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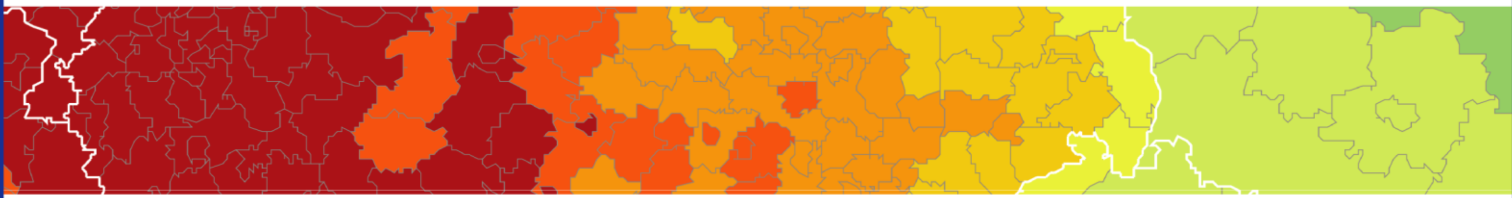

Territories and low-carbon economy

Applied Research

Interim Report

Version 06/04/2017

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Territories and low-carbon economy

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Abbreviations

agenbur	Agencia provincial de la energia de burgos, provincial energy agency, Spain
BEE	Biomass Energy Europe
CEP	Central Europe Programme
CF	Cohesion Fund
CORINE	Coordination of Information on the Environment
DG ENER	European Commission‘s Directorate-General for Energy
DTU	Danmarks Tekniske Universitet, Technical University of Denmark
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
EE	Energy Efficiency
EEA	European Environment Agency
EMFF	European Maritime and Fisheries Fund
ENPI/ENI	European Neighbourhood and Partnership Instrument/European Neighbourhood Instrument
ERDF	European Regional Development Fund
EREN	Ente Regional de la Energía, regional energy agency of Castilla y León
ESI funds	European Structural and Investment Funds
EU	European Union
EU-28	European Union’s 28 member states
EUROSTAT	Statistical office of the European Union
FEDARENE	European Federation of Agencies and Regions for Energy and the Environment
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GMCA	Greater Manchester Combined Authority
GW	Gigawatt
IEE	Intelligent Energy Europe
Interreg	Community initiative aiming at stimulating interregional cooperation
IPA	Instrument for Pre-accession Assistance
IPCC	Intergovernmental Panel on Climate Change (UN Climate Panel)
ISI	(Fraunhofer) Institute for Systems and Innovation research
KEEP	source of aggregated information regarding projects and beneficiaries of European Union programmes
ktoe	kilotonne of oil equivalent
LCE	Low Carbon Economy
LULUCF	Land Use, Land Use Change and Forestry
MENA	Middle East & North Africa
MMR	Monitoring Mechanism Regulation
MS	Member State
MW	Megawatt
MWh	Megawatt hour
NGO	Non-Governmental Organisation
NUTS	Nomenclature des Unites Territoriales, nomenclature of territorial units for statistics
PaM	Policies and Measures
PV	photovoltaic
RAI	Regional Authority Index
REAP	Regional Energy Agency of Pazardjik
REC	Regional Energy Concept
RES	Renewable Energy Source
TO	Thematic Objective
ToR	Terms of Reference
TU Wien	Technical University Vienna
TWh	Terawatt hour
UK	United Kingdom
UN	United Nations
Under2MOU	Sub-national Global Climate Leadership Memorandum of Understanding

Introduction

Background and objectives of the research activity

The objective of this project on “Territories and low-carbon economy” is to provide evidence on the territorial dimension of implementing the low-carbon economy approach in different parts of Europe and in different types of European regions and cities. The research focus here is to provide information for regions throughout EU-Europe at NUTS 3 level, which does not exist relating to energy consumption patterns and the potential to produce (and use) renewable energy sources. It will be a valuable innovation to provide such database for analysis and policy formulation – with respect to the great variation of regional spatial and economic features in Europe.

In an attempt to understand the variation of regional powers for policy making and implementation with focus on energy, an overview of policies and energy-relevant regional competencies will be provided. Together with case study experience on innovative policy approaches at the regional level, ideas and recommendations will be developed for policy formulation towards the transition to low-carbon economy. In doing so, it will be of special interest, how policies and regulations from different levels (EU, national, regional) are interacting and how they can be combined effectively. Since regional competencies in policy making differ widely, it will also be of importance to look at more informal cooperation arrangements, initiatives and joint actions. The contribution of the regional level is of major importance for the success and intensity of transition processes, particularly relating to the success of private sector involvement, including enterprises and households.

