRisk claimed out that the increase of energy prices has a heavy impact on all basic industry, including food production, and not only on the so-called energy-intensive sectors. The

construction business, in turn, is affected in a minor way and rather indirectly, since most energy purchases correspond to the supplier industry.

Specialisation means that a considerable proportion of employment and/or wealth creation in the region depends on these industries. Many studies like ReRisk show that the negative effects on regional economies are not limited to industries which are known to be energy-intensive, such as paper or aluminium, but also affect other sectors, for example the food processing industry.

Interpretation of the geographical pattern of the map 46

This map shows the regional differences that exist between the EU countries with regard to industrial energy spending. The percentage of total employment in sectors with high energy spending can be considered as an indicator of regional "economic vulnerability" as ReRisk claimed. According the ReRisk project, most of the Eastern European countries spend more on energy purchases (in terms of cost per unit of energy) across a number of industrial sectors, while in Western Europe, Luxemburg has particularly high energy costs. These differences cannot be explained entirely by the levels of energy prices or general price indexes, so it must be assumed that energy is not efficiently used in some industrial processes.

The analysis of the sectors which spend most in absolute terms on energy purchases at the national level can be broken down to regional level by associating the corresponding employment on NACE 2-digit level.

Firstly, it is important to emphasise that not all sectors taken into consideration are present within NUTS2 regions. Generally, it can be argued that two-thirds of NUTS-2 regions have a share of employment in sectors with high energy spending below 6% but just a 5% of the regions is located between 0.39% and 2%. The latter are regions from Spain (Ceuta and Melilla), United Kingdom (London area and Sussex), Germany (Hamburg and Berlin), Greece (South Aegean or Cyclades island group and Ionian islands) and Ireland. However, data for these regions are not complete since not all NACE 2 sectors taken in consideration are found in these regions.

Table 35 and 36 show the NUTS2 regions where all sectors are present divided in top and bottom regions. Table 35 shows the highest share of employment in sectors with high energy spending, whilst Table 36 shows the regions with the lowest share. Table 35 shows that the regions with the most unfavourable position in terms of economic vulnerability (>10%

of employment in industries with high energy spending) are located in the Czech Republic (Moravskoslezsko, Střední Morava, Severozápad), Spain (Navarra and Pais Vasco), Sweden (North Middle Sweden), Greece (Sterea Ellada) and Italy (Emilia Romagna). In the latter case, the highly vulnerable regions combined represent more than 50% of industrial employment. However, Italian industries do not perform badly in the EU comparison with regard to energy spending, despite the relatively high energy prices in the country.

On the contrary, from Table 36 it results quite evident that regions like the Spanish islands, the rural areas of the UK and large capital cities such as Berlin, Madrid, Brussels and Oslo have very low shares. This is likely to be the consequence of low levels of industrialisation, in terms of employment in the industry sector of the economy, and of prevalence in these areas of other economic sectors with lower energy consumption such as tertiary and tourism, due to geographic as well as urban and economic characteristics.

From the data processed by SIESTA Project with the ReRisk methodology, most of the regions in which 6-10% of employment depends on industries with high energy purchases belongs to countries that have industrial tradition as Germany, Poland, Spain, Italy, Czech Republic and United Kingdom. It should be noted that 5 of the 8 existing regions in the Czech Republic have unfavourable industrial structures in terms of energy purchases. When taking a closer look at how Czech industries perform with regard to the EU average spending on energy purchases in each of the sectors, we find that even though the divergence is minor, special attention should be paid to the "Manufacture of other non-metallic mineral products" sector, since energy purchases represent a considerable cost factor in this industry and the value of purchases is slightly higher than the EU median value.

The question is then whether these findings on national industrial energy consumption can be extended to the regional level. The analysis of industrial energy consumption in regions of France, Germany, Italy and the UK confirms that there is a positive correlation between the regional specialisation in industries with high energy costs and their actual energy consumption.

MS	*Region*	*% of employment in high energy spending industries*
SE31	Norra Mellansverige	12.90
GR24	Sterea Ellada	11.33
CZ08	Moravskoslezsko	11.23
CZ07	Střední Morava	11.00
ES22	Navarra	10.84
ITD5	Emilia Romagna	10.33
ES21	Pais Vasco	10.17
CZ04	Severozápad	10.01
AT34	Vorarlberg	9.79
ES23	La Rioja	9.74

Country Code: AT Austria; CZ *Czech Republic;* ES Spain; GR Greece; IT Italy; SE Sweden.

Table 35 The 10 NUTS-2 Regions with highest share of employment in sectors with high energy spending

MS	*Region*	*% of employment in high energy spending industries*
DE30	Berlin	1.37
ES53	Islas Baleares	2.21
NO01	Oslo	2.25
UKH3	Essex	2.25
UKH2	Bedfordshire and Hertfordshire	2.35
ES30	Comunidad de Madrid	2.47
ES70	Canarias	2.48
UKJ4	Kent	2.65
UKJ1	Berkshire, Buckinghamshire and Oxfordshire	2.66
BE10	Région de Bruxelles	2.66

Country Code: BE Belgium; DE Germany; ES Spain; NO Norwey; UK United Kingdom

Table 36 The 10 NUTS-2 Regions with the lowest share of employment in sectors with high energy spending

MS	*Region*	*% of employment in high energy spending industries*
DE11	Stuttgart	5.30
RO22	Sud-Est	5.30
SK04	Eastern Slovakia	5.32
RO32	Bucharest-Ilfov	5.33
SE33	Upper Norrland	5.33
LT00	**Lithuania**	**5.36**
ITF5	Basilicata	5.41
ITE1	Toscana	5.42
PL11	Lodz Province	5.43
AT21	Carinthia	5.46

Country Code: AT Austria; DE Germany; IT Italy; LT Lithuania; PL Poland; RO Romania; SE Sweden; SK Slovakia.

Table 37 The 15 NUTS-3 Regions with or close to the median value (5.36)

Conclusions

As we have seen, climate is a major determinant of energy demand and changes in climate may alter energy demand as well as energy demand patterns. We claim that impacts are scale dependent due to region-specific climatic variables, infrastructure, socio-economic characteristics, and energy use profiles.

Europe is one of the largest energy consuming regions in the world and the current energy production of the European countries is insufficient to cover their energy demand. As a result, the dependency on energy imports is growing and current trends are forecast to reach almost 70% by 2030 if no adequate policy measures are taken in response (WEC, 2008). Constitutionally, the EU is the only international body with a legal mandate and the power to design energy policy and monitor its implementation in 27 member states. The EU Green Paper (2007) should certainly bring improvements and advance a single European energy market.

The growing dependency of Europe on energy imports and anticipated further increases in energy prices reinforce the concerns about meeting the future energy demand. It is well recognised that ensuring secure and reliable energy supplies at affordable and stable prices is vital to economic

and social development and should constitute an integral part of a sound and consistent energy policy.

The recent rapid changes in the economic environment in Europe require the energy sector to develop new concepts and policies to respond better to the security requirements of energy supply. Some recommendations for policy making could be as follows: Enhance the promotion of energy efficiency and a market for renewable energies; mitigate tensions and vulnerability level in electricity and gas markets; encourage further diversification of each national energy mix; and achieve more consistent and targeted research and development. In addition, a new dialogue between all stakeholders involved in energy policy making and implementation should be promoted, including the public since civil society should be more informed, consulted and integrated into policy making.

References

Bahgat, G. (2010): "The geopolitics of energy: Europe and North Africa", The Journal of North African Studies, 15(1), 39:49

ESPON (2009): Regions at Risk of Energy Poverty. Updated Interim Report, Belgium: ESPON Programme

Youngs, R. (2007): "Europe's external energy policy: between geopolitics and the market", CEPS Working Document No. 278

WEC (2008): Europe's Vulnerability to Energy Crises: Executive Summary. London: World Energy Council

3.4 New challenges of the green economy

3.4.1. Share of people commuting in total employment (map 47)

Definition of the indicator

The indicator under discussion is derived from Eurostat's "Employment and commuting among NUTS level 2 regions". It is the ratio of people commuting to another region or to another country between total employment. This variable measures the relation between the population commuting to other regions or to another country and population employed in the same region.

We define "commuters" as persons who work in a different NUTS2-region or country than they live in, although the available data cannot control for the duration of working abroad.

Data on "Employment" is defined as used by the Structural Business Statistics (SBS) as the number of people engaged in productive activities in an economy. The concept includes both employees and the self-employed.

Relevance of the indicator

Share of people commuting in total employment is quite an important indicator because it reflects one of the most important factors of transport demand at the *regional scale.* In other words, this indicator offers also for a direct measure of regional transport dependency.

Transport sector is one of the main emission-intensive sectors, with higher energy consumption and pollution shares: curbing greenhouse gas emissions. Transport is the only sector that has seen its emissions increase over the past two decades and under projections transport GHG emissions are expected to grow by 74% by 2050 (from the 1990 level).

The Common Transport Policy is an essential component of the EU policy since the Maastricht and The White Paper on Transport is the document of strategic reflection providing the conceptual framework for the CTP Treaty of 1992. The last "White Paper on Transport (2011)" (EC, 2011a) identify in the transition towards a more sustainable transport sector, focused on urban transport and commuting, an essential component in the flagship on resource-efficiency and directly referring to.

The 2011 "White Paper on Transport" puts transport in the wider "EU 2020" perspective, facing growing urban population and a need to reduce

emissions. If transport policy is now a shared competence between member states and the EU under the Lisbon Treaty, EU2020 Agenda support transport industry's shift towards low carbon emissions and firmer focus on sustainability issues.

MS Code	*Region NUTS2*	*Share of people commuting in total employment. (Year 2009) [%]*
BE31	Prov. Brabant Wallon	46.986
UKI2	Outer London	45.862
BE24	Prov. Vlaams-Brabant	41.859
BE34	Prov. Luxembourg	34.285
BE35	Prov. Namur	33.695
AT11	Burgenland	32.692
DE93	Lüneburg	30.821
NL23	Flevoland	30.694
DE41	Brandenburg - Nordost	27.858
AT12	Niederösterreich	27.085

Table 38 This table shows the ten regions with the highest share

MS Code	*Region NUTS2*	*Share of people commuting in total employment. (Year 2009) [%]*
GR25	Peloponnisos	0.039
GR30	Attiki	0.052
RO12	Centru	0.070
RO32	Bucuresti - Ilfov	0.076
FR91	Guadeloupe	0.080
FR94	Réunion	0.084
PT30	Região Autónoma da Madeira	0.084
GR11	Anatoliki Makedonia Thraki	0.085
GR13	Dytiki Makedonia	0.091
GR22	Ionia Nisia	0.105

Table 39 This table shows the ten regions with the lowest share

MS Code	Region NUTS2	Share of people commuting in total employment. (Year 2009) [%]
ITF1	Abruzzo	3.864
HU33	Dél-Alföld	4.058
SE23	Västsverige	4.062
UKM5	North Eastern Scotland	4.149
TR42	Kocaeli	4.218
SE32	Middle Norrland	**4.290**
FI13	Southern Savonia	4.334
AT33	Tirol	4.436
DE25	Mittelfranken	4.447
PL33	Swietokrzyskie	4.493

Table 40 This table shows the ten regions with or close to the median share (i.e. 4.29%)

Notes: NO, TR, EL, PT, FR91, FR92, FR93, FR94 do not include people commuting in another country. Data for CH, NO, and SI are showed for 2007. Data for IE is showed for 2006.

Explanation of the geographical pattern expressed by the map 47

Introductory notes: transport sector as a main emission -intensive sectors

As European Commission affirms, transport is responsible for around a quarter of EU greenhouse gas emissions making it the second biggest greenhouse gas emitting sector after energy.

Road transport accounts for more than two-thirds of EU transport-related greenhouse gas emissions and over one-fifth of the EU's total emissions of carbon dioxide (CO2), the main greenhouse gas.

However, there are also significant emissions from the aviation and maritime sectors and these sectors are experiencing the fastest growth in emissions, meaning that policies to reduce greenhouse gas emissions are required for a range of transport modes.

Accessibility is one of the basic factors of competitiveness, but also of access to services, while at the same time it is one of the major sources of pollution and of energy consumption.

Environmental impacts of accessibility are relevant at all levels, but they are indirect and inversely related to accessibility, as good accessibility gives rise to more movements of goods and persons over longer

distances, and these movements generate negative environmental impacts, such as more energy consumption and greenhouse gas emissions (TRACC, 2011: 51).

The White Paper on transport committed to a 70% cut in carbon emissions from transport compared with 2008, and a 20% cut by 2030.

The EU Commission report identifies a mixture of technical and non-technical options that could reduce emissions from transport by 89% between 1990 and 2050, whereas a 74% rise is foreseen under business as usual.

Existing patterns and comparison with ESPON regions

Map 47 shows that the highest share of people commuting in total of employment for 2009 is in the north-west of Europe and part of Danube Space macro-regions: Austria, Netherlands, Deutschland, Belgium, United Kingdom and Ireland.

In general terms, the Nordic regions have higher share than most of the Southern European regions near to large cities areas (Amsterdam, Brussels, Berlin, Wien, London, Dublin, and Stockholm).

Data are not available for Bosnia ed Herzegovina regions.

The spatial patterns show that regions located more in the centre of the EU (e.g. in Austria, Belgium and the Netherlands), and in the territory dominated by the pentagon, the area delimitated by London, Hamburg, Munich, Milan and Paris, have higher commuting rates. Regions located in the periphery (e.g. Spain, Italy, etc.) and in the Mediterranean Basin macro-region, an south-east Europe have low commuting rates. In Spain we can identify a high level of share (10-12 percentage of total employment) in the region of Madrid.

In other words the main divisions that are present in the EU-27 and the candidates countries in terms of the share of people commuting in total employment are between metropolitan (especially big metropolitan) and non metropolitan regions and the north and south regions.

The regional distribution of higher share is still concentrated in the main urban cores and first of all, we can observe a concentration area that involve the European Centre-North, encompassing cities that are important global nodes. This because in one hand big cities concentrate more power, abundance of job opportunities and commanding functions

and because central Europe has an high development of transport networks.

In the other this issue could be linked also with lack of employees and opportunities in many peripheral and disadvantaged regions, especially in areas with low accessibility.

Conclusion: "greener" transportation modes, cooperation and territorial dimension

The theoretically informed study of map 47 proved that there is a distribution of share of people commuting in total employment determined by the division between metropolitan/non metropolitan regions across Europe and explicit linkage of development to transport (e.g. the number of links possible between a series of large European cities in one day return trips using rail (FOCI, 2010a: 11).

"EU Transport GHG: Routes to 2050" that is a project funded by the European Commission's DG Climate Action starter in January 2011, aims to the evaluation of a series of alternative pathways to transport GHG reduction for 2050, in the context of the 50-70% reduction target for transport from the European Commission's Roadmap for moving to a competitive low carbon economy in 2050 (EC, 2011b).

Therefore in Directive 2009/28/EC the EU has set itself a 10 % target for the use of renewable energy in transport by 2020 (see Maps 39-40).

The European Commission, in line with the Withe Paper, adopted a comprehensive strategy (Transport 2050) (EC, 2011c) that aims to dramatically reduce Europe's dependence on imported oil and cut carbon emissions in transport by 60% by 2050.

The Transport 2050 roadmap sets different goals for different types of journey - within cities, between cities, and long distance.

For intercity travel: 50% of all medium-distance passenger and freight transport should shift off the roads and onto rail and waterborne transport;

For long-distance travel and intercontinental freight, air travel and ships will continue to dominate. New engines, fuels and traffic management systems will increase efficiency and reduce emissions;

For urban transport, it's expected a big shift to cleaner cars and cleaner fuels. 50% shift away from conventionally fuelled cars by 2030, phasing them out in cities by 2050.

The European Economic and Social Committee (EESC) and the Section for Transport, Energy, Infrastructure and the Information Society (TEN) recognises the need to optimise the transport system to meet the demands of EU competitiveness, social cohesion and sustainable development in order to complete the internal market. But the link between energy and transport issues will remain a central concern: the TEN section emphasises that future European transport policy, while maintaining the sector's competitiveness, must pursue four main objectives: the promotion of low-carbon modes of transport, energy efficiency, security and independence of supply and the reduction of traffic congestion.

Therefore, as the White Paper indicates, a higher share of travel by collective transport, combined with minimum service obligations, will allow increasing the density and frequency of service, thereby generating a virtuous circle for public transport modes.

So reducing CO2 emissions by upgrading commuting to "greener" transportation modes will require an array of coordinated, progressive transportation policies, supplemented by public-outreach campaigns on the carbon impacts of commuting as well as the availability of less-polluting commuting options.

In this direction also demand management and land-use planning can lower traffic volumes.

The modernisation of transport and energy networks in the way of a reduction of greenhouse gas emissions should take into account the *territorial dimension* and, in a regional perspective of planning, in the way of a polycentric territorial development and *an inter-urban polycentric cooperation* (FOCI, 2010b: 19).

The territorial dimension of transport policies is a "central issue for reducing the vulnerability of regions with a high level of commuting and for the development of broader and complementary portfolios of renewable energy sources in neighbouring regions" (ReRisk, 2010: 7).

If a change to low-carbon transport modes and reduction of traffic congestion including an higher share of travel by public transport are identified as main goals to achieve, as several researchers outline, also a *changing behaviour* available to actors and a raising of a digital society linked with the transport sector could contribute.

Thus, "the digitisation of daily life, which includes e-commerce, teleworking, e-government and e-learning, can contribute to decoupling." The direct effect of the behavioural changes is fewer passenger kilometres, but this effect may be offset by rebound effects, including […]

possible shift to more GHG intense modes (in the case of teleworking) […] the total reduction potential in passenger kilometres of teleworking and virtual meetings is 9.4% in 2020 and 15.1% in 2050." (Schroten, Skinner, Brinke et al. 2011: 28-29)

Therefore "for behavioural responses possible risks and uncertainties include e.g. the actual possibilities for changing behaviour available to actors, e.g. the possibility to work from home or opportunities to move closer to the work location in order to reduce commuting distance in response to road pricing of increased fuel taxes." (Hill, Brannigan, Smokers, et al. 2012: 48).

References

European Commission (2011a), WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system (available at Withe Paper of Transport, http://ec.europa.eu/transport/strategies/2011_white_paper_en.htm)

European Commission (2011b), COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, A Roadmap for moving to a competitive low carbon economy in 2050, COM (2011) 112 final. Available from DG Climate Actions website at: http://ec.europa.eu/clima/policies/roadmap/index_en.htm.

European Commission (2011c), Transport 2050: Commission outlines ambitious plan to increase mobility and reduce emissions, (available at http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/372&format=HTML&aged=0&language=en).

European Economic and Social Committee (EESC) and the Section for Transport, Energy, Infrastructure (available at http://www.eesc.europa.eu/?i=portal.en.ten-section).

FOCI (Future Orientations for Cities) project (2010a), Executive Summary (v. 15/12/2010) (available at http://www.espon.eu).

FOCI (Future Orientations for Cities) project (2010b), Final Report (v. 15/12/2010) (available at http://www.espon.eu).

Hill, N.; Brannigan, C.; Smokers, R.; Schroten, A., van Essen, H., and Skinner, I. (2012) Developing a better understanding of the secondary impacts and key sensitivities for the decarbonisation of the EU's transport sector by 2050. Draft final project report produced as part of a contract between European Commission Directorate-General Climate Action and AEA Technology plc; see website www.eutransportghg2050.eu p. 48.

ReRisk (Regions at Risk of Energy Poverty) project (2010), Final Report (v. 5/11/2010) (available at http://www.espon.eu).

Schroten, A.; Skinner, I.; Brinke, L. et al. (2011) Potential for less transport-intensive paths to societal goals. Task 4 paper produced as part of a contract between European Commission Directorate-General Climate Action and AEA Technology plc; see website www.eutransportghg2050.eu p. 28-29.

TRACC (Transport accessibility at regional/local scale and patterns in Europe) project (2011), Interim Report (v. 21/02/2011) (available at http://www.espon.eu).

3.4.2. Share of journeys to work by car in Urban Audit cities (map 48)

Definition of the indicator

This indicator refers to trips by commuters travelling to work places located within the boundary and should include trips by commuters not resident within the boundary. The proportion of journeys made by car is expressed by number of journeys to work by car x 100/Total number of journeys to work.

The indicator under discussion is derived from AUDIT "Mode of journey to work: rail/metro, bus, tram, car, cycle, walking ". The Urban Audit survey provides data on the distribution by mode of transport used for journeys to work.

In Urban Audit "Journey to work" refers to shortest trip (from place of residency to the work place, including change of transport mode) by commuters travelling to work places located within the boundary and should include trips by commuters not resident within the boundary but working within.

The spatial level of data is Larger Urban Zone (Label "LUZ"), which is an approximation of the functional urban zone centred around the town/city. The LUZ represents an attempt definition of the metropolitan area and it aims to have an area from a significant share of the resident commute into the city, a concept known as the "functional urban region." To ensure a good data availability, Eurostat adjusts the LUZ boundaries to administrative boundaries that approximate the functional urban region.

Relevance of the indicator

Share of journeys to work by car for urban areas reflects one of the main factors of traffic demands.

This indicator offers for a direct measure of car transport dependency at the urban scale and of the importance that cars have in cities.