EU cohesion policy is focusing on economic development, research and innovation activities across Europe. In the current period a special focus is on low-carbon relevant activities, explicitly as contribution to EU 202020 targets, with implementation now beginning. Regional experience, the findings from case studies and good practice examples will be used here to formulate recommendations for successful transition policies. While the focus is on regions, EU and national framework regulations and aid schemes must be designed in a way to allow regions to use their potential to act in full. In this project it will be the ambition to bring together the views and needs from different levels in order to make regional-level policy making effective.

As formulated in the section on the context for the call, “low-carbon economy would have a much greater need for renewable sources of energy, energy-efficient building materials, hybrid and electric cars, “smart grid” equipment, low-carbon power generation and carbon capture and storage technologies.” To have a good understanding of how different regional potentials are to generate renewable energies is one key, to provide effective policies to make production, distribution and consumption economically feasible in different regions, is the other. The attempt here is to contribute to both key questions.

Main outcome and conceptual approach

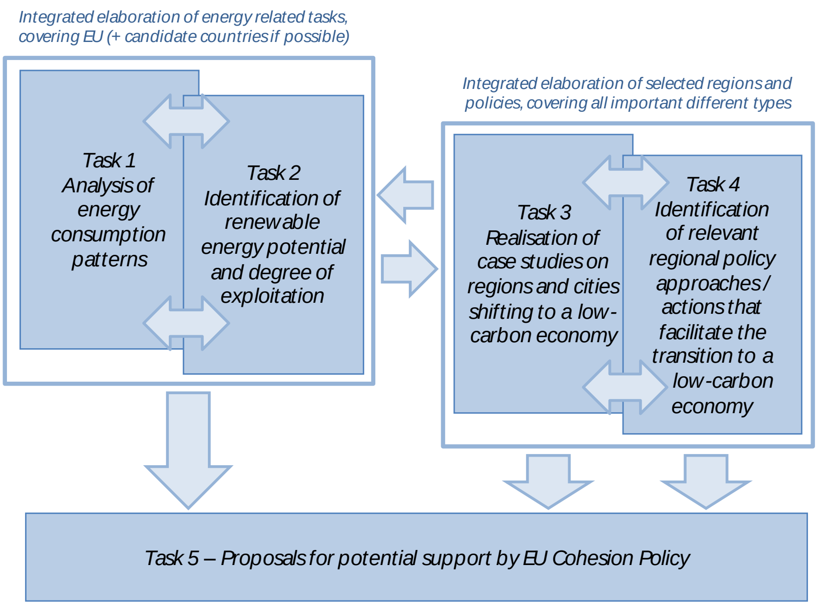
As main outcome of the research activity it is envisaged both, quantitative as well as qualitative results. In more detail, the research project aims at elaborating the following final outcomes:

- Evidence on energy consumption patterns in European regions broken down into households, public buildings, economic activities and transport, and their change over the past 10 years at NUTS 3 level.
- Evidence on the regional potential for the production and exploitation of renewable energy in Europe at NUTS 3 level.
- Five case studies on different types of European regions that provide a more detailed insight into regional patterns of energy consumption as well as experiences and lessons learnt in shifting to a low-carbon economy.
- Knowledge about the factors supporting European regions in making use of their low-carbon potential including evidence on specific governance aspects that can help involving the private sector in unlocking low-carbon investments.
- Experience about the role of cohesion policy in supporting regional low carbon development in Europe.

Conceptual approach and general understanding

Quantitative and qualitative research components contribute in an integrated work process to generate a greatly improved knowledge on current and past patterns of energy consumption and the potential to produce renewable energies at a disaggregate regional level (NUTS 3).

Conceptual framework of the project – combining quantitative and qualitative tasks



While the quantitative potential will be estimated and documented in tasks 1 and 2, the necessary governance structures, policies and measures to actually make use of these potentials and help towards the transition to a low-carbon economy, will be analysed in tasks 3 to 5.

Conclusions and recommendations will be drawn from both strands of research, relating to data availability and demand, necessary governance structures and policy designs and also to further research needed.