If transport sector is one of the main emission-intensive sectors, with higher energy consumption and pollution shares and also only sector that has seen its emissions increase over the past two decades (see map 47), road transport contributes about one-fifth of the EU's total emissions of carbon dioxide (CO2), the main greenhouse gas. While emissions from other sectors are generally falling, those from road transport have continued to increase since 1990.

Eager to tackle climate change, the European Commission has a comprehensive strategy designed to help the EU reach its long-established objective of limiting average CO2 emissions from new cars to 120 grams per km by 2012.

The Common Transport Policy is an essential component of the EU policy since the Maastricht and the last "White Paper on Transport (2011)" (EC, 2011a) is the providing the conceptual framework for the CTP Treaty of 1992.

The White Paper on Transport, document of strategic reflection of Common Transport Policy, identify in the transition towards a more sustainable transport sector, focused on urban transport and commuting, an essential component in the flagship on resource-efficiency and directly referring to.

The White Paper views current mobility patterns as unsustainable, with greenhouse gas emissions and rising congestion as the main sources of un-sustainability.

A somewhat similar view, but this on a global level, is found in the 2012 IEA – Energy Technology Perspectives report (IEA, 2012). More generally, as the "The international transport forum outlook 2012" (2012) affirms, the future growth of CO2 emissions from global mobility depends strongly on the development of urban mobility.

LUZ Code	*Larger Urban Zone LUZ*	*Share of journeys to work by car. Urban areas (Year 2007-2009) [%]*
BE004L	CHARLEROI	86.45
BE005L	LIÈGE	85.65
ES016L	TOLEDO	81.11
ES022L	VIGO	80.97
ES014L	PAMPLONA/IRUÑEA	80.64
ES004L	SEVILLA	80.22
ES026L	CORUÑA	79.94
ES011L	SANTIAGO DE COMPOSTELA	79.90
ES009L	VALLADOLID	78.97
BE007L	BRUGGE	78.45
ES015L	SANTANDER	78.35

Table 41 This table shows the ten regions with the highest share

LUZ Code	**Larger Urban Zone LUZ**	**Share of journeys to work by car. Urban areas (Year 2007-2009) [%]**
SK001L	BRATISLAVA	15.00
SK003L	BANSKÁ BYSTRICA	25.00
SK006L	ŽILINA	28.10
SK004L	NITRA	29.00
SK005L	PREŠOV	29.90
SK002L	KOŠICE	30.00
SK008L	TRENČÍN	33.30
ES001L	MADRID	40.40
FI001K	KERNEL HELSINKI	43.00
DE001L	BERLIN	46.60

Table 42 This table shows the ten regions with the lowest share

LUZ Code	Larger Urban Zone LUZ	Share of journeys to work by car. Urban areas (Year 2007-2009) [%]
DE021L	GÖTTINGEN	63.40
DE025L	DARMSTADT	63.70
DE007L	STUTTGART	63.90
ES005L	ZARAGOZA	64.12
DE037L	MAINZ	**64.30**
BE006L	BRUGGE	64.89
DE036L	MÖNCHENGLADBACH	65.30
DE032L	ERFURT	66.00
FI002L	TAMPERE	66.00
DE020L	WIESBADEN	66.20

Table 43 This table shows the ten regions with or close to the median share (i.e. 64.3%)

Notes:

Data are not available for the following countries: AT, BG, CZ, GR, IT, CY, LV, LT, LU, HU, MT, PL, PT,RO, SI, HR, TR and CH.

Data for BE, DE, EE, ES, SK, UK and FI are shown for 2008. Data for DK, FR0041, FR022L, and NL are shown for 2003. IE and FR025 are shown for 2004. SE and NO are shown for 2005.

Explanation of the geographical pattern expressed by the map 48

Introductory notes: road transport as a main emission-intensive of transport sectors

If, as European Commission states, transport is responsible for around a quarter of EU greenhouse gas emissions making it the second biggest greenhouse gas emitting sector after energy, road transport is responsible for around 12% of total EU emissions of carbon dioxide (CO2), the main greenhouse gas.

As part of the EU's efforts to tackle climate change, the European Commission proposed legislation, back in 2007, setting emission performance standards for new passenger cars. That legislation, adopted in 2009 by the European Parliament and the Council, is the cornerstone of the EU's strategy to improve the fuel economy of cars and ensure that

average emissions from new passenger cars in the EU do not exceed 120 gCO2/km.

To improve planning certainty for the automotive sector while ensuring that CO2 reductions from light-duty vehicles continue to take place, the Commission considers, based on a thorough impact assessment, to propose a target for passenger car emissions to be reached by 2025. Among other options, the Commission will assess the feasibility of the target suggested by the European Parliament of reaching 70 gCO2/km by 2025.

"EU Transport GHG: Routes to 2050" (EC, 2011b) in line with the "Withe Paper", adopted a comprehensive strategy (Transport 2050) (EC, 2011c) for a competitive transport system reducing Europe's dependence on imported oil and cut carbon emissions in transport by 60% by 2050.

The Transport 2050 roadmap sets different goals for different types of journey within cities and between cities. For urban transport it is important a big shift to cleaner cars and cleaner fuels. The 50% shift away from conventionally fuelled cars by 2030, phasing them out in cities by 2050 (EC, 2011b).

Existing patterns and comparison with ESPON regions

Map 48 shows spatial patterns in terms of the share of journey to work by car in EU-27. Cities that have higher rates are located in Belgium and Spain.

These are small-medium size cities (with population of less than 250,000 inhabitants) with the exception of Seville (around 700,000 inhabitants), Valladolid and Vigo (around 300,000 inhabitants).

In Spain we can identify a general high level of share (around 80%) with the exception of Madrid that is a city that present a really low rate (40,4 %).

Most of other cities that have lower rates are located in Slovakia and others are capital cities, like Madrid, as said before, Helsinki and Berlin.

It should be noted that a relatively big area of EU-27 cannot be evaluated as no data were found.

Theoretically speaking, it seems that spatial patterns show that the main divisions that are present in the EU-27 and the candidates countries in terms of the share of journey to work by car could be linked with a different development level of public transport networks, with an high multimodal accessibility of cities and habitat fragmentation and agglomeration.

EU2020 targets and conclusion

The theoretically informed study of map 48 proved that there is a distribution of the share of journey to work by car not clearly determined by the division between cities across Europe (a light division could be identified between North an South cities), but is possible to link patterns of transport development into urban areas and their urban structure.

Combination of measures could be identified as the most effective approach to reducing GHG emissions by private cars and road transport.

Policies to improve fuel economy and shift to eclectic mobility and other fuels for transport with potentially lower carbon-intensity are the core of green growth policies for transport.

Some measures take the form of national and European legislation to limit the average fuel consumption of new cars supplied to the market like agreement between vehicle manufacturers and government to produce *low-fuel consumption vehicles;* graduated vehicle taxes; fuel taxes and excise duties; and promotion of greater fuel efficiency in the different sectors involved.

For instance, the "Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles" aims at a broad market introduction of environmentally-friendly vehicles.

Others measures are designed to *limit passenger car traffic* in urban areas in order to improve the use of public transport, with an indirect but positive impact on CO2 emissions.

First of all a better balanced mobility will reduce reliance on car use and provide opportunities to reducing the greenhouse gas footprint of mobility overall.

Other suggestions to reduce the need to travel mainly include IT-based solutions, such as tele-working, internet conferences, etc. Also it is considered important to support small neighbourhood stores, enabling people to shop close to home. "Together this provides the signal that the future Action Plan should not just look at accommodating people's needs to travel" (Green Paper on Urban Mobility, 2008).

The interrelationship between polycentrism and commuting

The link between urban fragmentation/agglomeration, polycentrism and mobility is however a much debated issue.

In current urban planning debate research shows that there is an important relationship between the urbanisation driver and daily commuting patterns.

If some research outcomes show the more the city is dispersed, the greater is the share of peripheral commutes (Aguilera and Mignot, 2002), the suburbanization also led to a growth in the average commuting distance and of car use, because of the increased distances but also because public transport is so inefficient on peripheral axes (Aguilera and Mignot, 2004).

Urban sprawl entails building extensive transportation systems because houses are increasingly far away from workplaces and commercial centres. This new constructed infrastructure, in return, spurs further urban sprawl – investments made in new motorways or road connections attract new development along the improved transport lines. Growing car ownership and the concentration of work and shopping in out-of-town locations have resulted – and may continue to result - in continuing increases in journey length for all purposes, but particularly for commuting (Report on Transport Scenarios with a 20 and 40 Year Horizon, 2009).

In other words, one of the most relevant consequences of urban sprawl is an increasing dependence on the car for intra and inter-metropolitan travel. An its efficient control has resulted in increased population densities that in turn fostered the use of public transport and reduced the growth of car use (Report on urban transport in Europe, 2007).

Two models of city and planning actions in these directions of cities development could have factors in the reduction of car use especially by means of a reduction in the commuting distances and/or commuting times:

The compact and dense city (Gordon and Richardson, 1997);

The polycentric model,in which the location of workers and jobs in and around dense and mixed subcenters facilitate the commuting and the mobility. In polycentric cities the periphery attracts a significant share of the commuters, conversely than centralised cities, where most home-to-work travels concern the city centre (Van Der Laan, 1998).

As the Withe Paper point out Urban Mobility Plans should be encouraged fully in cities above a certain size and they should be aligned with Integrated Urban Development Plans. In the "urban context, to reduce congestion and emissions is needed a mixed strategy involving land-use planning, pricing schemes, efficient public transport services and

infrastructure for non-motorised modes and charging/refuelling of clean vehicles." (EC, 2011a: 13)

References

Aguilera A., Mignot D. (2004), "Urban Sprawl, Polycentrism and Commuting. A Comparison of Seven French Urban Areas", Urban Public Economics Review, n. 1 pp. 93-114

Aguilera A., Mignot D. (2002), "Structure des localisations intra-urbaines et mobilité domicile-travail", Recherche Transport Sécurité, n. 77, pp. 311-325.

European Commission (2011a)- WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and efficient transport system (available at Withe Paper of Transport, http://ec.europa.eu/transport/strategies/2011_white_paper_en.htm).

European Commission (2011b), COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, A Roadmap for moving to a competitive low carbon economy in 2050, COM (2011) 112 final. Available from DG Climate Actions website at: http://ec.europa.eu/clima/policies/roadmap/index_en.htm.

European Commission (2011c), Transport 2050: Commission outlines ambitious plan to increase mobility and reduce emissions, (available at http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/372&format=HTML&aged=0&language=en).

European Economic and Social Committee (EESC) and the Section for Transport, Energy, Infrastructure (available at http://www.eesc.europa.eu/?i=portal.en.ten-section).

FOCI (Future Orientations for Cities) project (2010), Final Report (v. 15/12/2010) (available at http://www.espon.eu).

Green Paper on Urban Mobility - Stakeholder Consultation Report (available at http://ec.europa.eu/transport/urban/studies/doc/2007_urban_transport_europe.pdf).

International Transport Forum, Transport Outlook, Seamless Transport for Greener Growth, (2012) (available at http://www.internationaltransportforum.org/Pub/pdf/12Outlook.pdf).

IEA 2012, Energy Technology Perspectives 2012. IEA/OECD, Paris.

Report on urban transport in Europe, prepared for the European Commission, Directorate-General for Energy and Transport (available at http://ec.europa.eu/transport/urban/studies/doc/2007_urban_transport_europe.pdf).

Report on Transport Scenarios with a 20 and 40 Year Horizon - Developing a set of long-term scenarios (2030-2050) for transport and mobility in Europe (available at http://ec.europa.eu/transport/strategies/studies/doc/future_of_transport/2009_02_transvisions_report.pdf).

ReRisk (Regions at Risk of Energy Poverty) project (2010), Final Report (v. 5/11/2010) (available at http://www.espon.eu).

TRACC (Transport accessibility at regional/local scale and patterns in Europe) project (2011), Interim Report (v. 21/02/2011) (available at http://www.espon.eu)

Van der Laan N. (1998), "Changing urban systems: an empirical analysis at two spatial levels", *Regional Studies*, vol. 32, pp. 235-247.

3.4.3. Rate of municipal waste collection (map 49)

Definition of the indicator

The regional coverage rate of municipal waste collection indicator is derived from Eurostat's statistics at NUTS2 level. No definition is available for the indicator. However, Eurostat emphasises that municipal waste is mainly produced by households though there are other sources of similar waste such as commerce, offices and public institutions. The flagship initiative "A resource-efficient Europe" stressed the need for a set of indicators to cover, among others, issues of waste generation and recycling rates. Availability of data is not consistent among all MS.

The most recent year with greater consistency is 2008 to which data here presented refers. However, there is a lack of data which concerns quite a few States, both MS and Candidate Countries. Data were not available for: United Kingdom, Iceland, Finland, Sweden, Denmark, Estonia, Latvia, Czech Republic, France, Spain, Greece, Switzerland, Albania, Montenegro, Serbia and Bosnia and Herzegovina. As regards Ireland, data were collected at the national level from the Environmental Protection Agency of Ireland.

Relevance of the indicator

EU policies to reduce the impact of waste have been put in place since the 1970s (Eurostat, 2010). More recent policy measures have been introduced in the mid 1990s with the Directive 1994/62/ on packaging and packaging waste which, according to a Eurostat's publication, might have contributed to reduce the share of landfilling in favor of other treatment strategies such as incineration, recycling and composting. The latest legislative measure on waste is the Directive 2008/98. The EU waste legislation comprises three main elements or layers: legislation on waste management; technical legislation which sets out standards for different treatment operations; and legislation on specific waste streams, mostly hazardous waste.

The EU policy for waste is to consider it as an EU's key resource by 2020. This view is clearly expounded within the Commission Communication "Roadmap to a Resource Efficient Europe" (EC, 2011a) where it is set out that by 2050 residual waste should be close to nought. Furthermore, the Flaship Initiative "A resource efficient Europe" (EC, 2011b) emphasizes a set of key actions that could be undertaken to reduce waste generation and improve waste management such as: improving the design of products can reduce the demand for raw material and the amount of waste generated; just in time collection of waste and recycling which can reduce the need for storage; incentives for waste prevention; public investment in modern facilities. In 2008, the EU reformed its legal framework for waste on the basis of the so-called "waste hierarchy" (prevention, reuse, recycling and recovery).

According to Eurostat's Evironmental Statistics and Accounts in Europe (2010), overall the EU strategy for dealing with waste is based on four cornerstones: waste prevention and reuse, waste recycling, turning waste into a greenhouse-neutral energy source, and improving final waste disposal. The target is to re-introduce waste into the economy as a raw material. Thus, in order to achieve this, much higher priority should be given to re-use and recycling with all Member States that should aim at a close to 100% of waste recycled target (EC, 2011a).

Discussion of the geographical pattern of map 49

Introductory notes: A great discrepancy between old Member States and new Member States

Map 49 shows a geographical pattern with great differences between old Member States and new Member States. This pattern is comparable to that of many other maps, e.g. energy intensity maps, where generally new Member States have far better performances than old Member States.

In fact all of the old MS for which data are available at NUTS2 level (Belgium, Germany, Italy, Luxembourg, the Netherlands, Austria and Portugal) show coverage rates which fall in the highest category (>90). More precisely, all of their 100 NUTS2 regions show a coverage rate of 100% which is matched by Cyprus, Slovenia, Slovakia and Malta regions for the new MS. Moreover, an effort of generalization on the basis of other available data on waste such as, for example, rates for recycling, amounts of waste being landfilled and amounts being incinerated may lead to argue that countries such as France, Spain, Sweden, Finland and the UK, which show comparable rates for these indicators (Eurostat, 2011a), may also have coverage rates of municipal waste collection close to 100%. In fact, Sweden, after Germany, shows the highest recycling rate with 36% of all waste being recycled.

Yet, with regard to the amounts of waste being landfilled Sweden and Denmark show rates below 5% like Germany, the Netherlands and Austria, whilst France, the UK and Finland report amounts being landfilled in the range of 32% to 50% comparable to Italy's statistics (Eurostat, 2011a). Ireland is the only old MS to show a rate, even though at national level, lower than 100 and exactly of 91.

Table 44 shows the ten EU-27 NUTS2 regions with the lowest coverage rates. Seven of these regions are located in Romania and the remaining three in Poland. In these countries none of the regions reaches a coverage rate of 100% and this pattern is also true for all other new MS with the exceptions of Cyprus, Slovenia, Slovakia and Malta. The other new MS and Candidate Countries for which data are available (Bulgaria, Hungary, Lithuania, Croatia and Turkey) show a coverage rate lower than 100%. However, there is a great difference between new MS and data vary considerably from very low rates in Romania and Poland to higher rates close to 100% in Hungary, Bulgaria. Taking into consideration national

states and the regions within them, map 49 presents a geographical pattern which shows higher rates in the regions of the capital cities. This is true for Romania which has the highest rate of 81.8% in the Bucaresti-Ilfov region and for Hungary where the highest rate of 96.3% is reported for the region Kozep-Magyarorzag where Budapest is located. In Bulgaria, the region of Sofia, Yugozapaden, has the second highest rate of 97.9%. The exception is Poland where the Warsaw's region of Mazowieckie has a rate of 75% closer to the lowest of 66.4% than to the highest of 90.2%. Some of these findings are reported in table 46.

However, coverage rates do not show any direct correlation with the ESPON regional typologies. It is not possible to identify a geographical pattern for low coverage rates that is related, for example, to mountain, coastal or rural regions. In fact, mountain regions of Bulgaria, Romania and Poland generally show the higher coverage rates. This can also be said of rural regions of Bulgaria and Romania which have coverage rates in line with the other NUTS2 regions.

MS Code	*Region NUTS-2*	*Rate %*
RO41	Sud-Vest Oltenia	31.62
RO21	Nord-Est	42.19
RO31	Sud - Muntenia	46.73
RO22	Sud-Est	48.9
RO11	Nord-Vest	61.79
RO42	Vest	63.34
PL11	Łódzkie	66.4
RO12	Centru	66.54
PL34	Podlaskie	68.5
PL33	Świętokrzyskie	71.9
Country Codes: RO Romania, PL Poland		

Table 44 This table shows the EU-27 NUTS2 Regions with the lowest ratios

It is interesting to notice that things change considerably if candidate countries are considered. In this case Turkey shows very low rates which are somewhat comparable with Romania's regions' rates. Table 45 in fact shows that Poland's regions do not fall within this chart having higher rates and that Turkey comes in with five NUTS2 regions. Of the other candidate countries Macedonia has a rate quite low of 72% whilst Croatia performs relatively well with rates ranging from 84% to 98.6%.

MS Code	*Region NUTS-2*	*Rate %*
RO41	Sud-Vest Oltenia	31.62
RO21	Nord-Est	42.19
RO31	Sud - Muntenia	46.73
RO22	Sud-Est	48.9
TRA2	Agri	51
TR82	Kastamonu	55
TRB2	Van	56
RO11	Nord-Vest	61.79
TR90	Trabzon	62
TR81	Zonguldak	63
Country Codes: RO Romania, TR Turkey		

Table 45 This table shows the 10 NUTS2 Regions with the lowest ratios

After having said that nearly all of the old Member States' regions and Cyprus, Slovenia, Slovakia and Malta regions have a rate of 100%, it is of interest to have a look at those new Member States' regions which are not included in the previous tables, nor in the best performing regions, but have rates closer to 100. This allows well performing new MS regions to be identified. The pattern is immediately clear with Hungary and Bulgaria standing out. In fact, all ten new MS best performing regions belong to these two countries with coverage rates ranging from 90.6 to 98.1 so highlighting the need for more urgent action in other countries which show lower rates where greater action is required to match old MS rates.

MS Code	Region NUTS-2	Rate %
HU32	Észak-Alföld	90.6
HU23	Dél-Dunántúl	91.9
HU21	Közép-Dunántúl	92.2
HU31	Észak-Magyarország	92.2
BG34	Yugoiztochen	92.45
BG31	Severozapaden	92.82
HU22	Nyugat-Dunántúl	93.9
HU10	Közép-Magyarország	96.3
BG41	Yugozapaden	97.9
BG42	Yuzhen tsentralen	98.1
Country Codes: BG Bulgaria, HU Hungary		

Table 46 Ten EU-27 regions with a coverage rate closer to 100.

Conclusions: need for improved collection facilities and strategies and for reduction of waste generation

Waste management is of absolute importance within the EU policies and waste should be treated as a resource in order to decouple waste generation from economic growth. However, waste generation shows steady increasing trends in some of the EU-27 Member States which should be reversed if the objective stated above is to be achieved. Yet, newer and more efficient collection strategies and operations especially in new Member States, which show a prevalence of landfilling, should be encouraged and incentivized.

Even though municipal waste constitutes only a small part of the total waste generated and the EU-27 level has stabilized at about 520 Kg per capita in the period 2002-2009, in too many countries (Denmark, Cyprus, Luxembourg, Malta, Iceland, Italy, France, Belgium, Portugal, Sweden, Finland, Greece, Slovania, Czech Republic, Poland and Slovakia) the amounts of waste generated are increasing and 2009 per-capita levels are higher than 2002 levels (Blumenthal, 2011:1). Considering the fact that

Municipal waste is for the most part households generated waste, it is fundamental to take action on citizens behaviours and consumption models, especially in new MS, if the the trend is to be reversed.

Moreover, the Flagship initiative "A resource-efficient Europe" emphasizes the need for MS to prepare waste management plans covering the type, quantity, sources of waste and collection systems with a special focus on the first layer of the waste hierarchy, waste prevention, "with a view to breaking the link between economic growth and waste generation" (Blumenthal, 2011:7).