Structure of the interim report

Accordingly, the interim report at hand provides with interim results and information on the ongoing work progress laid down in the project proposal and informs about the plan to fulfil the tasks objectives and about results and findings so far:

- Task 1: Modelling results on regional energy consumption distinguishing between renewable and non-renewable energy and broken down by sectors over the past 10 years (chapter 1);
- Task 2: Overview on regional potential for generating and distributing renewable broken down into various renewable energy sources (chapter 2);
- Task 3: The state of affairs of case study work including interim results from our selected case study reports and the meta-analysis on other regional case reports (chapter 3);
- Task 4: State of affairs on the identification of regional policy approaches/actions for different types of regions and on the overview on existing regional policies, planning instruments and initiatives set up to support regional low-carbon development (chapter 4);
- Task 5: Preliminary results and recommendations on European cohesion policy (chapter 5)

Following the requirements of ESPON EGTC, the main report is limited to a length of 40 pages. Consequently this report is containing only a small number of figures and maps and a short presentation of results.

In addition, the scientific interim report in the annex – also structured by tasks – provides with detailed information on methodologies applied, outcomes of interim working steps, figures and maps as well as findings from the tasks at this stage of work.

Please note

Responding to the ToR, where it is stated that the aim of this research activity is to provide with "comprehensive evidence of energy consumption patterns for the past 10 years – broken down into different consumers and – at NUTS3 level – together with the same regional level of results on renewable energy production and exploitation" we have stated in our offer, that such a task is posing a major challenge on the project team. Research providing this evidence is highly innovative since such disaggregated data on energy consumption, production and renewable potential are not provided by official statistics, for many countries not even on national level.

The research team has put major effort in collecting available information, modelling and elaborating such a comprehensive evidence for the interim report. The results will be checked and refined for the final report. Nevertheless, it has to be stated that this research activity has to be perceived as a pilot study at European level and further research needs will have to be expected for the future.

1 Task 1 – Analysis of energy consumption patterns in European regions and cities

The objective of this task is to provide evidence on energy consumption patterns in European regions broken and their development over the past 10 years. The analysis is conducted in a spatial resolution on a NUTS3 level. The results for the year 2012 are contrasted with the consumption patterns in the year 2002, thus revealing the change of these consumption patterns in the period of 10 years from 2002-2012. Furthermore, the analysis differentiated between energy demand sectors and energy end-uses. Thereby, energy consumption of the households, services, agriculture and forestry, transport energy are considered. Energy consumption in buildings is further differentiated in heating/cooling energy demand and energy demand for appliances and lighting.

This research is innovative since such a disaggregated data on energy consumption is not even included in the official statistics on national level of most European countries and there are definitely no such data on NUTS3 level available on official statistics. The basis for the analysis is the final energy demand balances reported by Eurostat. It only includes final energy consumption per sector and energy carrier level and does not differentiated between end-use categories.

This chapter is structured in two sections. To begin with, Section 1.1 explains the methodological approach for deriving the energy consumption patterns on NUTS3 level. By making use of econometric methods and simulation methods regional conversion matrices had been developed to scale needed indicators. The results of this task are presented in Section 1.2.

1.1 Methodological approach

As methodological approach we show how the intended detailed energy consumption patterns in European regions and cities had been developed. The approach is described in four separate subchapters in the Annex, each covering the specific methods applied.

Different approaches are applied in order to account for the peculiarities of all prescribed sectors of energy consumption. The applied methods can be categorised either as econometric analysis or as bottom-up simulation models. The simulation models INVERT/EE-Lab[1] – for heating and cooling energy demand – and FORCAST-Regional[2] – for appliances, lighting and processes – are applied within this analysis..