Stronger emphasis and action is needed to increase the amounts of waste being recycled though results achieved in the fifteen years from 1995 to 2009 are encouraging. In fact, the amount of municipal waste recycled increased in this period from 11% to 24% showing an absolute increase from 21.8 million tonnes (46 kg per capita) in 1995 to 59.2 million tonnes (118 kg per capita) in 2009. Action should involve especially new MS which show the highest share of landfilling which in Bulgaria, Romania, Croatia, Turkey, Lithuania top nearly 100% (Blumenthal, 2011).

It is quite important to deliver such changes and innovations since they could bear significant benefits both economic and environmental. Improved management of municipal waste could result in 92 million tons of greenhouse gas emissions avoided in 2020 compared with 1995 and at least 500.000 new jobs would be created in Europe if countries recycled 70% of their waste (Blumenthal, 2011).

References

Blumenthal, K. (2011): *Generation and treatment of municipal waste.* Environment and energy, Eurostat Statistics in focus. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-SF-11-031

European Commission (2011a) Roadmap to a Resource Efficient Europe. Available at:

http://ec.europa.eu/environment/resource_efficiency/about/roadmap/index_en.htm

European Commisson (2011b) A resource efficient Europe. Available at: http://ec.europa.eu/resource-efficient-europe/index_en.htm

Eurostat's (2010) Evironmental Statistics and Accounts in Europe. Available at:

http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-32-10-283

Eurostat (2011a) Municipal Waste Statistics, Data from March 2011. Available at:

http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Municipal_waste_statistics)

European Parliament and Council (1994) Directive 1994/62 on packaging and packaging waste. Available at:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:NOT

European Parliament and Council (2008) Directive 2008/98 on Waste and repealing certain Directives. Available at:

http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/sectors/municipal_waste

3.4.4. Urban waste-water treatment capacity (map 50) Treatment capacity as % of generated load

Definition of the indicator

The urban waste water treatment capacity indicator is derived from the Directorate-General for the Environment work and refers to 2007 data. The indicator defines the amount of urban waste water treated as a percentage of generated load. Data are available generally at NUTS2 level and in some cases at NUTS0 level such as for Malta, Luxembourg, Lithuania and Estonia. Availability of data is more widespread for waste water treatment than it is for urban waste collection. This is probably due to the Directive 1991/271 which requires Member States to publish situation reports every two years.

However, data are lacking for Czech Republic, Greece, Latvia, Cyprus and some regions of Italy and Bulgaria within the EU-27 Member States. Whist, as regards candidate countries data are not available for any of these.

Relevance of the indicator

The main document for the Member States is the Directive 1991/271 of the Council concerning urban waste water treatment. The Directive defines urban waste water as "domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain

water" (European Council, 1991). The Directive was amended in 1998 by the Directive 1998/15/ (EC, 1998).

The directive 1991/271 requires situation reports to be published by MS every two years and this explains the different situation of MS compared to that of candidate countries and other countries such as Switzerland and Norway for which data are not available. This can be considered an achievement of the Union and its legislative measures.

Though the EC press release "Final assessment of the 6th Environment Action Programme" states that the Commission continues to pursue an ambitious environment policy which is now part of the EU2020S (EC, 2011), in the latter there is no evidence of waste water treatment capacity objectives. Low degree of emphasis placed on waste water treatment by MS is also evident from the fifth report of the European Environment Agency on Resource efficiency in Europe49 (EEA, 2011). In fact, only four of the 31 countries surveyed have mentioned waste water among the strategic objectives for resource efficiency compared to targets such as increase recycling, improve energy efficiency and increase RES share reported by about 20 countries.

However, the Fifth Cohesion Progress Report claims that the number of cities where waste water treatment is below EU standards has fallen over the past decade. The geographical pattern which emerges from map 50 confirms the the need, emphasized by the Fifth Cohesion Progress report, for more investment in several of the eastern Member States to fully comply with the urban waste water directive (EC, 2010: XVII).

Discussion of the geographical pattern of map 50

Introductory notes: greater consistency within the EU-27

Map 50, differently than map 49 for urban waste collection, shows a greater consistency between old MS and new MS, even though Romania and Poland are still lagging behind. The main reason for this greater consistency is the low percentage shown by some regions across the EU-15 MS and as a counterpart the high percentage near 100% shown by some regions, for example, of Poland. It surprises that some regions of Belgium and Ireland have low percentages of urban waste water

[49] The complete title of the report is: *Resource efficiency in Europe: Policies and approaches in 31 EEA member and cooperating countries.*.

treatment capacity. However, as a general pattern regions of old Member States show percentages above 90% which are matched by many regions of Slovakia, Slovenia, Poland and Lithuania.

Table 47 below shows the ten EU-27 NUTS2 level regions with the lowest rate of urban waste water treatment capacity. It is of interest to see that, apart from regions of Romania and Bulgaria which confirm the need for further investment in technologies of urban waste water treatment and waste collection, there are two regions of Belgium and one of Malta. The Guyana region, a France's "département d'outre-mer" region in South America, shows a percentage close to zero but of course cannot be considered as a region within the EU physical territory.

It is striking however to see percentages as low as 1% and 8%. As the EC points out within its facts and figures on urban waste waster, approximately €35 billion investment will be required to enable EU-12 MS to implement the Directive on urban waste water treatment with the highest investment in Romania and Poland of about 29% and 32% respectively (EC, 2012)50. In Romania Bucharest's region shows the lowest rate of 1% and the same could be said for Poland where Warsaw's region, Mazowieckie, has one of the lowest rates in the country of 65%. If, together with these data, data for the region of Brussels (22%) is taken into consideration it is possible to see that capital cities' territories are found to face the greater challenges.

Other data of interest concern Ireland, some regions of Italy and Spain. As regards Ireland its two NUTS2 level regions show UWWT capacity of 46% and 54%, being the 11th and 13th regions with the lowest rates in the EU-27. If in Spain the lowest rates are reported for two of the poorest regions, Canarias (69) and Extremadura (80), in Italy the situation is different with the lowest rate (80%) being reported for the Veneto region in the north east which is one of the richest in the whole country.

[50] http://ec.europa.eu/environment/water/water-urbanwaste/implementation/factsfigures_en.htm. Last updated 23 February 2012. Accessed on June 24, 2012.

MS Code	*Region NUTS-2*	*Rate %*
RO32	Bucharest - Ilfov	1
FR93	Guyane	2
BG32	Severen tsentralen	8
RO41	Sud–Vest Oltenia	15
MT00	Malta	21
RO12	Centru	22
BE10	Region de Bruxelles-Capital	22
RO42	Vest	24
BE35	Prov. Namur	29
R031	Sud-Muntenia	43
Country Codes: RO Romania; TR Turkey; BE Belgium; FR France; MT Malta		

Table 47 This table shows the ten EU-27 NUTS2 level regions with the lowest rate of urban waste water treatment capacity.

Table 48 shows the ten NUTS2 level regions with the UWWT rates closer to the median value. The median value has been calculated taking into consideration only one region with the value of 100% being such regions the vast majority. It is possible to see that regions across old Member States do not all have values of 100%, differently than urban waste collection coverage rates of map 49. There are a few countries which show all regions with values of 100%. These are Sweden, Slovenia, the Netherlands, Denmark and France apart from Guyane region. However, all regions of Germany, Finland, Austria, Slovakia report performances in the highest category (90-100), whilst in the UK there is only one region below 90%, Surrey, East and West Sussex south of London.

MS Code	*Region NUTS-2*	*Rate %*
LT00	Lietuva	92.8
DED3	Leipzig	93.2
ITC4	Lombardia	93.3
ES13	Cantabria	93.7
UKK2	**Dorset and Somerset**	**93.9**
DE93	**Luneburg**	**94.1**
ITF1	Abruzzo	94.3
DE94	Weser-Ems	94.6
DEG0	Thuringen	95.4
BE21	Prov. Antwerpen	95.7

Country Codes: LT Lithuania; DE Germany; IT Italy; ES Spain; UK United Kingdom; BE Belgium

Table 48 This table shows the ten EU-27 NUTS2 regions with treatment rates closer to the median value

Urban waste water treatment rates do not show any direct correlation with the ESPON regional typologies. It is not possible to identify a geographical pattern for low treatment rates that is related, for example, to mountain, coastal or rural regions. If this could be true for example for mountain regions of Veneto and Umbria in Italy and Extremadura in Spain, the same cannot be said for Austria which instead shows treatment rates in the highest category as well as north west Scotland's NUTS2 region of Highlands and Islands.

Furthermore, it is of interest to have a look at those new Member States' regions, where generally the highest investment is needed, which instead perform well and show treatment rates within or closer to the highest category (90-100), excluding those new MS regions with rates of 100% mentioned above (nearly all regions of Slovakia and Slovenia). This allows well performing new MS regions to be identified. The pattern is varied and comprises regions from many countries, sign that there is a greater

consistency among MS and that high performances may be found all around Europe.

MS Code	*Region NUTS-2*	*Rate %*
HU22	Nyugat-Dunantul	84
HU21	Kozep-Dunantul	86
PL61	Kujawsko-Pomorskie	88
HU23	Dél-Dunantul	89
EE00	Eesti	89
PL32	Podkarpackie	89
PL52	Opolskie	90
SK01	Bratislavsky kraj	91
RO11	Nord-Vest	91
LT00	Lietuva	93
Country Codes: HU Hungary; PL Poland; EE Estonia; SK Slovakia; Ro Romania; LT Lithuania		

Table 49 This table shows new Member States' NUTS2 regions with treatment rates closer to 100%.

Conclusions: need for further investment in some new MS

Although urban waste water treatment does not represent one of the headline and most important targets of the EU2020 Strategy and it is not included in the key actions and commitments of MS, the fifth Cohesion Report highlights steady progresses towards increased standards across Europe and higher numbers of people connected to waste water collection and treatment facilities (EC, 2010: XXI).

Increased rates of waste water treatment are fundamental so as to preserve the quality of water reserves for several uses such as drinking, tourism, agriculture and not least industry. Some gaps however are evident as shown in the section dedicated to the geographical pattern of this indicator and do not only concern new Member States such as Bulgaria and Romania but also old MS such Belgium which shows incredibly low rates in a couple of regions and Ireland. The reasons for

this may be found, as the Final Report for the Assessment of the 6th Environment Action Programme explains, in a slow or incomplete implementation of existing policy and legislation measures such as the Urban Waste Water Treatment Directive (EC, 2011:61).

In order to protect the water environment the Directive 1991/271 requires MS to identify sensitive areas since the designation of water bodies determines the type and thoroughness of waste water treatment that should be put in place. Other than the water bodies identified by single MS the European Commission through its DG for the Environment has identified further water bodies that are at risk of becoming eutrophic and need further protection. These include the Baltic Sea, the Northern Adriatic and the North Sea, together with a significant number of other inland waters and estuaries (EC, 2012).

Immediate action and implementation of the existing policy and legislative measures is needed to further improve the standards of waste water treatment across Europe and preserve the water environment and not only. Greater challenges that the EU-27 has the priority to face concern some capital cities' areas such as Bucharest, Warsaw and Brussels and other Member States' territories such as Malta and Bulgaria. Moreover, with regard to Candidate Countries the need for data on waste water treatment should be addressed.

References

European Council (1991), Directive 1991/271 concerning urban waste water treatment. Available at:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0271:EN:NOT

European Council (1998) Directive 1998/15 amending Council Directive 1991/271. Available at: http://ec.europa.eu/environment/water/water-urbanwaste/amendment.html.

European Commission (2010) Fifth Report on Economic, Social and Territorial Cohesion. Available at: http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/cohesion5/index_en.cfm.

European Commission (2011) Final assessment of the 6th Environment Action Programme. Available at:

http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/996.

*European Commission (2012) Facts and Figures about Urban Waste Water Treatment. Available at:*http://ec.europa.eu/environment/water/water-urbanwaste/implementation/factsfigures_en.htm*.*

European Environment Agency (2011) Resource efficiency in Europe: Policies and approaches in 31 EEA member and cooperating countries. EEA Report No 5/2011. ISSN 1725-9177 EEA: Copenhagen. Available at: http://www.eea.europa.eu/highlights/publications/resource-efficiency-in-europe/.

3.4.5. Protected areas included in the Natura 2000 network as a share of total area (map 51)

Definition of the indicator

This map refers to the indicator @38 (Protected areas included in Natura 2000 network, in percentage) which has a homogeneous definition for the entire EU and shows how the reported Natura 2000 network areas are distributed in Europe at NUTS3 level for years 2009 and 2011.

As stated by EEA (European Environment Agency) "Natura 2000 is the key instrument to protect biodiversity in the European Union. It is an ecological network of protected areas set up to ensure the survival of Europe's most valuable species and habitats"51. More precisely, Natura 2000 is an ecological network based on the Habitats Directive (EEC/92/43)52 adopted in 1992 and the Birds Directive53 (2009/147/EC) signed in 1979 and updated in 200954 which form the cornerstone of Europe's nature conservation policy and today represents the world's largest network of protected areas. According to these two EU Directives, conservation should be achieved while taking account of economic, social, cultural, regional and recreational needs.

As reported by Eurostat "The Natura 2000 network consists of sites designated by Member States under the Birds Directive (Special Protection Areas = SPA) and the Proposed Sites of Community Importance (pSCI) that are subsequently designated under the Habitats Directive (Special Areas of Conservation = SAC)"55.

Relevance of the indicator

With the adoption of the Lisbon Treaty, entered into force on 1 December 200956, the territorial dimension was added to the objective of Policy Cohesion on EU. Among others, the territorial cohesion reinforces the

51 http://www.eea.europa.eu/data-and-maps/data/natura-1 (Last access 15 June 2012).

52 http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm. (Last access 15 June 2012).

53 http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm. (Last access 15 June 2012).

54 The 2009 Birds Directives replaces the 1979 version of the Birds Directive (79/409/EEC). The Annex VII of the 2009 Directive gives a correlation table between the 1979 Directive and the 2009 Directive.

55 http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/t_env_biodiv_esms.htm (Last access 18 June 2012).

56 http://europa.eu/lisbon_treaty/index_en.htm. (Last access 08 June 2012).

importance of the sustainable development whose environmental dimension has a stronger territorial dimension (EC, 2010a). The flagship "A Resource-Efficient Europe"57 of the Europe 2020 Strategy (EU2020S) states that biodiversity conservation is an essential issue in achieving the overall target, thus biodiversity loss must be prevented, and that this issue has to be considered when referring to a resource-efficient economy.

One of the major key elements in delivering this flagship is the new EU biodiversity strategy aimed at halting "further loss to and restore biodiversity and ecosystem services in the light of pressures on ecosystems"58. In this respect, on 20 April 2012, the European Parliament has adopted a resolution on the "EU 2020 Biodiversity Strategy"59 built around six mutually supportive main targets each of them is further translated into a set of time-bound actions (20 in total) and other accompanying measures in order to combat biodiversity loss. In particular, Action 1 is devoted to "Complete the establishment of the Natura 2000 network and ensure [its] good management".

Currently, the only clear indicator available to measure biodiversity conservation in Europe is the percentage of terrestrial protected spaces. As the best way to standardise the various national legal arrangements, the Natura 2000 is a common framework which can be scanned across the EU.

Natural Protected areas not only safeguard the biodiversity loss but can also play a key role in maintaining our economic and social well-being (Kettunen et al. 2009b; Dudley et al. 2008; Mulongoy & Gidda, 2008). Furthermore, the Natura 2000 network plays an important active role in a view of climate change mitigation and adaptation. As matter of fact, is estimated that the network currently stores around 9.6 Gt (Giga tonnes) of Carbon, equivalent to 35000 million tonnes of CO2 (EC, 2011).

As reported on the "Cohesion Policy and Sustainable Development" study led by IEEP (Hjerp et al., 2011)60 Natura 2000 sites can have a significant relevance in providing several ecosystem services: creating tourism and jobs, maintaining food security, supporting physical and mental health and protecting cultural heritage values. Estimating on visitors' willingness to

[57] http://ec.europa.eu/resource-efficient-europe/index_en.htm (Last access 12 June 2012).

[58] http://ec.europa.eu/resource-efficient-europe/pdf/resource_efficient_europe_en.pdf (Last accessed 07 June 2012).

[59] http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm (Last access 10 June 2012).

[60] Study completed in October 2011 by a consortium led by the IEEP, Institute for European Environmental Policy Available at http://ec.europa.eu/regional_policy/information/studies/index_en.cfm#1 (). (Last accessed 11 June 2012).

pay per recreational visit, it is valued recreational benefits between €5 and €9 billion per year (EC, 2011).

Focussing on ecosystem services provided by a site, Kettunen et al. (2009a) considers that the total value of a protected area can be divided into two components: the added value of designation (e.g. symbolic value of protected area status; value of subsequent avoided degradation due to measures on and off site) and the value of services maintained even without the designation.

As stated in the Fifth Report on Economic, Social and Territorial Cohesion (EC, 2010a), Regions should not consider Natura 2000 sites concerned as merely areas to protect but as important assets in development strategies. Economically speaking and with specific reference to the Natura 2000 framework, Jacob (2004) showed that in Scotland these ecosystems provide benefits to the Scottish public worth more than three times than associated costs, including direct management and opportunity costs. In the European Commission staff working paper (EC, 2011), an ongoing work aiming at estimating benefits flowing from the network of Natura 2000 is reported; this benefits are of the order of €200 to €300 billion/year (including carbon sequestration and storage, national hazards prevention, tourism & recreation, etc.).

Moreover, as highlighted in the official documents of the EU Biodiversity Strategy to 2020, the biodiversity loss has a significant economic impact if we consider that, according to the economists61, 'each year we lose 3% of GDP due to the loss of biodiversity'. Furthermore, the European Parliament Resolution of 20 April 2012 on "our life insurance, our natural capital EU biodiversity strategy to 2020 (2011/2307(INI))"62 highlights that "the loss of biodiversity has devastating economic costs for society which until now have not been integrated sufficiently into economic and other policies".

Discussion of the geographical pattern of map 51

Introductory notes

Data and statistics on the state of the environment in Europe and the pressures acting upon it are provided by Eionet (The European

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61 http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/EP_resolution_april2012.pdf (Last accessed 10 June 2012).

62 http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/EP_resolution_april2012.pdf (Last accessed 10 June 2012).

Environment Information and Observation Network)63 while an overview of where are in establishing the Natura 2000 network - both under the Birds and the Habitats Directives - are given by the so-called "Natura 2000 Barometer"64. Regarding the use of EU Macro-regions in analysing this indicator it should be noticed that their use could be not valuable. As a matter of fact, in order to facilitate the conservation of species and habitat types existing under similar natural conditions across national boundaries, Habitats Directive sites are protected according to specific nine biogeographical regions whose boundaries do not correspond to the political and administrative boundaries (EEA, 2010), thereby it easier to conserve species and habitat types65:

Region	***Countries involved***	***% of EU territory***
Atlantic	Belgium, Germany, Denmark, Spain, France, Ireland, Portugal, Netherlands, United Kingdom	18.4
Boreal	Estonia, Finland, Latvia, Lithuania, Sweden	18.8
Continental	Austria, Belgium, Bulgaria, Czech Republic, Germany, Denmark, France, Italy, Luxembourg, Poland, Romania, Sweden, Slovenia	29.3
Alpine	Austria, Bulgaria, Germany, Spain, Finland, France, Italy, Poland, Romania, Sweden, Slovenia, Slovakia	8.6
Pannonian	Czech Republic, Hungary, Romania, Slovakia	3.0
Steppic	Romania	0.9
Black Sea	Bulgaria, Romania	0.3
Mediterranean	9 Cyprus, Spain, France, Greece, Italy, Malta, Portugal	20.6
Macaronesian	Spain, Portugal	0.2

63 Eionet is a partnership network of the European Environment Agency (EEA) and its member and cooperating countries (http://www.eionet.europa.eu/) (Last access 12 June 2012).

64 http://ec.europa.eu/environment/nature/natura2000/barometer/index_en.htm (Last accessed 14 June 2012).

65 Natura 2000: Habitats Directive Sites according to Biogeographical Regions. Available at http://ec.europa.eu/environment/nature/natura2000/sites_hab/biogeog_regions/index_en.htm (Last accessed 19 June 2012).

Brief notes on geographical patterns of Natura 2000 network

Areas under Natura 2000 protection framework are particularly dense in the Mediterranean Europe (Portugal, Spain, Italy, Greece, and Mediterranean France) and in Slovenia and Bulgaria. Natura 2000 Network covers a smaller part of the territory in many English and northern French regions as well as in those in Southern Finland and Sweden.

Focussing on trends registered in time-span 2009-2011, it is important to notice that in only two years, the actions for promoting the Natura 2000 framework have allowed to pass from a 17,5% of terrestrial protected areas as a share of total area in 2009 until a value of 22% circa in 2011. Areas with 0% of protected area under Natura 2000 were 77 in 2009 and 40 in 2011 (43 of which in year 2009, and 22 in year 2011, are located in UK). NUTS3 regions with more than 50% of their surface covered by Natura 2000 network are 16 in 2009 (mostly located in Spain, Italy and Germany) and even 79 in 2011 (mostly located in Bulgaria, Spain, Germany and Greece).

The fifteen regions with			*The fifteen regions closer*			*The fifteen regions with*		
MS	***NUTS-3 Region***	***Area under***	***MS***	***NUTS-3 Region***	***Area under***	***MS***	***NUTS-3 Region***	***Area under Natura***
RO225	Tulcea	74	AT225	West- und Südsteiermark	1	DE111	Stuttgart, Stadtkreis	11
ES703	El Hierro	58	BE334	Arr. Waremme	1	DEA2C	Rhein-Sieg-Kreis	11
BG422	Haskovo	54	DE227	Landshut, Landkreis	1	DK050	Nordjylland	11
DE21D	Garmisch-Partenkirchen	54	DEA13	Essen, Kreisfreie Stadt	1	ES213	Vizcaya	11
DE418	Uckermark	54	FR302	Pas-de-Calais	1	FR102	Seine-et-Marne	11
ES708	Lanzarote	54	GR251	Argolida	1	GR115	Kavala	11
ITD33	Belluno	54	ITF44	Brindisi	1	HU313	Nógrád	11
SI018	Notranjsko-kraška	53	NL111	Oost-Groningen	1	IE023	Mid-West	11
BG413	Blagoevgrad	52	PL114	Łódzki	1	ITD55	Bologna	11
DE136	Schwarzwald-Baar-Kreis	52	RO212	Botoşani	1	LT00A	Vilniaus apskritis	11
DEB3E	Germersheim	52	SE124	Örebro län	1	LV007	Pierīga	11
ES707	La Palma	51	UKC11	Hartlepool and Stockton-on-Tees	1	PL332	Sandomiersko-jędrzejowski	11
FR824	Bouches-du-Rhône	51	UKE13	North and North East Lincolnshire	1	RO113	Cluj	11
ITF11	L'Aquila	50	UKK41	Plymouth	1	SE322	Jämtlands län	11
SK042	Košický kraj	50	UKN01	Belfast	1	UKM33	East Ayrshire and North Ayrshire mainland	11

Country codes: AT, Austria; BE Belgium, BG, Bulgaria; DE, Germany; DK Denmark; ES, Spain; FR France; GR, Greece; HU, Hungary; IE, Ireland; IT, Italy; LV, Latvia; NL, Netherlands; SE, Sweden; PL, Poland; RO, Romania; SI, Slovenia; SE Sweden; SK, Slovakia; UK, United Kingdom.

Table 50 The fifteen regions (NUTS3 level) with the lower, close-to-median and higher values of "area included in the Natura 2000 network as a share of total area [%]" in 2009.

The fifteen regions with			*The fifteen regions closer to*			*The fifteen regions with*		
MS	***NUTS-3 Region***	***Area under Natura***	***MS***	***NUTS-3 Region***	***Area under Natura***	***MS***	***NUTS-3 Region***	***Area under Natura***
DEB3E	Germersheim	95.9	DE21E	Landsberg a. Lech	15.4	DE233	Weiden i. d. Opf. Kreisfreie Stadt	0.1
SI018	Notranjsko-kraška	89.7	DEA1E	Viersen	15.4	UKG34	Staffordshire CC	0.1
DE21D	Garmisch-Partenkirchen	89.3	UKL18	Swansea	15.4	UKC22	Tyneside	0.2
SI024	Obalno-kraška	87.8	UKM27	Perth & Kinross and Stirling	15.4	ES640	Melilla	0.2
BG422	Haskovo	86.7	DED23	Hoyerswerda. Kreisfreie Stadt	15.4	UKF15	North Nottinghamshire	0.2
NL221	Veluwe	86.5	LT005	Panevėžio apskritis	15.4	UKE42	Leeds	0.2
SI017	Jugovzhodna Slovenija	85.3	LV008	Vidzeme	15.5	DEA21	Aachen. Kreisfreie Stadt	0.2
GR124	Pella	84.7	DEB35	Mainz. Kreisfreie Stadt	15.5	UKG12	Worcestershire	0.2
PL345	Suwalski	82.7	ITC11	Torino	15.5	UKG22	Shropshire CC	0.2
BG424	Smolyan	81	PL311	Bialski	15.5	DEA43	Herford	0.3
FR824	Bouches-du-Rhône	79.4	FR242	Eure-et-Loir	15.5	DE231	Amberg. Kreisfreie Stadt	0.3
ITD44	Trieste	78.5	DEA5A	Siegen-Wittgenstein	15.5	UKC23	Sunderland	0.3
BG423	Pazardzhik	77.2	NL411	West-Noord-Brabant	15.6	UKJ14	Oxfordshire	0.3
SI011	Pomurska	76.6	AT125	Weinviertel	15.6	UKD31	Greater Manchester South	0.3
GR144	Trikala	76.1	PT169	Beira Interior Sul	15.6	DED1A	Stollberg	0.4

Country codes: AT, Austria; BG, Bulgaria; DE, Germany; ES, Spain; FR France; GR, Greece; IT, Italy; LV, Latvia; LT, Lithuania; NL, Netherlands; PL, Poland; PT, Portugal; RO, Romania; SI, Slovenia; UK, United Kingdom.

Table 51 The fifteen regions (NUTS3 level) with the lower, close-to-median and higher values of "area included in the Natura 2000 network as a share of total area [%]" in 2011.

Discussion in the frame of EU2020s targets

In the Europe 2020 strategy, and particularly in the flagship initiative 'Resource Efficient Europe', the European Council of 17 June 2010 highlighted the need for cohesion policy to support this strategy to help put the EU economy on the path to sustainable and job-creating growth (EEA, 2011a). In the Commission communication COM(2011) 17 Final66 it is recognised that territorial cohesion plays a strong role in contributing to the sustainable growth objectives including ecosystem services, biodiversity, resource efficiency, and a low-carbon and climate-resilient competitive economy.

In 2009, Natura 2000 Network covers 17.5% of the land area of the EU27, 22.3% in 2011, with an uneven distribution along the territory. Nevertheless, and although progress has been made in protecting habitats, the European objective of halting biodiversity decline by 2010 has not been achieved (EC, 2010b). Recently, the EU has adopted an ambitious headline target for 2020 (EU Council, 2010): ''to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, restore them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss"[67].

Final remarks: promoting the conservation of natural and environmental assets is a key for territorial cohesion

The Fifth Report on Economic, Social and Territorial Cohesion (EC, 2010) stresses the need to better integrate territorial cohesion into a cohesion policy. Moreover, the Commission communication COM(2011)68 recognises that territorial cohesion plays a strong role in contributing to sustainable growth objectives, including ecosystem services, biodiversity, resource efficiency and a low-carbon and climate-resilient competitive economy.

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66 Commission Staff Working Document (SWD) of "Regional Policy contributing to sustainable growth in Europe 2020" COM(2011) 17 Final http://ec.europa.eu/regional_policy/sources/docoffic/official/communic/sustainable/swd_sec2011_92.pdf (Last accessed 15 June 2012).

67 Council conclusions on "Biodiversity: Post-2010 EU and global vision and targets and international ABS regime".

68 Commission Staff Working Document (SWD) of "Regional Policy contributing to sustainable growth in Europe 2020". COM(2011) 17 Final http://ec.europa.eu/regional_policy/sources/docoffic/official/communic/sustainable/swd_sec2011_92.pdf (last access 15 June 2012).

Most discussions focus on the economic and social issues of territorial cohesion, and there is often a tendency to consider environment and territorial cohesion as antipodes also because the environmental dimensions of territorial cohesion are generally poorly understood and need to be placed on an equal standing with the economic and social elements of the concept (EEA, 2010; 2011).

Although a clear definition of territorial cohesion is not explicitly mentioned in the official documents, it is broadly recognised that territorial cohesion is a multidimensional and a dynamic concept. According to EEA (2011a) Territorial Cohesion can be seen as the spatial representation of sustainability, which would mean that assessing policies in terms of the environmental dimensions (e.g. green infrastructure) of territorial cohesion can constitute an important step towards the better integration of environment and sustainability.

It is also clear that the size and the crosscutting nature of the Cohesion Policy create both significant challenges and major opportunities for environmental protection and sustainable development in Europe (EEA, 2009). To achieve these objectives it should be considered that the recent EU Biodiversity Strategy 2020 provides a new policy context for developing an Ecosystem Assessment for Europe.

References

EC, European Commission (2008): *Turning Territorial Diversity into Strength. Green Paper on Territorial Cohesion COM(2008) 616*. Luxembourg, Office for Official Publications of the European Communities, 28 pp. + 13 maps. DOI: 10.2776/85336.

EC, European Commission (2010a): Investing in Europe's future. *Fifth report on economic, social and territorial cohesion*. Publications Office of the European Union, Luxembourg: 37 pp. DOI: 10.2776/29620.

EC, European Commission (2010b): Report from the Commission to the Council and the European Parliament: the 2010 Assessment of Implementing the EU Biodiversity Action Plan. COM(2010) 548 final. Brussels, 8.10.2010. http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/bap_2010/1_EN_ACT_-part1_v2.pdf (Last accessed 15 June 2012).

EC, European Commission, Commission Staff Working Paper (2011): Financing Natura 2000. Investing in natura 2000: Delivering benefits for nature and people. SEC(2011) 1573 final. Available at

http://ec.europa.eu/environment/nature/natura2000/financing/docs/financing_natura2000.pdf (Last accessed 21 june 2012).

EEA, European Environment Agency (2010): *The territorial dimension of environmental sustainability. Potential territorial indicators to support the environmental dimension of territorial cohesion*. EEA Technical report series, Technical report n. 9/2010, Publications Office of the European Union, Luxembourg: 96 pp. DOI: 10.2800/42669.

EEA, European Environment Agency (2011a): *Green infrastructure and territorial cohesion. The concept of green infrastructure and its integration into policies using monitoring systems*. EEA Technical report series, Technical report n. 18/2011, Publications Office of the European Union, Luxembourg: 138 pp. DOI: 10.2800/88266.

EEA, European Environment Agency (2011b): *Landscape fragmentation in Europe*. Joint EEA-FOEN report n. 2/2011, EEA Report series. Publications Office of the European Union, Luxembourg, 87 pp. DOI:10.2800/78322

EEA, European Environment Agency, (2006): Urban sprawl in Europe. The ignored challenge. EEA Report n. 10/2006, Publications Office of the European Union, Luxembourg, 56 pp.

EEA, European Environment Agency, (2009): *Territorial cohesion. Analysis of environmental aspects of the EU Cohesion Policy in selected countries*. EEA Technical report series Technical report n. 10/2009, Publications Office of the European Union, Luxembourg, 128 pp. DOI 10.2800/12634.

EU Council (2010): Environment Council conclusions of 15 March 2010. www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/envir/113373.pdf (Last accessed 18 June 2012). Endorsed by the European Council conclusions www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/113591.pdf (Last accessed 18 June 2012).

Hjerp, P., Medarova-Bergstrom, K., Cachia, F., Evers, D., Grubbe, M., Hausemer, P., Kalinka, P., Kettunen, M., Medhurst, J., Peterlongo, G., Skinner, I. and ten Brink, P., (2011): *Cohesion Policy and Sustainable Development.* A report for DG Regio, October 2011.

IEEP et al. (2010): The costs and socio-economic benefits associated with the Natura 2000 network. DG Environment. Available at http://ec.europa.eu/environment/nature/natura2000/financing/docs/natura2000_costs_benefits.pdf

Jacobs, (2004): Environment Group Research Report: An Economic Assessment of the Costs and Benefits of Natura 2000 Sites in Scotland. Scottish executive, Environment Group Research Report

2004/05.Available at www.scotland.gov.uk/Resource/Doc/47251/0014580.pdf (Last access 20 June 2012).

Kettunen et al., (2009a): *Recognising the value of protected areas*. In TEEB - The Economics of Ecosystems and Biodiversity for National and International Policy Makers(2009). www.teebweb.org.

Kettunen, M., Bassi, S., Gantioler, S., and ten Brink, P. (2009b): *Assessing socio-economic benefits of Natura 2000 – a Toolkit for Practitioners*. Output of the European Commission project Financing Natura 2000: Cost estimate and benefits of Natura 2000. IEEP, Brussels, Belgium. Available at http://ec.europa.eu/environment/nature/natura2000/financing/docs/benefits_toolkit.pdf (last accessed 20 June 2012).

Mulongoy, K. J. and Gidda, S. B., (2008): *The Value of Nature: Ecological, Economic, Cultural and Social Benefits of Protected Areas*. Secretariat of the CBD, Montreal. Available at www.cbd.int/doc/publications/cbd-value-nature-en.pdf (last accessed 20 June 2012).

TSP, Territorial State and Perspectives of the European Union 2011 update, (2011): Background document for the Territorial Agenda of the European Union 2020 presented at the Informal Meeting of Ministers responsible for Spatial Planning and Territorial Development on 19th May 2011 Gödöllő, Hungary.

3.4.6. Environmental Pressures on European coasts (map 51b)

Definition of the indicator

The map under discussion refers to a composite indicator called "Environmental Pressures" derived from the ESPON project Seas ESaTDOR (*European Seas and Territorial Development, Opportunities and Risks*)[69] led by the University of Liverpool, UK. Linked to this we also consider another indicator discussed in the ESaTDOR project: "Coastal protected areas". The latter is strictly linked to our indicator @38 (*Protected areas included in Natura 2000 network, in percentage*) which has a homogeneous definition for the entire EU (map 51).

69 http://www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/ESaTDOR.html (Last access 18 November 2012).

Indeed, in 1992 the Convention on Biological Diversity (CBD) signed in the Rio "Earth Summit" pledged the sustenance of biodiversity values also by creating an extensive system of protected areas that could protect valuable species, habitats and ecosystems. According to CBD, the biological diversity is "*the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*"[70].

The composite indicator "*Environmental Pressures on European Coasts*" implemented by the ESaTDOR project, provides a synthesis map of environmental pressures around the European coasts. This indicator has been developed in the ESaTDOR project by using three different data sets reflecting human impacts on the environment[71]:

- *Incidence of invasive species;*
- *Organic inputs;*
- *Nutrient inputs from fertilisers.*

According to the ESaTDOR project, current pressures on the marine environment, and in particular in coastal areas, derive from 'river inputs' and 'shipping and ports'.

On the one hand, many substances (Organic, Nutrients from fertilisers, heavy metals, etc.) are transported by major rivers from industrial, urban or agricultural land towards the sea. Actually, nutrients (mainly Nitrogen, N and Phosphorus, P) are not a pollutant per se, their pressure on marine ecosystems is a result of the addition of extra-nutrients in an complex ecosystem that lead to the eutrophication phenomenon favouring only certain species; these species can then outcompete other species and can disrupt the entire ecosystem functionality.

On the other hand, shipping is maybe the major source of invasive species in coastal zones and marine environments. In fact, ships take unwanted species on board and transport them to new areas where they can become invasive or even dangerous for the new environment. Thus, if we consider that most sea ports are also located at large rivers, we can easily

70 www.cbd.int/ (Last access 18 November 2012).

71 For more details on datasets employed and about methodological aspects, please refer to the webpage of the ESaTDOR project in the Espon portal (www.espon.eu/main/menu_projects/menu_appliedresearch/esatdor.html) (Last access 18 November 2012).

understand how in that ciareas there is a close land-sea interaction with strong effects on the environment.

Relevance of the indicator

As highlighted in the discussion of map 51, the flagship *"A Resource-Efficient Europe"*[72] of the Europe 2020 Strategy (EU2020S) states that biodiversity conservation is an essential issue in achieving the overall target. Moreover, one of the major key elements in delivering this flagship is the new EU biodiversity strategy aimed at halting "further loss to and restore biodiversity and ecosystem services in the light of pressures on ecosystems"[73].

Discussion of the geographical pattern of map 51a

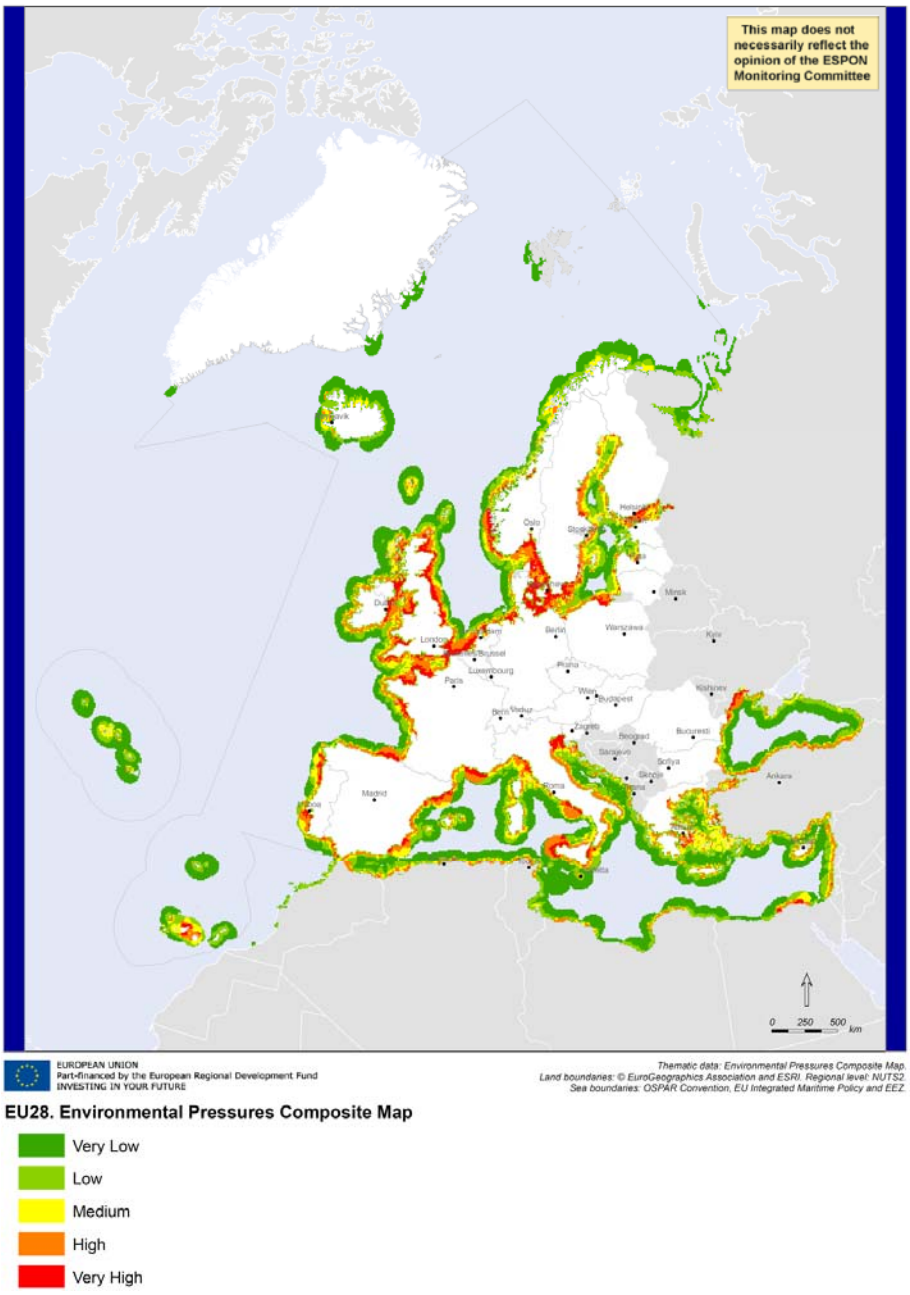
As highlighted in the 'Draft Final Report - Scientific Report' of the Espon project Seas ESaTDOR[74], the composite map of environmental pressures (Map 51b) reinforces the picture of ports and estuaries being the areas where environmental pressures are greatest. Ports in general show the highest incidences of invasive species, especially in the Northern Sea where they are large both in size and in volume of shipping. In this respect, areas around major European harbours such as Dublin (Ireland), Le Havre (France), Rotterdam (Netherlands), Naples (Italy) and Athens (Piraeus) (Greece). The similar situation can be noticed around the Canary Islands or in the Kattegat (a sea area comprised by Denmark and Sweden) where shipping traffic is rather high assisting the movement of invasive species. According to the ESaTDOR project, the land-based sources of pollution are also significant in estuaries such as the Dordogne and Loire (France), the Dnieper, and Danube in the Black Sea and the river Po in Italy.

Additional pressures on European marine systems deriving from a much broader spectrum of human activities such as fisheries and aquaculture.

72 http://ec.europa.eu/resource-efficient-europe/index_en.htm (Last access 12 June 2012).

73 http://ec.europa.eu/resource-efficient-europe/pdf/resource_efficient_europe_en.pdf (Last accessed 07 June 2012).

74www.espon.eu/export/sites/default/Documents/Projects/AppliedResearch/ESaTDOR/ESaTDOR_DFR_Part_C_Scientific_Report.pdf (Last access 21 November 2012).



Map 51b Environmental Pressures on European coasts (*Environmental Pressures Composite Map* in the ESaTDOR project).

Discussion in the frame of EU2020s targets

In the Europe 2020 strategy, in the flagship initiative '*Resource-Efficient Europe*' of EU2020s the European Council of 17 June 2010 highlighted the need for cohesion policy to support this strategy to help put the EU economy on the path to sustainable and job-creating growth (EEA, 2011a). Moreover, in the Commission communication COM(2011) 17

Final[75], the strong role played by territorial cohesion in contributing to the sustainable growth objectives, including biodiversity, is recognised.

The analyses carried out in the framework of ESaTDOR project, clearly shown that land-sea interactions are prominent and that human activity and environmental pressure coincide.