[1] http://www.invert.at

[2] http://www.forecast-model.eu

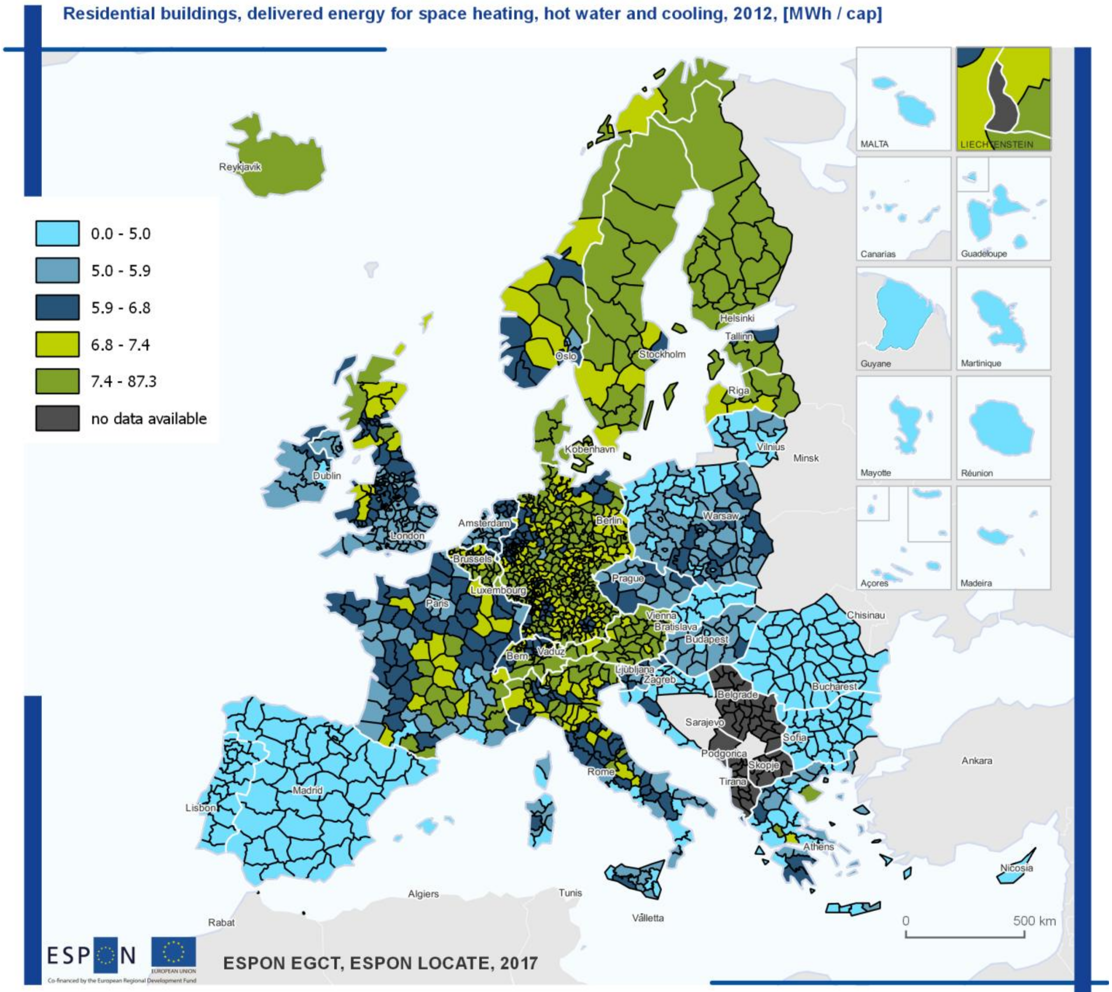
1.2 Regional energy consumption

This chapter presents the key results regarding energy consumption patterns and related share of renewable energy on NUTS3 level for all EU-28 member states plus Switzerland, Norway, Iceland and Liechtenstein for the years 2002 and 2012.

1.2.1 Final energy demand for space heating, hot water and cooling

In this section, the indicators of the energy consumption for space heating, domestic hot water and air conditioning of the residential and non-residential building stock on the level of NUTS3 regions are shown.The first map depicts the results for the year 2012.

Map 1.1: Energy demand for space heating, domestic hot water production and air conditioning of residential buildings in 2012, MWh per capita



Regional level: NUTS 3 (version 2013)
Source: ESPON LOCATE, 2017
Origin of data: Eurostat, 2001-2016, own calculations
CC - UMS RIATE for administrative boundaries