Strengths / Potentials	Threats / Challenges	Policy recommendations
– *Coastal protected areas have a good distribution in all European boundaries;* – *Increasing societal pressure on the fishing industry in order to adopt more sustainable fishing methods and to reduce overfishing.*	– *Europe's wildlife and ecosystems are under threat.* – *Ongoing globalization is expected to result in an increase in shipping of goods to-and-from Europe. As a result, this increased shipping will inevitably lead to an increased transport invasive species.* – *Climate change poses considerable challenges for the marine environment.* – *Europe's landscapes are suffering an increasingly fragmentation, mainly caused by factors linked to urban sprawl, transport infrastructures and intensifying farming practices.* – *Currently, fisheries represent one of significant pressure on the marine environment.*	– *To reinforce the application of the Water Framework Directive* – *To further develop the Natura 2000 network into an integrated, solid and sustainable ecological structure (TSP, 2011).* – *To reinforce the network of Marine Protected Areas (MPA's) also with the end to ensure a more sustainable fishery.*

Strength, Threats and Policy recommendations for the improvement of the Natura 2000 framework in view of the EU 2020 Strategy.

75 Commission Staff Working Document (SWD) of "Regional Policy contributing to sustainable growth in Europe 2020" COM(2011) 17 Final http://ec.europa.eu/regional_policy/sources/docoffic/official/communic/sustainable/swd_sec2011_92.pdf (Last accessed 15 June 2012).

References

EC, European Commission (2010a): Investing in Europe's future. *Fifth report on economic, social and territorial cohesion*. Publications Office of the European Union, Luxembourg: 37 pp. DOI: 10.2776/29620.

EC, European Commission (2010b): Report from the Commission to the Council and the European Parliament: the 2010 Assessment of Implementing the EU Biodiversity Action Plan. COM(2010) 548 final. Brussels, 8.10.2010.

http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/bap_2010/1_EN_ACT_-part1_v2.pdf (Last accessed 15 June 2012).

EC, European Commission, Commission Staff Working Paper (2011): Financing Natura 2000. Investing in natura 2000: Delivering benefits for nature and people. SEC(2011) 1573 final. Available at:

http://ec.europa.eu/environment/nature/natura2000/financing/docs/financing_natura2000.pdf (Last accessed 21 june 2012).

EEA, European Environment Agency (2010): *The territorial dimension of environmental sustainability. Potential territorial indicators to support the environmental dimension of territorial cohesion*. EEA Technical report series, Technical report n. 9/2010, Publications Office of the European Union, Luxembourg: 96 pp. DOI: 10.2800/42669.

EEA, European Environment Agency (2011a): *Green infrastructure and territorial cohesion. The concept of green infrastructure and its integration into policies using monitoring systems*. EEA Technical report series, Technical report n. 18/2011, Publications Office of the European Union, Luxembourg: 138 pp. DOI: 10.2800/88266.

EU Council (2010): Environment Council conclusions of 15 March 2010. www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/envir/113373.pdf (Last accessed 18 June 2012). Endorsed by the European Council conclusions www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/113591.pdf (Last accessed 18 June 2012).

TSP, Territorial State and Perspectives of the European Union 2011 update, (2011): Background document for the Territorial Agenda of the European Union 2020 presented at the Informal Meeting of Ministers responsible for Spatial Planning and Territorial Development on 19th May 2011 Gödöllő, Hungary.

4. Green economy and energy efficiency: the path to sustainable European cities and regions

Today we are experiencing a transition between a strategy failed as the Lisbon Agenda and a new strategy that looks to the future as Europe 2020, a crucial strategy to move forward with structural sustainable reforms. Probably EU2020 strategy is the only one political response that may offer serious opportunities to enhance sustainability in a short time, to address local challenges and respond to or even reverse damaging trends. In a few words, it should be the good chance for European regions to shift towards green economy.

In consideration of human activities which are consuming many natural resources and are causing global warming, they need to be reconsidered in a way which will allow the regenerative capacity of these assets to function, European countries agree that reversing climate change and achieving energy efficiency are the overall policy priorities of the coming decades and that the gradual transformation towards a resource-efficient and low-carbon economy will be the decisive trend of the future. According to scientific evidence that shows an acceleration of climate change patterns and a deepening of the climate crisis[76], the EU as a whole must restructure strongly its economy and reduce domestic greenhouse gas emissions by 25%-40% identified by the IPCC to give us a 50% chance of avoiding the 2°C temperature rise[77]. So changing our current patterns of resource use betting mostly on renewables that is a sector in strong expansion[78], and the transition towards the green economy are not

76 See: EU Energy Policy to 2050. Achieving 80-95% emissions reductions, European Wind Energy Association (EWEA) Report March 2011. Sea levels are rising, oceans are acidifying and ice caps are melting all much quicker than initially anticipated and current emission trends are steadily following the most serious of the official scenarios, with dramatic implications.

77 IPCC Fourth Assessment Report: Climate Change 2007.

78 International Energy Agency (IEA) sees renewable energy growth accelerating over next 5 years. According to a new report from the IEA – published in July 2012 – that acknowledges the coming-of-age of the renewable energy sector, despite economic uncertainties in many countries, global power generation from hydropower, solar, wind and other renewable sources is projected to increase by more than 40% to almost 6 400 terawatt hours (TWh) For further detail, see: IEA Report (2012): Medium-Term Renewable Energy Market Report 2012 - Market Trends and Projections to 2017.

a choice but a necessity (Whitehead, 2007). Europe 2020 and its Roadmap for resource efficient Europe provide clear guidance[79].

From this starting point, this paper looks at the critical role that global warming, resource scarcity, biodiversity loss and a growing European population is playing to shift towards a lower emissions and environmental friendly economy. Clearly, these topics have an important economic relevance in as much as a cleaner environment and greener cities are costly (Butter and Verbruggen, 1994; Meyer, 1995; Brock and Taylor, 2005). On the other hand, the path to more sustainable European cities and regions can generate an economic opportunity boosting, among other things, growth and job creation (Zysman and Huberty, 2012).

Addressing environmental concerns directly addresses economic problems. As it is known, Europe is facing a great financial crisis and problems of (urban) unsustainable development. By addressing climate change mitigation through the pursuit of a sustainability pathways, it is increasingly necessary to build even stronger links between ecology and economy encouraging an integrated global approach that considers not only emissions reductions, resources efficiency and climate change policies, but also the drivers of unsustainable patterns of production and consumption (Edwards, 2010).

A green transition of Europe as a whole should be exactly the way to recover from the financial crisis because green economy is a challenging opportunity for the European countries (Roadmap 2050)[80]. Regions and cities see the challenge as an opportunity to take our societies out of the global economic crisis transformed into more sustainable, low carbon, less resource intense and inclusive communities; as well as to exchange experiences and increase regional skills and competiveness towards a green economy. In this context, regions are particularly well placed for identifying the needs and the strengths of our societies in tackling climate change. Clearly, the overarching concept of a green economy recognizes that ecosystems, the economy and human well-being, and the related types of capital they represent, are intrinsically linked. At the core of

[79] A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy COM(2011) 21. The flagship initiative for a resource-efficient Europe provides a long-term framework for actions in many policy areas, supporting policy agendas for climate change, energy, transport, industry, raw materials, agriculture, fisheries, biodiversity and regional development. This is to increase certainty for investment and innovation and to ensure that all relevant policies factor in resource efficiency in a balanced manner.

[80] Roadmap to a competitive low carbon economy in 2050. COM(2011) 112. In July 2012, the 6th Environmental Program will expire, and the European Ministers for environment and climate are working to set the cornerstones in a new 7th Environment Action Programme that will lead the way for an ambitious environmental policy and transition towards a green economy in Europe 2020.

these are the continued challenges of improving resource efficiency whilst ensuring ecosystem resilience in the natural systems that sustain us.

The contents of this subsection "climate change, green economy and energy" show how the EU-27, if really wants to become greener, more sustainable and equity and addresses new global challenges in a coherent, consistent and efficient manner, needs to act collectively against the climate change and for building a green economy (The Lisbon Treaty, 2009). As the maps showed, there are more advanced countries in renewable energy consumption such as Norway and Sweden or in municipal waste collection such as the old MS, or in reduction of GHG emissions such as United Kingdom and Hungary, and on other hand, countries that have to make an effort to improve their situation (such as the new MS and candidate members). The more "organized" countries should help other countries with knowledge and technology transfer as well as various governance models. So the goal of sustainable growth can only be achieved with a concerted effort to improve the current situation. Just with a collective action there will be possible to fight climate change and change negative trends.

We believe that mostly these issues have to be addressed at regional and local levels. Regional development is usually considered very important for dealing with climate change, green economy and energy issues (Espon Climate 2011; OECD 2009; Stern 2006). Regional characteristics directly determine the extent to which EU regions can produce renewable energy. For example, the production of solar and wind energy is highly location dependent. Coastal regions tend to have a high wind energy potential, while southern regions with more sunny days have more potential for solar energy. Moving renewable energy between regions with a high potential to regions with a high demand will require the development of better and more intelligent energy networks.

In addition, regions and cities can reduce greenhouse gas emissions by promoting cleaner modes of public transport and shifting to more sustainable modes of transport. Initiatives to promote cleaner and more efficient transport have to adapt to the local context, focusing on the infrastructure in regions where it is still lacking while targeting the attractiveness of sustainable transport modes and demand management in other regions. Regions and cities can play a prominent role in fostering energy efficiency. This is particularly true in regards to buildings, where actions must adapt to the local context and climate. These actions are likely to be different between urban and rural areas or between places with old versus more recent buildings.

In this framework, Europe is strongly working to change the development model and move toward a more equal economy, balanced and respectful of a heritage to be passed on to future generations. Mostly the fight to tackle climate change, to improve resilience and to achieve the sustainable energy transition will be won or lost in cities because they generate around 75% of all CO_2 emissions because they host a high share of the population and an even higher share of economic activities, which is why cities need to be at the forefront of the fight against climate change (Register, 2006). In addition, approximately in Europe 375 million people live in urban regions and around 56% of urban population – or 38% of Europe's population as a whole – live in cities and towns of between 5.000 and 100.000 inhabitants[81]. Consequently it is evident that sustainable growth and climate change have a strongly urban characterization because just here in the cities it is actually most apparent in everyday life with stark impacts involving health, job, infrastructure, business, food. In this sense cities are competing with each other because depend highly on other regions in Europe and beyond. So the city level has to be a major focus of attention if we want to address the problems of environmental deterioration, global warming and climate change seriously.

Urban planning implications are reflected in buildings, streets and community design for more environmentally sustainable cities. Spatial planning is generally regarded to be responsible and capable to reduce regional vulnerability and to develop climate mitigation and adaptation capacities against the impacts of climate change (Stern 2006; IPCC 2007). In addition, it is the right tool to shape local communities' future and make cities livable and resilient. The importance of addressing these problems by the local level is stressed also by the EU White Paper "Adapting to climate change: Towards a European framework for action" (European Commission, 2009) when stated that "a more strategic and long-term approach to spatial planning will be necessary, both on land and on marine areas, including in transport, regional development, industry, tourism and energy policies".

References

Brock, W.A.; Taylor, M.S. (2005): "Economic Growth and the Environment: A Review of Theory and Empirics", in: Aghion, P.; Durlauf,

[81] Committee of the Regions (2012): "The European urban fabric in the 21 st century", *Proceedings of the 5th European Summit of Regions and Cities*, 22-23 March 2012, Copenhagen.

S. (ed.), *Handbook of Economic Growth*, edition 1, volume 1, chapter 28, 1749-1821

Butter, F. A. G.; Verbruggen, H. (1994): "Measuring the trade-off between economic growth and a clean environment", *Environmental and Resource Economics*, 4(2): 187-208

Committee of the Regions (2012): "The European urban fabric in the 21 st century", *Proceedings of the 5th European Summit of Regions and Cities*, 22-23 March 2012, Copenhagen

Daly, H.E. (1997): Beyond growth: the economics of sustainable development, Boston: Beacon Press (p.253)

Edwards, A.R. (2010): *Thriving Beyond Sustainability: Pathways to a Resilient Society*, Gabriola Island, B.C: New Society Publishers

ESPON-Climate (2011): *Territorial Potentials for adaptation to climate change*. ESPON Programme

European Commission (2011): *Energy Roadmap 2050*. COM(2011) 885/2

European Commission White Paper (2009): "Adapting to climate change: Towards a European framework for action". COM(2009) 147 final

Hopwood, B.; Mellor, M.; O'Brien, G. (2005): "Sustainable Development. Mapping Different Approaches", *Sustainable Development* 13(1): 38–52

IPCC (2007): *Climate Change 2007: Mitigation of Climate Change*, Intergovernmental Panel on Climate Change Working Group III, Netherlands Environmental Assessment Agency

Kahn, M. E. (2010): *Climatopolis: how our cities will thrive in the hotter future*, New York: Basic Books

Meyer, S.M. (1995): "The Economic Impact of Environmental Regulation", *Journal of Environmental Law & Practice*, 3(2): 4-15

OECD (2009): The Economics of Climate Change Mitigation: Policies and Options for Global Action Beyond 2012 (www.oecd.org/env/cc/econ/beyond2012)

Regional Policy Contributing to Sustainable Growth in Europe 2020 – European Commission Communication 26.01.2011

Register, R. (2006): *EcoCities.* Rebuilding Cities in Balance with Nature, Gabriola Island (Canada): New Society Publishers

Stern, N. (2006): *Stern Review: The Economics of Climate change*. London UK: HM Treasury

Ulhoi, J.P.; Madsen, H. (1999): "Sustainable Development and Sustainable Growth: Conceptual Plain or Points on a Conceptual Plain?", *Proceedings of the 17th International Conference of the System Dynamics Society "Systems thinking for the next millennium"*, Wellington New Zealand

Whitehead, M. (2007): *Spaces of sustainability: geographical perspectives on the sustainable society*, London: Taylor & Francis

Wilbanks, T.J.; Kates, R.W. (1999): "Global change in local places: how scale matters", Climatic Change 43: 601–628

Zysman, J.; Huberty, M. (2012): "From Religion to Reality. Energy systems transformation for sustainable prosperity", *Working Papers BRIE* Berkeley Roundtable on the International Economy

4.1 Towards sustainable European cities and regions. Geographical strengths and weaknesses in the GHG emissions

Regional estimates of greenhouse gas (GHG) emissions at NUTS-2 and NUTS-3 level are becoming increasingly significant to understand the contribution of cities to global climate change. Regions have different opportunities to embed adaptation and mitigation into their strategies, decreasing greenhouse gas emissions and adjusting their socioeconomic systems to a low carbon economy. The analysis of the regional differences serve several purposes as to identify the greatest sources of emissions within a particular region; to provide a basis for developing specific tools; and to contribute to trend analyses in the establishment of future goals and targets.

Regional distribution of GHG emissions across the Europe is heterogeneous enough. There is a clear metropolitan and non-metropolitan areas division equally spread in the new and in the old EU Member States. It is clearly evident that the concentration of GHG coincides with the major metropolitan areas of Europe as Madrid, Barcelona, Milan, Rome, Paris, Berlin, and Bucharest.

The Mediterranean regions have medium level of GHG emissions above all in the coastal areas of Spain, France, and Italy. Among the NUTS3, Istanbul is the major emitter of GHG, with the highest level of emissions. In other words, Turkey is the country with the highest level of emissions.

The two largest Spanish metropolitan areas of Madrid-Barcelona together with the Italian ones of Rome-Milan and Naples occupy the top five positioning for the highest level of emissions. Although the city's economy is primarily service based rather than manufacturing based, the electricity is mainly used for household air-conditioning systems. It is no coincidence that Italy and Spain have not yet reached their national EU2020 targets in GHG emission reduction (see map 38 report).

In the Balcanic area, Poland, Czech Republic and Slovakia are the three regions that more emitted GHG in 2009. This is probably due to the fact that their economy is still developing. Further north, Finland and Sweden have the highest level of GHG with NUTS3 in the urban areas whereas it was found that those levels were lower in the rural and mountain areas. Ireland has also medium to high levels of GHG mostly concentrated in the area of Dublin. On the other hand, it is important to say that the lowest levels of emissions are mostly located in the Mediterranean islands and the small urban areas of Germany, Austria, UK and Denmark. This can be easily explained by saying that those are less densed populated areas.

EU 27 Member States are doing a great effort to reach the national headline 2020 targets in the GHG emissions by sectors outside the ETS in 2009 compared to 2005. Indeed, the 2009 data highlight that the EU-wide emission reduction target will be reached by the EU as a whole in 2020. Some countries have already reached their target and only need to maintain this lower level of emissions. Among those, United-Kingdom achieved the highest GHG emissions reduction (-18.2 %) even if, as showed in map 37, it is the largest emitter (12.2%) of GHG after Germany that produces about 20 % of the EU-27 total or 919,6 million tones of CO2 equivalents in 2009. EU-15 MS accounted for 80.6 % of total GHG emissions within the EU-27 in 2009, some 4.3 percentage points above their corresponding share of 1990 base year.

Any case it must be said that among EU-15 MS, Germany (-26.3%) and United Kingdom (-27%) reduced their GHG emissions massively recording the biggest reductions in absolute and relative terms (see map 37 report). One reason may be that the UK benefited by switching from coal to natural gas which is now largely in place while Germany has certainly invested in GHG emission reductions, but has been helped in large part because of the reunification (East Germany, like much of eastern Europe and former Soviet states had economic problems, hence less emissions at the time).

It's very interesting to note that the "block" of eastern countries such as Latvia, Lithuania, Poland, Slovakia, Estonia, Hungary, Czech republic, Slovenia had committed to limit the increase in emissions, and actually

they have achieved the result to respect their national target. Exactly situation is mentioned for Portugal and Malta. As you know, the majority of these MS are eastern countries located in the Danube and Baltic Sea regions. Among these a number of countries are way ahead of their target, like for instance Hungary and Slovakia which agreed to limit their emissions to no more than 10 % and 13 % respectively and where emissions actually decreased significantly (Hungary actually reduced emissions by 16.9% and Slovakia by 12 %).

GHG gas emissions were approximately halved between 1990 and 2009 in each of the Baltic Sea regions, where Latvia and Estonia have recorded the largest decrease respectively -59.6 % and -58.9 %. In general, there were also significant reductions in Lithuania, Romania, Bulgaria and Slovakia. Very probably the main reason for these great reductions in the Baltic and Danube regions was a decline in emissions from heavy manufacturing industries that were either closed or modernised as a result of restructuring measures.

Also Portugal the coastal Espon type achieved a good result reducing 6.5% its GHG emissions. In the south of Europe, Greece committed to reducing the emissions by 4 % compared to the 2005 levels and had already cut them by almost 7 % in 2009. Cyprus has also reduced emissions by 10.5 % (map 38).

Although they are not parties to the Kyoto Protocol, Cyprus and Malta recorded significant increases in their emission levels. The candidate country Turkey is recorded the largest variation of GHG emission for 2009 compared to 1990 (see Table 7 and map 37). The Iberian Peninsula (Spain and Portugal) and Iceland are the other countries where was recorded a important increases in GHG emissions.

On the other hand, some Member States such as Ireland, Denmark and Luxembourg still need to cut their emissions by more than 10 % to reach their target. In other countries, the target for emission reduction is not yet reached but the emissions have started to reduce, for instance in Sweden where the target was set to a reduction of 17 % and the emissions decreased by 11.8 % compared to the levels of 2005. Among the Member States which have not reached their target, as mentioned, the distance to target is the highest in Ireland, Denmark and Luxemburg. It is the lowest in Italy, Spain and Belgium where additional reduction of 0.7 %, 2.2 % and 4.5 % are required to meet the objectives.

Geographically, the potential for further emission reductions is proportionally higher in poorer Member States. Most MS are unlikely to reach their national 2020 climate target only with existing measures. EU's

cohesion policy can be an important instrument to mobilise the necessary public and private finance.

4.2. Towards sustainable European cities and regions. Geographical strengths and weaknesses in renewables

The control of European energy consumption and the increased use of energy from renewable sources, together with energy savings and increased energy efficiency, constitute important parts of the package of measures needed to reduce greenhouse gas emissions and comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change, and with further Community and international greenhouse gas emission reduction commitments beyond 2012. Those factors also have an important part to play in promoting the security of energy supply, promoting technological development and innovation and providing opportunities for employment and regional development, especially in rural and isolated areas.

The political structure of the European Union, with 27 Member States, is quite diverse and there is no unified approach towards renewable energies yet. However, during the European Council Meeting in Brussels on 8-9 March 2007, the Council endorsed a binding target of a 20% share of renewable energies in the overall EU energy consumption by 2020.

The regions with the highest potential of wind power stations are undoubtedly those that are primarily rural and low population density, while it may be considered irrelevant the contribution that could provide the urban and metropolitan areas and all regions interested in biodiversity conservation policies, this is essentially caused by high levels of environmental impact that wind turbines are still engaging in the concerned territories.

The maximum potential for electricity production from PV panels is instead concentrated on the southern coastal regions, which have varying levels of urbanization enabling the creation of large production facilities in rural areas, since the installation of small plants can ensure in urban areas, substantial amounts of savings on energy consumption of buildings.