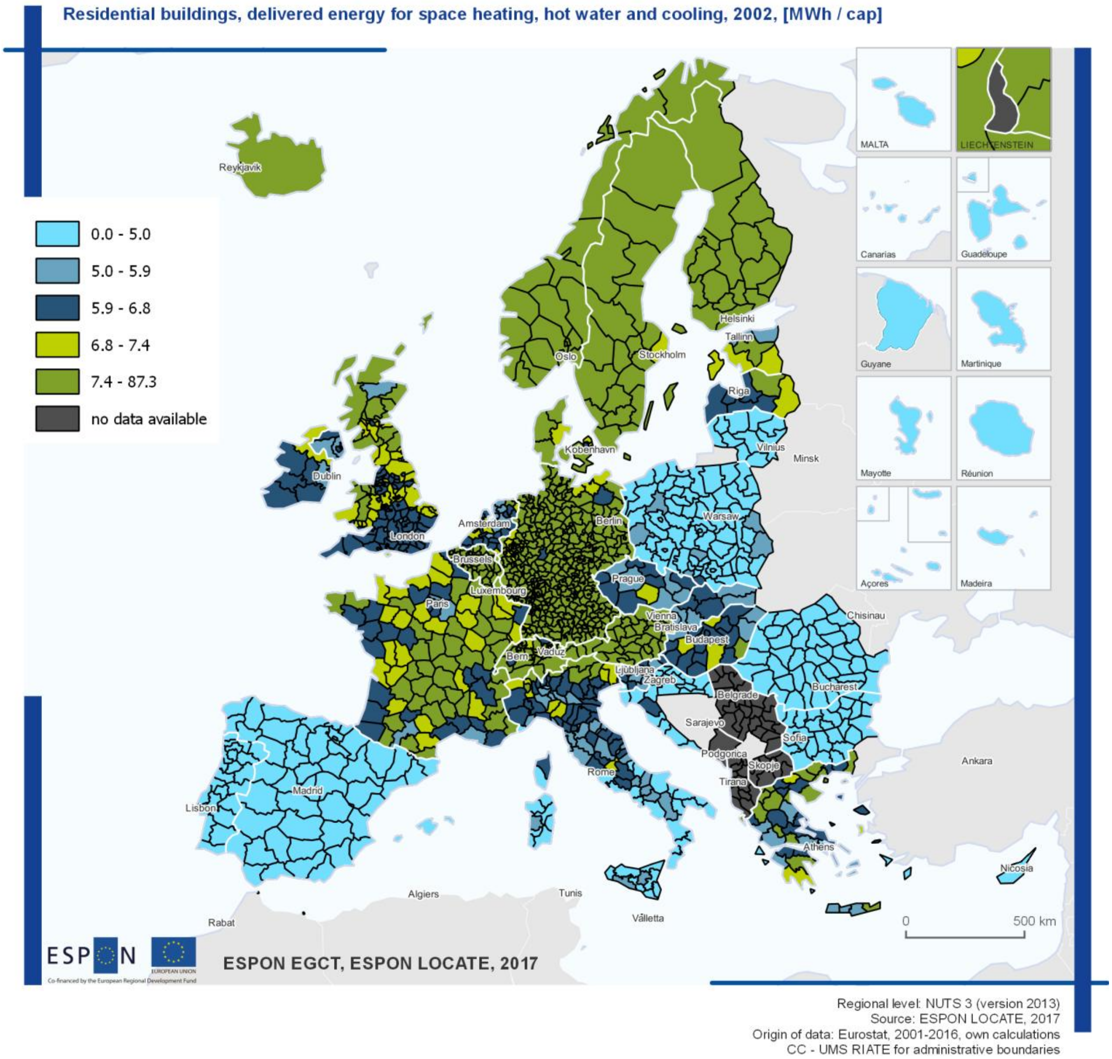
It is important to note that all maps show *final* energy consumption. Thus, conversion efficiencies of heat supply technologies are considered, the efficiency of the provision of energy carriers is not included. This is especially important in the assessment of electricity and district heating which would be considered in a primary energy balance.

The following map shows the same data for the year 2002. The development from 2002 to 2012 is mainly driven by following factors:

- Change in the energy performance of the building stock by thermal building renovation and installation of other (more efficient) heating systems.
- Change in the overall supply of energy services, e.g. the related floor area of the building stock of a certain region. However, also the comfort level plays a key role.

Since the specific climate conditions of the respective year do have a major influence on the space heating and cooling demand, climate correction factors based on heating and cooling degree days are applied in this analysis. Therewith, the results present energy consumption assuming the same temperature distribution for 2012 and 2002.