In 2009, energy from renewable sources contributed 11.7 % of EU-27 gross final energy consumption. The highest share of consumption from renewable sources was recorded in Norway that has a share of 64.9%,

though outside the EU-27. Sweden presents a share of 47.3 %, Latvia of 34.3% and Finland of 30.3 %. Austria, as one of the five countries with the highest share, has 29.7 %. Lowest share was recorded in Malta (0.2 %), Luxembourg (2.7 %), the United Kingdom (2.9 %), Netherlands (4.1%), Belgium and Cyprus (4,6 %).

Under the EU 2020 strategy, EU member states have varying national Targets for the share of renewable energy within their total energy generation adding up to the 20% overall target share of renewables on the EU27 level

Some Member States are close to the target they set under the Climate and Energy Package. For instance Romania has to increase the share of renewables by another 1.6 pp to reach it target of 24 % by 2020. Sweden has to increase the share of renewables by another 1.7 pp to reach it target of 49 % by 2020. And other countries are already close to their 2020 objective, like for instance Estonia, Slovakia and Austria which must respectively add another 2.2, 3.7 and 4.3 percentage points of renewables into final energy consumption for reaching their targets. For some, the distance to the target is far greater and additional efforts will be required to reach it on time. For example, the United Kingdom and Ireland want to increase their share of renewable by 12 and 11 pp by 2020.

	2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP
Sweden	49,0%	50,2%	62,9%
Latvia	40,0%	40,0%	59,8%
France	23,0%	38,0%	27,0%
Finland	38,0%	38,0%	33,0%
Austria	34,0%	34,2%	71,0%
Portugal	31,0%	31,0%	55,3%
Denmark	30,0%	30,4%	51,9%
Slovenia	25,0%	25,3%	39,3%
Estonia	25,0%	25,0%	17,6%
Lithuania	23,0%	24,0%	21,0%
Romania	24,0%	24,0%	42,6%
Spain	20,0%	22,7%	40,0%
Greece	18,0%	20,2%	39,8%
Germany	18,0%	19,6%	38,6%
Bulgaria	16,0%	18,8%	21,0%
Italy	17,0%	16,2%	26,4%
Ireland	16,0%	16,0%	42,5%
Poland	15,0%	15,5%	19,1%
Slovakia	14,0%	15,3%	24,0%
United Kingdom	15,0%	15,0%	30,0%
Hungary	13,0%	14,7%	10,9%
Netherlands	14,0%	14,5%	37,0%
Czech Republic	13,0%	13,5%	14,3%
Cyprus	13,0%	13,0%	16,0%
Belgium	13,0%	13,0%	20,9%
Malta	10,0%	10,2%	13,8%
Luxembourg	11,0%	8,9%	11,8%

Table 52 EWEA 2011 – EU27 renewable energy shares - 2020 targets

The lack of data at regional and local level reduces the possibility of assessing in detail the sector growth, but some considerations can be

done. Almost all ESPON regions have a large production potential, not yet fully exploited.

In recent years the rising cost of fossil fuels has prompted the production of renewable energies and technological development in continuous growing has made the production of renewable energy one of the strategic sectors of European industry in the next years. Public and private investment in renewable energy is steadily increasing and EU Citizens' awareness about the importance of using renewable energy sources is steadily growing. At the same time, in some regions, difficulties in assessing the real environmental impact of renewable technologies restrain development. The amount of 24.6 GW production is far below the anticipated contribution of sun-rich Mediterranean countries in order to reach the 2020 targets. Some regions with high production potential are far from the EU2020 targets because they are limited by rigid bureaucratic systems.

4.3 Towards sustainable European cities and regions. Geographical strengths and weaknesses in energy efficiency

The energy intensity of the economy indicator should guide action of all MS in achieving and delivering a greater energy efficiency. New Member States such as Bulgaria, Romania and Estonia have very high energy intensity ratios around and over 600 Kilograms of oil equivalent per 1000 Euros, showing great potentials for large improvements continuing on the paths of steady reduction which currently characterise many new MS as shown in Map 45.

Good performances are reported by several old MS, above all Denmark, UK, Italy, Austria and Ireland, which show ratios close to the lowest energy intensity economy of Japan. Old MS show potential to reduce the gap from Japan and action is needed to invert the negative trends of Austria within the EU-27 and Norway outside the EU-27.

The energy sector could deliver important economic and environmental benefits with the creation of new jobs and reduction of energy dependency from imports of energy and raw materials. Greater energy security for the Union will be delivered as a consequence if the target of 20% increase in energy efficiency is delivered.

However, the current energy efficiency trends at national levels will deliver together an increase of energy efficiency of about 10% compared to the

EU-27 target of 20%. If action is not undertaken to invert this trend the achievement of the Union's energy targets could be jeopardised. This is evident in the National Reform Programmes which give not enough weight to the energy efficiency target having set much lower national goals. The failure in achieving the energy efficiency target might have wider impacts and affect the delivery of the greenhouse gas reduction target too. Within the EU 2020S industry plays a major role for economic growth and job creation. Innovation in energy intensive and manufacturing industries is of paramount importance to reduce consumption of energy. Thus, technology transfers in favour of new MS with higher energy intensity ratios are fundamental and may prove to be a challenge. SMEs need to be at the core of innovation polices having fewer resources to implement innovation programmes. Furthermore, there is a need for a generally higher awareness by the public opinion of the importance of energy efficiency. Households and individuals behaviours should be addressed towards greater efficiency.

4.4 Towards sustainable European cities and regions. Geographical strengths and weaknesses in commuting and transport

Transport sector measured in commuting at the regional scale (map 47) and at the urban areas scale (map 48) is one of the main emission-intensive sectors, with higher energy consumption and pollution shares that contribute to hinder the development of energy efficiency and curbing greenhouse gas emissions. Transport is the only sector that has seen its emissions increase over the past two decades and under projections transport GHG emissions are expected to grow by 74% by 2050 (from the 1990 level). Share of people commuting in total employment is quite an important indicator because it reflects one of the most important factors of transport demand at the regional scale. In other words, this indicator offers also for a direct measure of regional transport dependency.

The Common Transport Policy is an essential component of the EU policy since the Maastricht and The White Paper on Transport is the document of strategic reflection providing the conceptual framework for the CTP Treaty of 1992. The last “White Paper on Transport (2011)” (EC, 2011a) identify in the transition towards a more sustainable transport sector, focused on urban transport and commuting, an essential component in the flagship on resource-efficiency and directly referring to.

Map 47 shows that the highest share of people commuting in total of employment for 2009 is in the north-west of Europe and part of Danube Space macro-regions: Austria, Netherlands, Deutschland, Belgium, United Kingdom and Ireland.

In general terms, the Nordic regions have higher share than most of the Southern European regions near to large cities areas (Amsterdam, Brussels, Berlin, Wien, London, Dublin, Stockholm). Data are not available for Bosnia ed Erzegovina regions.

The spatial patterns show that regions located more in the centre of the EU (e.g. in Austria, Belgium and the Netherlands), and in the territory dominated by the pentagon, the area delimitated by London, Hamburg, Munich, Milan and Paris, have higher commuting rates. Regions located in the periphery (e.g. Spain, Italy, etc.) and in the Mediterranean Basin macro-region, an south-est Europe have low commuting rates. In Spain we can identify a high level of share (10-12 percentage of total employment) in the region of Madrid.

In other words the main divisions that are present in the EU-27 and the candidates countries in terms of the share of people commuting in total employment are between metropolitan (especially big metropolitan) and non metropolitan regions and the north and south regions.

The regional distribution of higher share is still concentrated in the main urban cores and first of all, we can observe a concentration area that involves the European Centre-North, encompassing cities that are important global nodes. This because in one hand big cities concentrate more power, abundance of job opportunities and commanding functions and because central Europe has an high development of transport networks.

In the other this issue could be linked also with lack of employees and opportunities in many peripheral and disadvantaged regions, especially in areas with low accessibility.

Regarding to the trips by commuters travelling to work places located within the boundary and should include trips by commuters not resident within the boundary, share of journeys to work by car for urban areas reflects one of the main factors of traffic demands. This indicator offers for a direct measure of car transport dependency at the urban scale and of the importance that cars have in cities.

The last "White Paper on Transport (2011)" (EC, 2011a) that is the providing the conceptual framework for the CTP Treaty of 1992, views current mobility patterns as unsustainable, with greenhouse gas emissions and rising congestion as the main sources of un-sustainability.

As it has been said, transport sector is one of the main emission-intensive sectors, with higher energy consumption and pollution shares, then road transport contributes about one-fifth of the EU's total emissions of carbon dioxide, the main greenhouse gas. While emissions from other sectors are generally falling, those from road transport have continued to increase since 1990.

Eager to tackle climate change, the European Commission has a comprehensive strategy designed to help the EU reach its long-established objective of limiting average CO2 emissions from new cars to 120 grams per km by 2012.

Map 48 shows spatial patterns in terms of the share of journey to work by car in EU-27. Cities that have higher rates are located in Belgium and Spain. These are small-medium size cities (with population of less than 250,000 inhabitants) with the exception of Sevilla (around 700,000 inhabitants), Valladolid and Vigo (around 300,000 inhabitants). In Spain we can identify a general high level of share (around 80%) with the exception of Madrid that is a city that present a really low rate (40,4 %). Most of other cities that have lower rates are located in Slovakia and others are capital cities, like Madrid, as said before, Helsinki and Berlin. It should be noted that a relatively big area of EU-27 cannot be evaluated as no data were found.

Theoretically speaking, it seems that spatial patterns show that the main divisions that are present in the EU-27 and the candidates countries in terms of the share of journey to work by car could be linked with a different development level of public transport networks, with an high multimodal accessibility of cities and habitat fragmentation and agglomeration.

4.5 Towards sustainable European cities and regions. Geographical strengths and weaknesses in waste collection and water treatment

Within the EC's "Roadmap to a resource efficient Europe" waste is considered a key resource and residual waste by 2050 should be close to zero. The logic behind this policy is to break the link between economic growth and waste generation. Recycling, in fact, now accounts for about one quarter of the total amount of waste collected and could produce, if brought to a level of 70%, 500,000 new jobs and a considerable reduction

of CO_2 emissions. In fact, as the "Final Report for the Assessment of the 6th Environment Action Programme" underlines, waste emissions amounted to 2.8% of total emissions in 2009 despite a remarkable reduction by 34% from 1990 to 2007. The majority of these emissions are produced by landfilling procedures (over 90%) and the tendencies to reduce landfilling in new MS (map 49) may deliver important reductions.

The pattern within Europe is split into two. Old MS perform very well in term of collection rates, though there is a widespread lack of data which should be address by the commission. Generalization on the basis of other indicators such as share of landfilling, incineration and urban waste water treatment capacity, however, allows countries such as France, Sweden and Finland to be considered at the same levels as the other old MS for which data are available. Strong action is needed to improve the situation of Romania and Poland which show deficiencies both in urban waste collection and waste water treatment capacities.

No clear link exists between high or low waste collection and waste water treatment rates and Espon regional typologies. If for some countries it could be true that mountain areas present lower ratios, some parts of Italy and Spain, the same cannot be said for Austria and Scotland.

In order to achieve important reductions in waste generation emphasis should be placed on the need to invert the trend of waste generation which has increased in several old MS from 2002 to 2009. In order to do so, it is important to act and address household's behaviors and habits, being these the largest producers of urban waste.

4.6 Towards sustainable European cities and regions. Geographical strengths and weaknesses in Natura 2000 network

Natura 2000 Network represents the world's largest network of protected areas and forms a policy cornerstone for the conservation of Europe's most valuable species and habitats (See, among others, IEEP et al., 2010) and can be viewed as a good example of a policy with a strong spatial dimension. In this respect, it should be noticed that Natura 2000 is a network of nature conservation areas not restricted to nature reserves, but based on a much broader principle of conservation and sustainable use.

Natura 2000 sites are still growing over the whole Europe and are important in enforcing tourism, maintaining food security, supporting physical and mental health and protecting cultural heritage values. A well-managed Natura 2000 network will make a key contribution to meeting EU2020S targets. In some Regions, such as the Mediterranean one as well as in Slovenia, Romania and Bulgaria, Natura 2000 protection framework are particularly dense.

Europe's landscapes are suffering an increasingly fragmentation, mainly caused by factors linked to urban sprawl, transport infrastructures and intensifying farming practices. Some biogeographical Regions such as the Mediterranean one, in which occur almost half of the plants and animals listed in the Habitats Directive, is under an ongoing severe anthropic pressure: it is the first world's tourism destination and much of its coastline has experienced very strong urban sprawl so as to be classified as one of 34 biodiversity hotspots in the world (EEA, 2006). Moreover, Mediterranean region is constantly threatened by forest fires. On the other hand, most areas of Continental Region are affected by air-borne pollution from industrial activities

In terms of policy and past strategies, we have to consider that the previous European objective of halting biodiversity decline by 2010 has not been achieved (EC, 2010b) and even today Natura 2000 network is highly fragmented and represents an unconnected set of unevenly protected 'islands' (EEA, 2011b). In some Regions such as Northern France, UK, Southern Finland and Sweden the Natura 2000 networks is not yet well implemented. Moreover, Europe's wildlife and ecosystems are under threat (e.g.: forest fires, air pollution, etc.) and are suffering an increasingly fragmentation, mainly caused by factors linked to urban sprawl, transport infrastructures and intensifying farming practices.

Analysing data provided by DG Regio and EEA of the European Union for years 2009 and 2011 (map 51) it is important to highlight how a general improvement on implementation of the Natura 2000 framework is an ongoing process in the most part of the 27 EU members. In particular, this trend is interesting in some northern countries such as UK and Ireland which have further reinforce the Natura 2000 framework in addition to their national protected areas system. Good performance for this indicator can be noticed for all the Mediterranean countries, especially Spain and Italy and for the most part of the continental countries (among others, Bulgaria and Hungary).

In the next years, also in a view of the EU 2020 biodiversity strategy, the Natura 2000 framework needs significant improvements in the Northern part of Europe: United Kingdom, Finland and Sweden.

5. Policy conclusions and recommendations

5.1 Policy guidelines in GHG emissions

European Member States are at the forefront of international efforts to tackle climate change, establish protected areas (for example with Natura 2000 Network) and reduce air pollution, yet the region's environmental footprint remains disproportionately high[82]. As already mentioned in previous chapters, global climate change and the reduction of GHG emissions represent the largest environmental challenge of the 21st century, and potentially beyond, from which depends our own future.

GHG emissions are directly related to the impacts of climate change that vary considerably across Europe in terms of geographical regions with different types of impacts and different degrees of vulnerability. The implementation of a set of policy guidelines should take into account the double dimension of the problem: local (city and regional level) and global (state level). Global changes in climate, environment and economies converge in localities. Changes at a local scale, in turn, contribute to global changes as well as being affected by them. As a result, across a broad range of disciplines and problems, linking the local and the global scales – integrating assessments of population, economy, technology, and environmental change – potentially yields deeper understandings of global change in all its complexity. We need to act both locally that a state level. For that reason, regional estimates of GHG emissions at NUTS-2 and NUTS-3 level are becoming increasingly significant to understand the contribution of cities to global climate change. Regions have different opportunities to embed adaptation and mitigation into their strategies, decreasing greenhouse gas emissions and adjusting their socioeconomic systems to a low carbon economy.

The analysis of the regional differences can help to define a general framework of policy guidelines. Implementation of effective policies is the cornerstone for achievement of climate policy targets. What we currently

[82] See: *GEO5 Global Environment Outlook 5. Environment for the future we want.* United Nations Environment Programme. Report June 2012.

find on the European level is a predominance of declaratory objectives without any concrete instruments of implementation. Perhaps the only two practical tools that are trying to achieve GHG emissions reduction are the Europe 2020 Strategy with challenging headline targets and the EU's energy roadmap for 2050 with which the European Union is mapping out an long-term energy strategy to meet its goals of ensuring a secure, affordable and sustainable energy supply. The Roadmap provides information about the cost structures of various energy transformation paths towards the target of reducing greenhouse gas emissions by 80 percent by 2050. The fundamental decision about climate protection and renewable energy targets for 2030 is, in the final instance, again a matter for the heads of state and government. The influence of Commission and European Parliament is mainly restricted to the policy process of formulating implementing directives, regulations and decisions. We should make an effort to make a proper assessment of the effects of concrete and planned climate mitigation policy.

As it is known, a wide range of human activities generate greenhouse gases, including the burning of fossil fuels for electricity generation, the operation of our transportation systems, and the manufacture of goods. Even forestry and agricultural practices, and the way we dispose of solid waste, add climate pollutants to the atmosphere. Surely the industry sector is the most important (direct and indirect) source of GHG emissions in European countries. It is also a highly heterogeneous sector that has seen both rapid increases and decreases in direct emissions from different sources over the last decade. Given these trends, the remaining potential for cost-effective emission reductions in industry, and the difficulty in reducing emissions in other sectors (such as transport), emissions from the industry sector are expected to draw increasing attention by policy-makers as they look for means to reduce domestic GHG emissions.

There are a broad range of opportunities to reduce GHG emissions through common sense, cost-effective actions that also advance other important state objectives, including sustainable economic development, job creation, energy independence, and cleaner air. As chapter 4 reported, large parts of Europe are consuming unsustainable levels of resources even if it is possible to note some successes in 'decoupling' environmental pressures from economic growth. Since the regional distribution of emissions across the EU Space is quite heterogeneous, actions and policies should be undertaken by each MS with a major effort by those which are large emitters of GHG such as Germany, UK, France and Italy. It is possible conceive a range of policies to reduce greenhouse gas emissions in industry, with a focus on voluntary approaches (VAs), taxes and trading.

In this sense, it is very important to promote territorial cooperation through the EU MS. New Member States with a older industrial basis need large investments in new energy infrastructure and restructuration of internal energy market. More efforts need to be undertaken by the majority of EU MS (with the exception of Germany) to increase energy efficiency and renewable energy development with the goal of decrease the amount of fuel burned in power plants and other industries, in commercial buildings, and in homes. Getting access to cleaner energy supplies, including the building of renewable and green resources - from photovoltaic panels and wind generators to ultra-clean fuel cells - represents an important way to meet future energy needs while dramatically cutting carbon emissions. The pathways should be ambitious, achieve significant reductions earlier rather than later to give industry the right signals from the start, and enable Europe to achieve and then benefit from its first mover advantage in wind power and other renewable energy technologies.

To date, the bulk of the research relating local places to global climate change has been top-down, from the global toward the local, concentrating on methods of impact analysis that use as a starting point climate change scenarios derived from global models, even though these have little regional or local specificity. There has been a growing interest, however, in considering a bottom-up approach, asking such questions as how local places contribute to global climate change, how those contributions change over time, what drives such changes, what controls local interests exercise over such forces, and how efforts at mitigation and adaptation can be locally initiated and adopted. In this way, actions and policies should be implemented by all EU MS implementing also a coordinated outreach program to educate for example the public about greenhouse gas impacts of electricity generation.

In the Baltic and Danube regions, some policies should encourage energy efficiency for existing buildings, expansion state role in long-term contracts for renewable energy purchases and greater waste prevention and recycling (above all at local level). The old MS are doing great effort to reduce GHG emission starting at city level with many local communities that have already pledged to address climate change issues and to lower their GHG emissions by reducing their generation of solid waste, implementing good policies on green transportations, water supplies, urban forests, farmlands, etc. We believe that it is necessary to strengthen the current situation with policies that encourage living and working patterns that can be served by clean transportation options.

European countries can reduce GHG emissions also enhancing business competitiveness through energy efficiency as well as growing low GHG emissions businesses and products. EU countries should encourage business, industry, and non-profit sector leaders to set and achieve targets through focused strategies that promote new technologies, reduce demand for fossil fuels, cut carbon emissions, and create new jobs.

About transportation (including cars, trucks, buses, and trains) that is a great source of GHGs, Italy, Portugal and the majority of the East countries need to develop an efficient and sustainable transportation system that both stops the anticipated growth of GHG emissions and reduces current emissions. In those countries, it would be desirable improve the efficiency of transit vehicle movement with clean and efficient new technologies or develop new bicycle and pedestrian policies, programs, and facilities. In general, at city level European countries should encourage the demand for and sale of hybrid cars and other efficient clean vehicles.

Finally, natural resource protection could be a strong climate strategy. In this sense, Natura 2000 Network is directly interrelated with the reduction of GHGs because parks, forests, green areas act as beneficial "carbon sinks" by temporarily removing and storing carbon dioxide.

In conclusion, a transition towards a low-emissions economy can present opportunities to the Europe as a whole. As more regions and countries adopt abatement targets, the demand for products and processes with lower greenhouse gas emissions will accelerate. Innovation will be critical in this growing market for clean technology—the expertise and equipment related to new developments in areas such as renewable energy (in particular, wind power, solar power, biomass, hydropower, and biofuels), electric motors and low emission transportation, energy efficient lighting and appliances, and green buildings. Global warming could be blocked with a serious reduction of oil and thus it is important to make our cities more sustainable using public transport gas or electric, and then replacing oil with alternative energy sources. The energy sector, the dominant source of today's emissions, is also the focus of much clean technology—clean energy. Given the well-established fact that the private sector acting alone will tend to underinvest in research and development (R&D), governments who are moving early towards abatement, such as Poland's, need to consider whether active support to clean technology R&D is an important complementary policy measure.

Strengths / Potentials	Threats / Challenges	Policy recommendations
– *Cities are place in which energy efficiency will be key;* – *There is a big potential to cut GHGs from municipal solid waste management;* – *More public awareness about the dangers of the GHGs.*	– *GHG emissions have serious impacts on climate change.* – *European economy depends largely on high energy industries;* – *Greenhouse gases are produced, directly or indirectly, for almost all major industries and human activities. This means that it is an environmental issue with a strong "economic value".*	– *To promote clean and reliable energy;* – *To promote more efficient buildings: reducing pollution through sustainable design and construction;* – *Strengthening the Capacity of Local Actors;* – *Global warming could be blocked with a serious reduction of oil;* – *Promote local and regional waste management tools;* – *Natural resource protection as a climate strategy.*

Strength, Threats and Policy recommendations for reducing GHG emissions view of the EU 2020 Strategy.

5.2 Policy guidelines in Renewables

It is necessary to develop a strategy that will enable renewables to for large-scale use in the decades beyond 2020. The EU introduced a comprehensive and robust supportive legislative framework but the challenge is now to move from policy design to implementation at national level, with concrete action on the ground (EC, 2011c).

In the IEA publication *Deploying Renewables: Principles for Effective Policies* (IEA, 2008), that provides an analysis of policy tools to support renewables, main objectives identified are an integrated approach able to achieve a smooth transition towards mass market integration of renewables, to improve policy and market functioning, maximising long-term cost efficiency while having regard to national circumstances (IEA, 2008: 180-181).

It is necessary to ensure that the legislation is fully implemented and legal framework must be properly enforced to give investors the confidence to invest in renewable sources. It will also be important to continue and to sustain effort in research, development and deployment (RD&D) for renewable energy technologies in order to increase productivity and reduce costs (IEA 2011). To promote the harmonious development of the renewable energy sector in all ESPON regions, favoring the market liberalization in order to put into effect the potential for local production.

Finally, implementing monitoring tools to identify effective indicators will help to describe the local development of renewable energy production. Given the proven success of the EU regulatory framework for renewables since 1997, it is considered the most effective post-2020 regulatory framework to be a binding 2030 renewable energy target. This would give to the power sector a vital stepping stone, taking it from expected 34% renewable electricity in 2020 to 100% renewables by 2050. So, due to the long lifetime of fossil fuel power plants, (35-45 years for coal and 30-35 years for gas), no new carbon emitting power plant should be built after 2015.

Strengths / Potentials	Threats / Challenges	Policy recommendations / Guidelines
– With the Directive on the "Promotion of the Use of Energy from Renewable Sources" the European Council called for an overall coherent framework for renewable energies. The Directive 2009/28/EC amends and subsequently repeals the Directives 2001/77/EC and 2003/30/EC and indicates the overall percentage of renewable energies for the different Member States, as well as the indicative trajectory how to reach it [EC 2009]. – The growth of renewable energy sources stimulates employment in Europe, the creation of new technologies and increased trade: the opportunities for establishing economic growth through the use of renewable sources of energy have been recognized.	– US and China cites are at this moment as the best investment opportunities for renewable energy. New stimulus is needed; more than ever EU leadership is called upon to address these challenges (EC, 2010). – Well-known barriers to deployment of renewable energy consist of: – economic barriers such as high upfront capital costs, unknown savings over time due to fluctuating fossil fuel prices, and competition from other well-established technologies that enjoy economies of scale; – technical barriers such as improved storage technology; – market and institutional barriers such as permitting procedures. (IEA, 2011). – Production of energy from renewable sources often depends on local or regional small and medium-sized enterprises (SMEs). – In Directive 2009/28/EC, as the statistical system for some renewable energy technologies is not yet fully developed to meet the requirements of this Directive. However, the contribution of these technologies is rather marginal for the time being.	– The green agenda must be prioritised especially in those member states with poor performance, whether this is due to lack of political commitment, unfavourable natural conditions, or both. – To develop a strategy that will enable renewables to for large-scale use in the decades beyond 2020. – Make faster progress in developing the electricity grid, start integrating renewable energy into the European market and ensure that any reforms of existing national support schemes will guarantee the stability for investors, avoiding retroactive changes (EC, 2011c). – To move to an integrated approach able to achieve a smooth transition towards mass market integration of renewables, to improve policy and market functioning, maximising long-term cost efficiency while having regard to national circumstances (IEA, 2008: 180-181). – To ensure that the legislation is fully implemented and legal framework must be properly enforced to give investors the confidence to invest in renewable sources. – To sustain effort in research, development and deployment (RD&D) for renewable energy technologies in order to increase productivity and reduce costs (IEA 2011).

Strength, Threats and Policy recommendations for the use of renewable energy sources in view of the EU 2020 Strategy.

5.3 Policy guidelines in Energy efficiency

Energy efficiency policies should involve obsolete industries and plants and be addressed to households and individuals, so to produce a positive switch in their behaviours towards a greater energy efficiency, which will both reduce greenhouse gas emission and improve energy security of the EU. Actions vary between old and new MS. Nevertheless, a first step towards a resource-efficient European economy will be to revise National Reform Programmes to include new and more stringent national targets on energy efficiency which are currently undersized and as such will not deliver the 20% target set out by the EU.

Actions and policies should be firstly undertaken by those MS which show high energy intensity ratios such as Bulgaria, Romania and Estonia. However, there is a need to gather data at regional level since current available data at NUTS0 national level do not allow policies to be adjusted to specific territorial, economic and technological conditions. New data will therefore allow actions to be directed to specific regions. However, despite this lack of data, it can be generalised that, in order to determine greater energy intensity, actions in the above mentioned MS should be directed to enhance innovation and modernisation of the industry sector, especially manufacturing and energy intensive industries and SMEs. This would allow the industry sector in such countries to reduce their energy intensity being one of the main causes of such high energy intensity ratios.

More generally, a requirement which applies to all countries across Europe, there is a need for more investment in R&D, possibly beyond the 3% Union target if the conditions are right, and in ICT and new energy infrastructure.

As for old MS, in this case priority actions and policies should involved and be addressed to households, offices and individuals. Information on benefits and advantages need to be more widespread and should encourage environmental friendly daily behaviours, also with the use of new and more efficient technologies. This is particularly true in capital cities and metropolitan areas (London, Paris, Madrid, Rome, and so on) where offices, businesses and generally the third sector represent the first sector of the economy.

Moreover, a sector which could be further developed being able to produce a twofold advantage is the renewable energy sector. In fact, a greater share of energy from renewable sources would have the double

benefit of delivering more efficient technologies while ensuring a greater reduction of greenhouse gas emissions.

Emphasis should be also placed on urban planning and building regulations. Regulatory frameworks and energy efficient schemes such as the American LEED scheme can be able to encourage construction of energy-efficient buildings with benefits in terms of energy consumption as well as production through new RES technologies, especially solar.

Strengths / Potentials	Threats / Challenges	Policy recommendations
— *Energy efficiency target is a headline target of the Europe 2020S and guides actions of MS in the energy sector.* — *There is great potential to improve energy intensity of the economy*[83] *in many MS, especially new MS.* — *Nearly all of the old MS show a good energy intensity ratio below 200 kgoe per 1,000 euros. There is potential for further improving this performance in line with Japan's lowest ratio of about 90.* — *All of the EU-27 MS, with the only exception of Austria, have improved their energy intensity of the economy. Such trends should be continued and encouraged.* — *Investment in energy efficiency coupled with RES could produce one million new jobs.* — *Greater efficiency could reduce energy dependency and so improve energy security.*	— *Achievement of Europe's target of 20% increase in energy efficiency is at risk.* — *Scarce consideration within National Reform Programmes of the importance of the energy intensity of the economy indicator. National objectives are generally lower than the EU-27 collective target of 20%.* — *Failure in achieving the 20% energy efficiency target may in turn jeopardize the attainment of greenhouse gas emissions reduction objectives.* — *Industry plays a major role in the Europe 2020S for economic growth and job creation. Lack of innovation in energy intensive and manufacturing industries will lead to lower reduction in energy intensity.* — *Supporting SMEs in adopting less energy-consuming technologies.* — *Lack of information to the general public on the importance of energy efficient behaviours.* — *Technological innovation in favor of more energy-efficient technologies.*	— *Energy efficiency policies should involve household behaviours and spread awareness of energy efficiency benefits.* — *Increased investment in R&D for the promotion of new energy-efficient technologies and material in the building sector.* — *Investment in ICT and new energy infrastructure and transmission networks.* — *Investment in Renewable Energy Sources which could deliver more efficient and market competitive technologies while ensuring a greater reduction of greenhouse gas emissions.* — *Greater competition in both energy and transport sector could produce improved efficiency.* — *Urban Planning and building regulations should encourage energy-efficient buildings within their regulatory framework.* — *Revising National Reform Programmes to include new and more stringent national targets on energy efficiency.*

Strength, Threats and Policy recommendations for the improvement of energy intensity of the economy

83 The energy intensity of the economy indicator measures the gross inland consumption of energy per unit of GDP and is therefore expressed in terms of Kilograms of oil equivalent per 1,000 euros of GDP.

5.4 Policy guidelines in Commuting and transport

The Transport 2050 roadmap sets different goals for different types of journey - within cities, between cities, and long distance:

- for intercity travel: 50% of all medium-distance passenger and freight transport should shift off the roads and onto rail and waterborne transport;
- for long-distance travel and intercontinental freight, air travel and ships will continue to dominate. New engines, fuels and traffic management systems will increase efficiency and reduce emissions;
- for urban transport, a big shift to cleaner cars and cleaner fuels. 50% shift away from conventionally fuelled cars by 2030, phasing them out in cities by 2050.

Therefore, as the White Paper indicates, a higher share of travel by collective transport, combined with minimum service obligations, will allow increasing the density and frequency of service, thereby generating a virtuous circle for public transport modes. So reducing CO_2 emissions by upgrading commuting to "greener" transportation modes will require an array of coordinated, progressive transportation policies, supplemented by public-outreach campaigns on the carbon impacts of commuting as well as the availability of less-polluting commuting options.

In this direction also demand management and land-use planning can lower traffic volumes. The modernization of transport and energy networks in the way of a reduction of greenhouse gas emissions should take into account the territorial dimension and, in a regional perspective of planning, in the way of a polycentric territorial development and an inter-urban polycentric cooperations (FOCI, 2010b: 19).

The territorial dimension of transport policies is a "central issue for reducing the vulnerability of regions with a high level of commuting and for the development of broader and complementary portfolios of renewable energy sources in neighbouring regions" (ReRisk, 2010: 7).

If a change to low-carbon transport modes and reduction of traffic congestion including an higher share of travel by public transport are identified as main goals to achieve, as several researchers outline, also a changing behaviour available to actors and a raising of a digital society linked with the transport sector could contribute.

Combination of measures could be identified as the most effective approach to reducing GHG emissions by private cars and road transport.

Policies to improve fuel economy and shift to eclectic mobility and other fuels for transport with potentially lower carbon-intensity are the core of green growth policies for transport.

Some measures take the form of national and European legislation to limit the average fuel consumption of new cars supplied to the market like agreement between vehicle manufacturers and government to produce low-fuel consumption vehicles; graduated vehicle taxes; fuel taxes and excise duties; and promotion of greater fuel efficiency in the different sectors involved. For instance, the "Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles" aims at a broad market introduction of environmentally-friendly vehicles.

Others measures are designed to limit passenger car traffic in urban areas in order to improve the use of public transport, with an indirect but positive impact on CO2 emissions. First of all a better balanced mobility will reduce reliance on car use and provide opportunities to reducing the greenhouse gas footprint of mobility overall.

Other suggestions to reduce the need to travel mainly include IT-based solutions, such as teleworking, internet conferences, etc. Also it is considered important to support small neighbourhood stores, enabling people to shop close to home. "Together this provides the signal that the future Action Plan should not just look at accommodating people's needs to travel" (Green Paper on Urban Mobility, 2008).

The link between urban fragmentation/agglomeration, polycentrism and mobility is however a much debated issue. In current urban planning debate research shows that there is an important relationship between the urbanisation driver and daily commuting patterns.

If some research outcomes show one of the most relevant consequences of urban sprawl is an increasing dependence on the car for intra and inter-metropolitan travel. An its efficient control has resulted in increased population densities that in turn fostered the use of public transport and reduced the growth of car use (Report on urban transport in Europe, 2007).

As the White Paper point out Urban Mobility Plans should be encouraged fully in cities above a certain size and they should be aligned with Integrated Urban Development Plans. In the "urban context, to reduce congestion and emissions is needed a mixed strategy involving land-use planning, pricing schemes, efficient public transport services and infrastructure for non-motorised modes and charging/refuelling of clean vehicles." (EC, 2011a: 13).

Strengths / Potentials	Threats / Challenges	Policy recommendations / Guidelines
– The Common Transport Policy is an essential component of the EU policy since the Maastricht and The White Paper on Transport is the document of strategic reflection providing the conceptual framework for the CTP Treaty of 1992. – The last "White Paper on Transport (2011)" (EC, 2011a) identify in the transition towards a more sustainable transport sector, focused on urban transport and commuting, an essential component in the flagship on resource-efficiency and directly referring to.	– Transport sector is one of the main emission-intensive sectors, with higher energy consumption and pollution shares and also only sector that has seen its emissions increase over the past two decades. – Road transport contributes about one-fifth of the EU's total emissions of carbon dioxide (CO2), the main greenhouse gas. While emissions from other sectors are generally falling, those from road transport have continued to increase since 1990. – The "White Paper on Transport (2011)" (EC, 2011a) views current mobility patterns as unsustainable, with greenhouse gas emissions and rising congestion as the main sources of un-sustainability.	– For intercity travel: 50% of all medium-distance passenger and freight transport should shift off the roads and onto rail and waterborne transport (EC, 2011c). – For long-distance travel and intercontinental freight, air travel and ships will continue to dominate. New engines, fuels and traffic management systems will increase efficiency and reduce emissions (EC, 2011c). – For urban transport, a big shift to cleaner cars and cleaner fuels. 50% shift away from conventionally fuelled cars by 2030, phasing them out in cities by 2050 (EC, 2011c). – To upgrade mobility systems to "greener" transportation modes. – To limit passenger car traffic in urban areas in order to improve the use of public transport. – Urban Mobility Plans should be encouraged fully in cities above a certain size and they should be aligned with Integrated Urban Development Plans (EC, 2011a). – In the "urban context, to reduce congestion and emissions is needed a mixed strategy involving land-use planning, pricing schemes, efficient public transport services and infrastructure for non-motorised modes and charging/refuelling of clean vehicles." (EC, 2011a: 13). – To take into account the territorial dimension and, in a regional perspective of planning, in the way of a polycentric territorial development and an inter-urban polycentric cooperations (FOCI, 2010b: 19). – To reduce the need to travel mainly includes IT-based solutions.

Strength, Threats and Policy recommendations for the improvement of commuting and transport

5.5 Policy guidelines in Waste collection and water treatment

National and European policies should be aimed at increasing awareness of households so as to achieve a reduction of the amount of municipal waste generated and at reducing landfilling processes which contribute more than other processes to greenhouse gas emissions. Policy documents underline that greater attention should be given to the first step of the so called "waste hierarchy" where major emphasis is placed on waste prevention. Moreover, EU policies need to encourage the collection of data on municipal waste. There is in fact a general lack of data which does not allow regional policies to be developed by national and regional governments. This deficiency concerns too many countries such as United Kingdom, Iceland, Finland, Sweden, Denmark, Estonia, Latvia, Czech Republic, France, Spain, Greece, Switzerland, Albania, Montenegro, Serbia and Bosnia and Herzegovina.

Innovation and modernisation of waste treatment facilities should be developed and technology transfer in favour of new MS should be encouraged in order to reduce the share of landfilling which is still too high in countries such as Romania, Bulgaria, Croatia, Turkey and Lithuania. Greater action aimed at increasing collection rates is needed in Romania and Poland where the ten regions with the lowest rates are located. Technology transfer, recycling and incinerating should be developed in such countries so as to improve their collection rates and ensuring lower greenhouse gas emissions.

However, important action is needed in old Member States as well. In fact, and this is a worrying trend, many of them including Denmark, Luxembourg, Italy, France, Belgium, Portugal, Sweden, Finland, Greece and also new MS such as Cyprus, Malta, Iceland, Slovenia, Czech Republic, Poland and Slovakia show 2009 per-capita waste levels higher than 2002 levels. Therefore, even in countries such as Denmark and Sweden, which show good recycling rates and where landfilling rates are low, there is a need to address households behaviours towards more sustainable patterns and improve product design.

Moreover, further attention should be placed on recycling which can be developed and incentivized beyond the current EU-27 share of about 25% because of the economic and environmental advantages which is able to bring about. Action in this sense is needed in all MS, old as well as new, trying to achieve Germany's level of 48%.

As for the waste water treatment capacity, it could prove to be very useful to extend the requirement of situation reports (Directive 1991/271) to candidate countries so as to collect more data and evaluate their situation in advance. Clear actions and measures should be set out by and for single MS to further implement the Directive on Urban Waste Water Treatment which, as highlighted by the "Final assessment of the 6th Environment Action Programme", has not been completely implemented. Moreover, clear policies and actions should be set out both at EU and national level. In fact, neither the EU2020 Strategy nor National Programmes place great emphasis on waste water treatment among their strategic objectives. Immediate action has to be directed to new MS such Romania, Bulgaria and Malta and especially to the regions of Bucaresti-Ilfov, Sud-Vest Oltenia, Centru, Vest and Sud-Muntenia in Romania and the region of Severen tsentralen in Bulgaria. Neverthless, there is the Région de Bruxelles-Capitale which reports a very low rate of 22% and should be at the centre of next actions.

Strengths / Potentials	Threats / Challenges	Policy recommendations
– *Waste is considered as an EU's key resource by 2020.* – *Increased recycling will bring about economic as well as environmental benefits in terms of new jobs and CO_2 emissions reduction.* – *Landfilling shows decreasing trends. Potential to reduce landfilling operations in many new MS that show very high rates of landfilling.* – *Recycling accounts for about a quarter of the total amount of waste treated in the EU-27. Potential to improve national levels to Germany's level of 48% exists.* – *Enhanced design of products can reduce the demand for raw material and the amounts of waste generated.* – *Greater consistency within the EU-27 of the urban waste water treatment indicator.*	– *There is an increasing waste generation in many old Member States though the EU-27 waste generation level has stabilized at 520 kg per capita per annum.* – *In many new Member States landfilling is still the major waste treatment strategy. Landfilling shares top nearly 100% in some MS with pollution consequences.* – *Very low coverage rates of municipal waste collection in less developed economies. Immediate action is needed.* – *Modification of consumption models towards a more sustainable and recyclable model.* – *Improve the situation of some old and new MS with regard to urban waste water, especially in some capital cities' areas.*	– *Greater attention to the first step of the waste hierarchy.* – *Households strongly encouraged to recycle and prevent generation of waste.* – *Waste treatment facilities and technologies for new Member States with low coverage rates.* – *Innovation and investment in waste treatment facilities will allow the coverage rate of municipal waste collection to increase.* – *Data collection for urban waste water treatment (UWWT) capacity for new MS and candidate countries on the basis of the requirements set out by the directive 1991/271.* – *Defining clear actions and measures to guarantee further implementation of the Directive on UWWT.*

Strength, Threats and Policy recommendations for waste collection and water treatment in view of the EU 2020 Strategy.

5.6 Policy guidelines in Natura 2000 network

The following policy guidelines and recommendations are based on a deep analysis of European official documentation published by European Environment Agency and by DG Environment of the European Union. In particular, interesting information in this respect are provided by several projects commissioned by DG Environment such as the one completed in 2010 'Dealing with conflicts in the implementation and management of the Natura 2000 network - best practices at the local/site level'84.

Analysing results coming from that projects in addition to the analysis of ongoing EU policy on biodiversity it is possible to better understand the territorial situation of the EU referring to this indicator and reported on map 51. To this end, policy recommendation are added to Strengths/Potentials and Threats/Challenges in the table reported in the following page.

In order to make easier to understand our policy recommendations and guidelines, we provided a simple list of the main issues in this respect:

- First of all, also in a view of the EU 2020 Biodiversity implementation, it is important to ensure adequate funding for establishing the agreed Natura 2000 management measures;
- Recognise the role of Natura 2000 framework in facing climate change pressures (both through Mitigation and Adaptation) and in reducing risks related to natural hazards. Linked to this, strengthening the awareness on the socio-economic benefits arising from the good management of Natura 2000 (EC, 2011), by means of targeted promoting actions.
- It is important to facilitate the exchange of knowledge by exchange of best practices (BP) on participation processes and conflict resolution in management planning in different countries;
- According to the EU 2020 Biodiversity Strategy, a core policy action for the next decade is the completion of the establishment of the Natura 2000 network ensuring the implementation of specific management plans for all Natura 2000 sites.
- Finally, it is necessary to further develop the Natura 2000 network into an integrated European Green infrastructure as an important mechanism to counterbalance intensive land use changes (TSP, 2011) and to support the achievement of EU2020 Biodiversity Strategy targets (EEA, 2011a) by

[84] www.ecnc.org/programmes/nature-and-society-completed-projects?action=detail&id=88 (last access 10 july 2012).

linking Emerald and Natura 2000 networks, National Parks and green infrastructure corridors (EEA, 2011b).

- Natura 2000 sites covers a smaller part of the territory in many English and northern French regions as well as in Southern Finland and Sweden so in these countries it would be recommended to enlarge the Natura 2000 network.