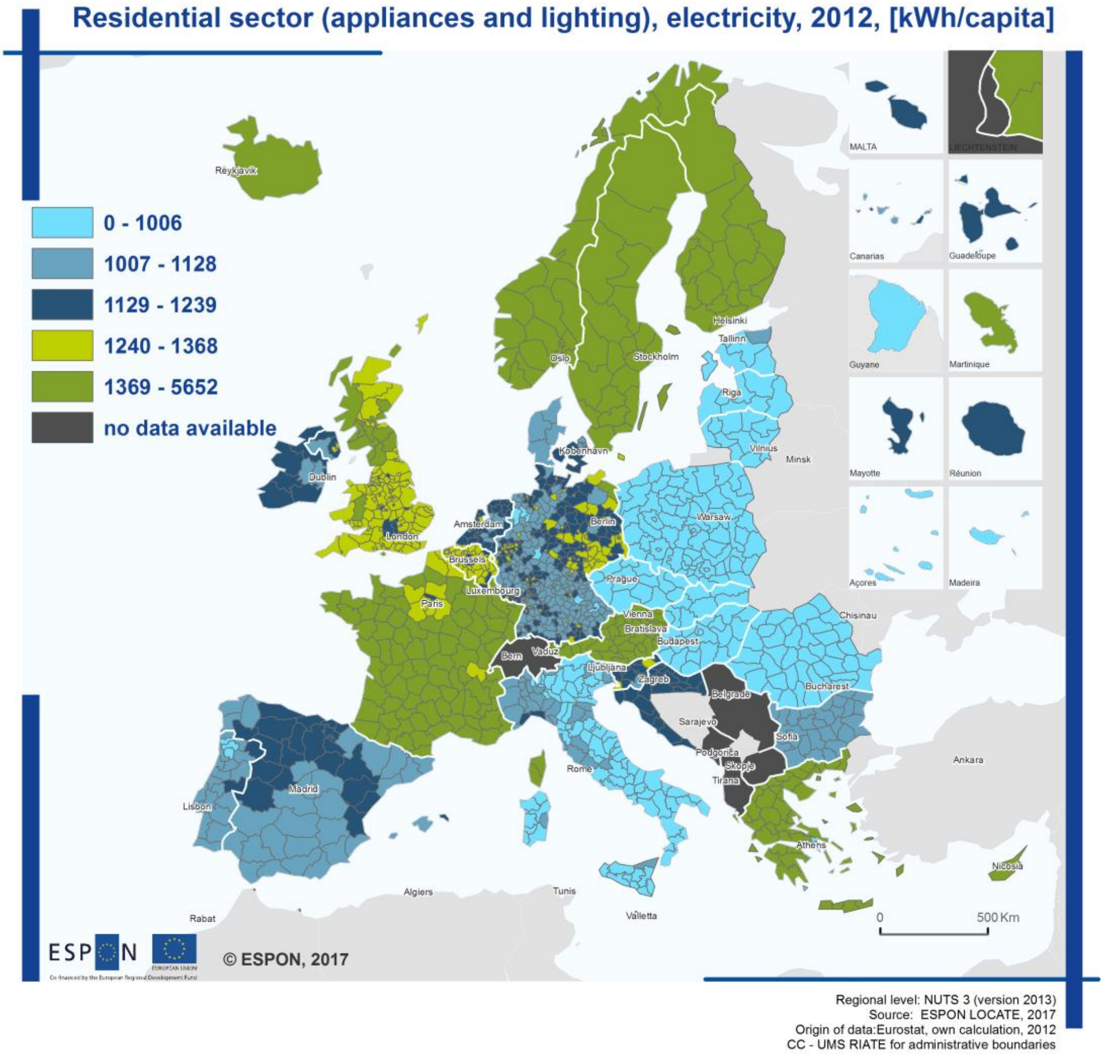
Map 1.2: The energy demand for space heating, domestic hot water production and air conditioning of residential buildings in 2002, MWh per capita



Final energy demand of appliances, lighting and processes

The *electricity demand of the residential sector* is essentially attributed to household appliances such as stoves and washing machines, lighting. The following map shows significant differences in the energy demand for these end-uses among countries but also among some regions within countries.

Map 1.3: Electricity demand per capita for appliances and lighting in the residential sector in 2012 in kWh/capita

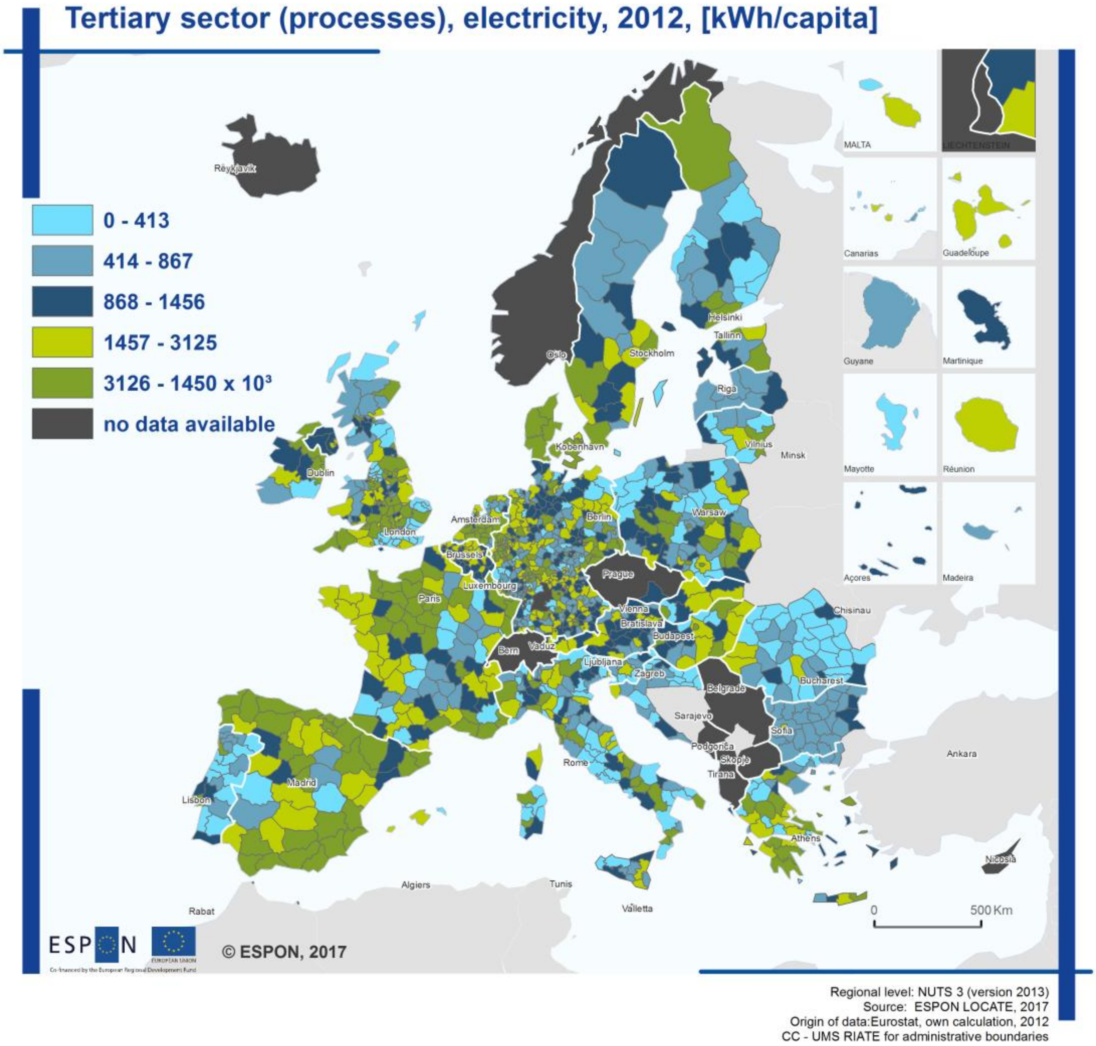


Especially in Norway and Sweden, the electricity demand per capita is above 3,000 kWh per capita in many regions. On the other hand, many Eastern European countries and parts of Spain exhibit very low specific electricity demand for appliances and lighting that is even below 1,000 kWh per capita. The comparison between 2012 and 2002 shows an increase of electricity demand per capita in almost all of the countries. The strongest increase can be observed in many regions of Greece, Romania and Lithuania.

The *gas demand* for cooking per capita of the *residential sector* is in a range up to 1,320 kWh per capita. The highest demand by far is in Romania and many regions of Poland with over 400 kWh per capita. In comparison, more than half of the analysed regions have a gas demand per capita below 100 kWh. The lowest demand per capita can be observed in Norway, Sweden, Finland and Island.

Map 1.4 includes the final energy demand per capita attributed to appliances, lighting and processes in the *service sector.* As illustrated in the legend of Map 1.4 the level of electricity demand per capita increases up to 100,000 kWh and even above. This is due to the fact that entire metropolises like Paris, Madrid or Berlin are capture by single NUTS3 regions.