Strengths / Potentials	Threats / Challenges	Policy recommendations / Guidelines
Natura 2000 Network forms a policy cornerstone for the conservation of Europe's most valuable species and habitats. *Natura 2000 is a good example of a policy with a strong spatial dimension.* *Natura 2000 sites are important in enforcing tourism, maintaining food security, supporting physical and mental health and protecting cultural heritage values.* *Natura 2000 is a network of nature conservation areas not restricted to nature reserves, but based on a much broader principle of conservation and sustainable use.* *Natura 2000 network represents the world's largest network of protected areas* *The network is growing constantly.* *Resolution on* EU2020 Biodiversity Strategy *adopted by the European Parliament on Friday 20 April 2012. Action 1 foresees the complete establishment of the Natura 2000 network ensuring its good management.* *A well-managed Natura 2000 network will make a key contribution to meeting EU2020S targets.* *Natura 2000 protection framework are particularly dense in the Mediterranean Europe and in Slovenia and Bulgaria.*	*Europe's wildlife and ecosystems are under threat.* *Europe's landscapes are suffering an increasingly fragmentation, mainly caused by factors linked to urban sprawl, transport infrastructures and intensifying farming practices.* *Some biogeographical Regions such as the Mediterranean one are under an ongoing severe anthropic pressure: it is the first world's tourism destination and much of its coastline has experienced very strong urban sprawl so as to be classified as one of 34 biodiversity hotspots in the world (EEA, 2006). Morevoer, is constantly threatened by forest fires.* *The Atlantic Region is one of the most heavily populated and intensely managed areas in Europe, it follows that there is a massive pressure on the natural environment.* *The Boreal Region is under increasing pressure above all by commercial forestry and, in some areas, by fishing.* *Most areas of Continental Region are affected by air-borne pollution from industrial activities.* *The previous European objective of halting biodiversity decline by 2010 has not been achieved (EC, 2010b).* *Currently, Natura 2000 network is highly fragmented and represents an unconnected set of unevenly protected 'islands' (EEA, 2011b).* *Natura 2000 Network covers a smaller part of the territory in many English and northern French regions as well as in Southern Finland and Sweden.*	*To recognise the role of Natura 2000 framework in facing climate change pressures (both through Mitigation and Adaptation) and in reducing risks related to natural hazards.* *To promote a designation of further Natura 2000 sites especially in some MS such as UK, SE, IE in order to reach a value of 20% of this indicator in each EU27 MS.* *To complete the establishment of the Natura 2000 network ensuring the implementation of specific management plans for all Natura 2000 sites*[85]*.* *To further develop the Natura 2000 network into an integrated, solid and sustainable ecological structure (TSP, 2011).* *To develop a Green infrastructure*[86] *as an important mechanism to counterbalance intensive land use changes (TSP, 2011) and to support the achievement of* EU2020 Biodiversity Strategy *targets (EEA, 2011a) by linking Emerald*[87] *and Natura 2000 networks, National Parks and green infrastructure corridors (EEA, 2011b).* *To strength the awareness about the socio-economic benefits arising from the good management of Natura 2000 (EC, 2011) by means of targeted promoting actions.*

Strength, Threats and Policy recommendations for waste collection and water treatment in relation to Natura 2000 network

85 The EC, in close cooperation with MS and stakeholders has elaborated guidance documents in this regard (Available at http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm. Last accessed 20 June 2012)

86 "Green infrastructure is a concept addressing the connectivity of ecosystems, their protection and the provision of ecosystem services, while also addressing mitigation and adaptation to climate change. It contributes to minimising natural disaster risks, by using ecosystem-based approaches for coastal protection through marshes/flood plain restoration rather than constructing dikes. [..]. The concept is central to the overall objective of ecosystem restoration, which is now part of the 2020 biodiversity target" (EEA, 2011a).

87 The Natura 2000 and Emerald networks are based on the same idea. EU Member States design Natura 2000 sites, while non-EU countries (Norway, Switzerland, Turkey and more recently Western Balkans) designate Emerald sites. (www.coe.int/t/dg4/cultureheritage/nature/econetworks/Presentation_en.asp last access 20 June 2012).

6. References

Aguilera, A. ; Mignot, D. (2002), "Structure des localisations intra-urbaines et mobilité domicile-travail", *Recherche Transport Sécurité*, n. 77, pp. 311-325.

Aguilera, A.; Mignot, D. (2004), "Urban Sprawl, Polycentrism and Commuting. A Comparison of Seven French Urban Areas", *Urban Public Economics Review*, n. 1 pp. 93-114

Blakely, E.J. (2007): *Urban Planning for Climate Change*, New Orleans: Lincoln Institute of Land Policy

Blumenthal, K. (2011): *Generation and treatment of municipal waste. Environment and energy*, Eurostat Statistics in focus. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-SF-11-031

Brock, W.A.; Taylor, M.S. (2005): "Economic Growth and the Environment: A Review of Theory and Empirics", in: Aghion, P.; Durlauf, S. (ed.), *Handbook of Economic Growth*, edition 1, volume 1, chapter 28, 1749-1821

Butter, F. A. G.; Verbruggen, H. (1994): "Measuring the trade-off between economic growth and a clean environment", *Environmental and Resource Economics*, 4(2): 187-208

Committee of the Regions (2012): "The European urban fabric in the 21st century", *Proceedings of the 5th European Summit of Regions and Cities*, 22-23 March 2012, Copenhagen

Corfee-Morlot, J.; Kamal-Chaoui L.; Donovan M.G.; Cochran I.; Robert A.; Teasdale P.J. (2009): "Cities, Climate Change and Multilevel Governance", *OECD Environmental Working Papers* n. 14, 2009

Daly, H.E. (1997): *Beyond growth: the economics of sustainable development*, Boston: Beacon Press (p.253)

Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources

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 and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

Dodman, D. (2009): "Blaming cities for climate change? An analysis of urban greenhouse gas emissions inventories", *Environment and Urbanization* 2009 21:185

Edwards, A.R. (2010): *Thriving Beyond Sustainability: Pathways to a Resilient Society*, Gabriola Island, B.C: New Society Publishers

Energy infrastructure priorities for 2020 and beyond - A Blueprint for an integrated European energy network. COM(2010) 677

ESPON INTERCO (2012): *Indicators of Territorial Cohesion*. Draft Final Report. ESPON Programme

ESPON-Climate (2011): *Territorial Potentials for adaptation to climate change*. ESPON Programme

EU Council (2010): Environment Council conclusions of 15 March 2010. www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/envir/113373.pdf (Last accessed 18 June 2012). Endorsed by the European Council conclusions www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/113591.pdf (Last accessed 18 June 2012).

European Commission (2008): *Turning Territorial Diversity into Strength. Green Paper on Territorial Cohesion* COM(2008) 616

European Commission (2010a): *Energy 2020. A Strategy for Competitive, Sustainable and Secure Energy.* COM(2010) 639/3 final

European Commission (2010b): *Europe 2020. A strategy for smart, sustainable and inclusive growth*. COM(2010) 2020

European Commission (2010c): *Investing in Europe's future*. Fifth report on economic, social and territorial cohesion. Luxembourg: Publications Office of the European Union

European Commission (2010d): *The 2010 Assessment of Implementing the EU Biodiversity Action Plan* COM(2010) 548 final http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/bap_2010/1_EN_ACT_-part1_v2.pdf (Last accessed 15 June 2012).

European Commission (2010e): *Using official statistics to calculate greenhouse gas emissions*. Luxembourg: Publications Office of the European Union

European Commission (2011a): *Energy Roadmap 2050*. COM(2011) 885/2

European Commission (2011b): *Final assessment of the 6th Environment Action Programme*. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/996.

European Commission (2011c): Regional Policy Contributing to Sustainable Growth in Europe 2020. COM (2011) 17 final (available at http://ec.europa.eu/regional_policy/information/pdf/brochures/rfec/2011_sustainable_growth_en.pdf)

European Commission (2011d): *Renewable Energy: progressing towards the 2020 target*. Communication from the commission to the European Parliament and the Council - COM(2011) 31 final

European Commission (2011e): *The Urban and Regional Dimension of Europe 2020. Seventh Progress Report on Economic, Social and Territorial Cohesion*. Luxembourg: Publications Office of the European Union

European Commission (2011f): *Annual Growth Survey 2011, Annex 1. Progress report on Europe 2020*. Available at: http://ec.europa.eu/economy_finance/articles/eu_economic_situation/2011-01-annual-growth-survey_en.htm

European Commission (2011g): *Annual Growth Survey 2012. Progress report on Europe 2020.* Available at: http://ec.europa.eu/europe2020/reaching-the-goals/monitoring-progress/annual-growth-surveys/index_en.htm

European Commission (2011h): *Energy Statistics Regulation 1099/2008* (available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:304:0001:0001:EN:PDF).

European Commission (2011i): *Roadmap to a Resource Efficient Europe*. Available at: http://ec.europa.eu/environment/resource_efficiency/about/roadmap/index_en.htm

European Commission (2011l): *White Paper Roadmap to a Single European Transport Area – Towards a competitive and efficient transport system* (available at http://ec.europa.eu/transport/strategies/2011_white_paper_en.htm).

European Commission (2011m): *A Roadmap for moving to a competitive low carbon economy in 2050*. COM (2011) 112 final

European Commission (2011n): *The flagship "A Resource-efficient Europe"*. COM (2011) 21 final (available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0021:FIN:EN:PDF)

European Commission (2011p): Energy Efficiency Plan. *Available at* http://eur-

lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011DC0109:EN:HTML:NOT

European Commission (2011p): *Renewable Energy: Progressing towards the 2020 target*. COM (2011) 31 final (available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0031:FIN:EN:PDF9)

European Commission (2011q): *Transport 2050: Commission outlines ambitious plan to increase mobility and reduce emissions*, (available at http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/372&format=HTML&aged=0&language=en).

European Commission (2011r): Energy Efficiency Plan. *Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011DC0109:EN:HTML:NOT*

European Commission, (2011s): *Financing Natura 2000. Investing in Natura 2000: Delivering benefits for nature and people*. SEC(2011) 1573 final. Commission Staff Working Paper. Available at http://ec.europa.eu/environment/nature/natura2000/financing/docs/financing_natura2000.pdf (Last accessed 21 June 2012).

European Commission (2012): *Facts and Figures about Urban Waste Water Treatment.* Available at: http://ec.europa.eu/environment/water/water-urbanwaste/implementation/factsfigures_en.htm

European Commission White Paper (2009): *Adapting to climate change: Towards a European framework for action*. COM(2009) 147 final

European Council (1991): *Directive 1991/271 concerning urban waste water treatment*. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0271:EN:NOT
.

European Council (1998): *Directive 1998/15 amending Council Directive 1991/271*. Available at: http://ec.europa.eu/environment/water/water-urbanwaste/amendment.html.

European Environment Agency (2006): *Urban sprawl in Europe. The ignored challenge*. EEA Report n. 10/2006

European Environment Agency (2009): *Territorial cohesion. Analysis of environmental aspects of the EU Cohesion Policy in selected countries*. EEA Technical report series Technical report n. 10/2009

European Environment Agency (2010): *The territorial dimension of environmental sustainability. Potential territorial indicators to support the environmental dimension of territorial cohesion*. EEA Technical report series, Technical report n. 9/2010

European Environment Agency (2011a): *Greenhouse gas emission trends and projections in Europe 2011. Tracking progress towards Kyoto and 2020 targets*, EEA Report, n.4/2011

European Environment Agency (2011b): *Resource efficiency in Europe: Policies and approaches in 31 EEA member and cooperating countries*. EEA Report No 5/2011. Available at: http://www.eea.europa.eu/highlights/publications/resource-efficiency-in-europe/.

European Environment Agency (2011c): *Resource efficiency in Europe Policies and approaches in 31 EEA member and cooperating countries*, EEA Report, n.05/2011

European Environment Agency (2011d): *Green infrastructure and territorial cohesion. The concept of green infrastructure and its integration into policies using monitoring systems*. EEA Technical report series, Technical report n. 18/2011

European Environment Agency (2011e): *Landscape fragmentation in Europe*. Joint EEA-FOEN Report n. 2/2011

European Environment Agency (2012a): *Annual European Union greenhouse gas inventory 1990–2010 and inventory report 2012. Submission to the UNFCCC Secretariat*, EEA Technical Report, n.03/2012

European Environment Agency (2012b): *Environmental indicator report 2012. Ecosystem Resilience and Resource Efficiency in a Green Economy in Europe*, EEA Report, 2012

European Environment Agency (2012c): *Urban adaptation to climate change in Europe. Challenges and opportunities for cities together with supportive national and European policies*, EEA Report, n.2/2012

European Parliament and Council (1994): *Directive 1994/62 on packaging and packaging waste*. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:NOT

European Parliament and Council (2008): *Directive 2008/98 on Waste and repealing certain Directives*. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/sectors/municipal_waste

Eurostat (2010): *Environmental Statistics and Accounts in Europe*. Luxembourg: Publications Office of the European Union. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-32-10-283

Eurostat (2011): *Municipal Waste Statistics, Data from March 2011.* Luxembourg: Publications Office of the European Union. Available at: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Municipal_waste_statistics)

EWEA (2011): *EU Energy Policy to 2050. Achieving 80-95% emissions reductions*. March 2011

FOCI project (2010a): *Future Orientations for Cities Final Report* (v. 15/12/2010). ESPON Programme (available at www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/foci.html)

FOCI project (2010b): *Future Orientations for Cities Executive Summary* (v. 15/12/2010) (available at www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/foci.html)

European Commission Stakeholder Consultation Report (2008): *Green Paper on Urban Mobility*. ECORYS Nederland BV December 2008 (available at http://ec.europa.eu/transport/urban/studies/doc/2007_urban_transport_europe.pdf)

Greiving, S.; Fleischhauer, M. (2012): "National Climate Change Adaptation Strategies of European States from a Spatial Planning and Development Perspective", *European Planning Studies*, Volume 20, Issue 1, 2012

Hill, N.; Brannigan, C.; Smokers, R.; Schroten, A., Van Essen, H., and Skinner, I. (2012): *Developing a better understanding of the secondary impacts and key sensitivities for the decarbonisation of the EU's transport sector by 2050*. Draft final project report produced as part of a contract between European Commission Directorate-General Climate Action and AEA Technology plc; see website www.eutransportghg2050.eu p. 48.

Hjerp, P., Medarova-Bergstrom, K., Cachia, F., Evers, D., Grubbe, M., Hausemer, P., Kalinka, P., Kettunen, M., Medhurst, J., Peterlongo, G., Skinner, I. and Brink, P., (2011): *Cohesion Policy and Sustainable Development.* A report for DG Regio, October 2011

Hopwood, B.; Mellor, M.; O'Brien, G. (2005): "Sustainable Development. Mapping Different Approaches", *Sustainable Development* 13(1): 38–52

Huld, T. et al. (2011): *A Database of Direct Normal Irradiation for Predicting Long-Term Performance of Concentrating PV Systems in Europe and Africa*, European Commission DG JRC, Ispra (Italy)

IEEP et al. (2010): *The costs and socio-economic benefits associated with the Natura 2000 network*. DG Environment. Available at http://ec.europa.eu/environment/nature/natura2000/financing/docs/natura2000_costs_benefits.pdf

International Energy Agency (2008): *Deploying Renewables: Principles for Effective Policies* (available at: www.iea.org/textbase/nppdf/free/2008/DeployingRenewables2008.pdf)

International Energy Agency (2010): *World Energy Outlook 2010*.

International Energy Agency (2011): *Co-Generation and Renewables: Solutions for a Low-Carbon Energy Future*, (available at http://www.iea.org/papers/2011/CHP_Renewables.pdf)

International Energy Agency (2012): *Energy Technology Perspectives 2012*. IEA/OECD, Paris

International Transport Forum (2012): *Transport Outlook, Seamless Transport for Greener Growth*, (available at http://www.internationaltransportforum.org/Pub/pdf/12Outlook.pdf).

IPCC (2007): *Climate Change 2007: Mitigation of Climate Change*, Intergovernmental Panel on Climate Change Working Group III, Netherlands Environmental Assessment Agency

IPCC (2007): *Fourth Assessment Report Climate Change 2007: Synthesis Report*, Intergovernmental Panel on Climate Change.

Jacobs, (2004): *Environment Group Research Report: An Economic Assessment of the Costs and Benefits of Natura 2000 Sites in Scotland*. Scottish executive, Environment Group Research Report 2004/05. Available at www.scotland.gov.uk/Resource/Doc/47251/0014580.pdf (Last access 20 June 2012).

Jaeger-Waldau, A. (2011): *PV Status Report 2011: Research, Solar Cell Production and Market Implementation of Photovoltaics*, European Commission DG JRC, Ispra (Italy)

Kahn, M.E. (2010): *Climatopolis: how our cities will thrive in the hotter future*, New York: Basic Books

Keskitalo, E.C.H. (2010): *Developing Adaptation Policy and Practice in Europe: Multi-level Governance of Climate Change*, New York: Springer

Kettunen et al., (2009a): *Recognising the value of protected areas*. In TEEB - The Economics of Ecosystems and Biodiversity for National and International Policy Makers(2009). www.teebweb.org.

Kettunen, M., Bassi, S., Gantioler, S., and ten Brink, P. (2009b): *Assessing socio-economic benefits of Natura 2000 – a Toolkit for Practitioners*. Output of the European Commission project Financing Natura 2000: Cost estimate and benefits of Natura 2000. IEEP, Brussels, Belgium. Available at http://ec.europa.eu/environment/nature/natura2000/financing/docs/benefits_toolkit.pdf (last accessed 20 June 2012).

Meyer, S.M. (1995): "The Economic Impact of Environmental Regulation", *Journal of Environmental Law & Practice*, 3(2): 4-15

Mickwitz, P. et al (2009): *Climate policy integration, coherence and governance*, Helsinky: Partnership for European Environmental Research

Mulongoy, K. J. and Gidda, S. B., (2008): *The Value of Nature: Ecological, Economic, Cultural and Social Benefits of Protected Areas*. Secretariat of the CBD, Montreal. Available at www.cbd.int/doc/publications/cbd-value-nature-en.pdf (last accessed 20 June 2012).

OECD (2009): *The Economics of Climate Change Mitigation: Policies and Options for Global Action Beyond 2012* (www.oecd.org/env/cc/econ/beyond2012)

Owen, D. (2010): *Green Metropolis: Why Living Smaller, Living Closer, and Driving Less Are the Keys to Sustainability*, New York: Penguin

Polverini, D. et al. (2011): *A Validation Study on Series Resistance Calculation According to IEC60891, ED 2.0*, European Commission DG JRC, Ispra (Italy)

Polverini, D. et al. (2011): *Effects of Operating Conditions on Thin Film Amorphous and Microcrystalline Silicon Module Performance*, European Commission DG JRC, Ispra (Italy)

Register, R. (2006): *EcoCities. Rebuilding Cities in Balance with Nature*, Gabriola Island (Canada): New Society Publishers

Report on Transport Scenarios with a 20 and 40 Year Horizon - Developing a set of long-term scenarios (2030-2050) for transport and mobility in Europe (available at http://ec.europa.eu/transport/strategies/studies/doc/future_of_transport/2009_02_transvisions_report.pdf).

Report on urban transport in Europe, prepared for the European Commission, Directorate-General for Energy and Transport (available at

http://ec.europa.eu/transport/urban/studies/doc/2007_urban_transport_europe.pdf)

ReRisk project (2010): Regions at Risk of Energy Poverty Final Report (v. 5/11/2010). ESPON Programme (available at http://www.espon.eu)

Roubanis, N.; Dahlström, C.; Noizette, P. (2010): *Environment and energy, Statistics in focus*. Eurostat (available at http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-10-056/EN/KS-SF-10-056-EN.PDF).

Sample T. et al. (2011): *Results of the International PV Module Quality Assurance Forum and the Road Ahead*, European Commission DG JRC, Ispra (Italy)

Schroten, A.; Skinner, I.; Brinke, L. et al. (2011): *Potential for less transport-intensive paths to societal goals*. Task 4 paper produced as part of a contract between European Commission Directorate-General Climate Action and AEA Technology plc; see website www.eutransportghg2050.eu p. 28-29.

Stern N. (2006): *Stern Review on the Economics of Climate Change*. London: HM Treasury

TRACC project (2011): *Transport accessibility at regional/local scale and patterns in Europe Interim Report* (v. 21/02/2011). ESPON Programme (available at http://www.espon.eu)

TSP, Territorial State and Perspectives of the European Union 2011 update, (2011): Background document for the Territorial Agenda of the European Union 2020 presented at the Informal Meeting of Ministers responsible for Spatial Planning and Territorial Development on 19th May 2011 Gödöllő, Hungary.

Ulhoi, J.P.; Madsen, H. (1999): "Sustainable Development and Sustainable Growth: Conceptual Plain or Points on a Conceptual Plain?", *Proceedings of the 17th International Conference of the System Dynamics Society "Systems thinking for the next millennium"*, Wellington New Zealand

Van der Laan N. (1998), "Changing urban systems: an empirical analysis at two spatial levels", *Regional Studies*, vol. 32, pp. 235-247

Whitehead, M. (2007): *Spaces of sustainability: geographical perspectives on the sustainable society*, London: Taylor & Francis

Wilbanks, T.J.; Kates, R.W. (1999): "Global change in local places: how scale matters", Climatic Change 43: 601–628

Zysman, J.; Huberty, M. (2012): "From Religion to Reality. Energy systems transformation for sustainable prosperity", *Working Papers BRIE* Berkeley Roundtable on the International Economy

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