Map 1.4: Electricity demand per capita for processes in the tertiary sector in 2012 in kWh/capita

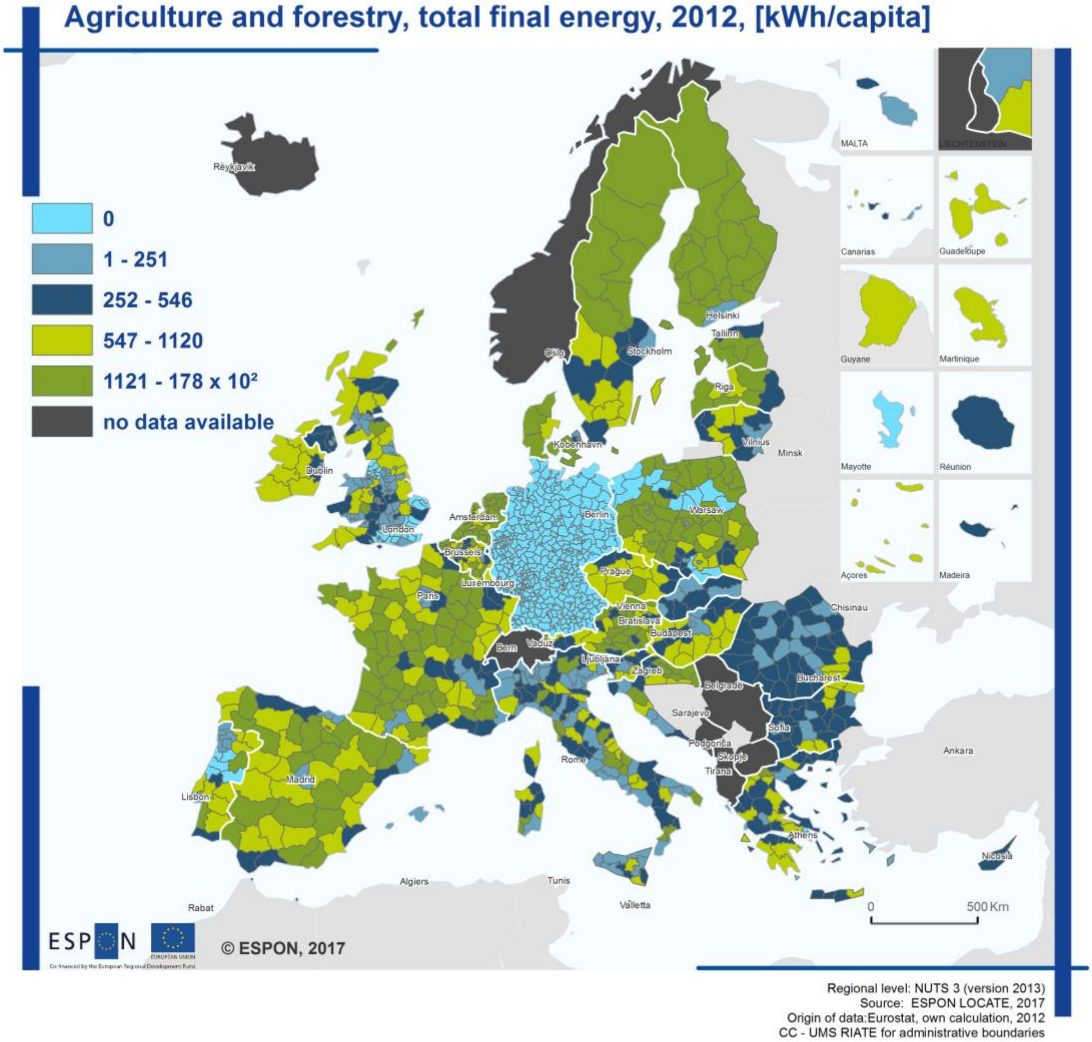


From 2002 to 2012, electricity demand per capita even increases in the service sector. Analysing the largest consuming regions per capita in 2012 reveals, that the ranking of regions largely have not changed since 2002. The strongest increase since 2012 can be observed in Romania and Belgium. For Island, Norway and the Czech Republic no data are available for the 2002 balance.

Final energy demand of the agriculture and forestry sector

The total final energy demand of the agriculture and forestry sector is related to the population per region. As the study reveals, the highest demand per capita can be seen in the Netherlands and in Poland with values even above 5,000 kWh per capita (Map 1.5). For instance, the total final energy demand in Germany is mainly below 100 kWh per capita, due to the fact of a high population density compared to the overall demand. Like for the service sector, there are some data gaps for Norway and Island.

Map 1.5: Total final energy demand per capita in the agriculture and forestry in 2012, kWh/capita

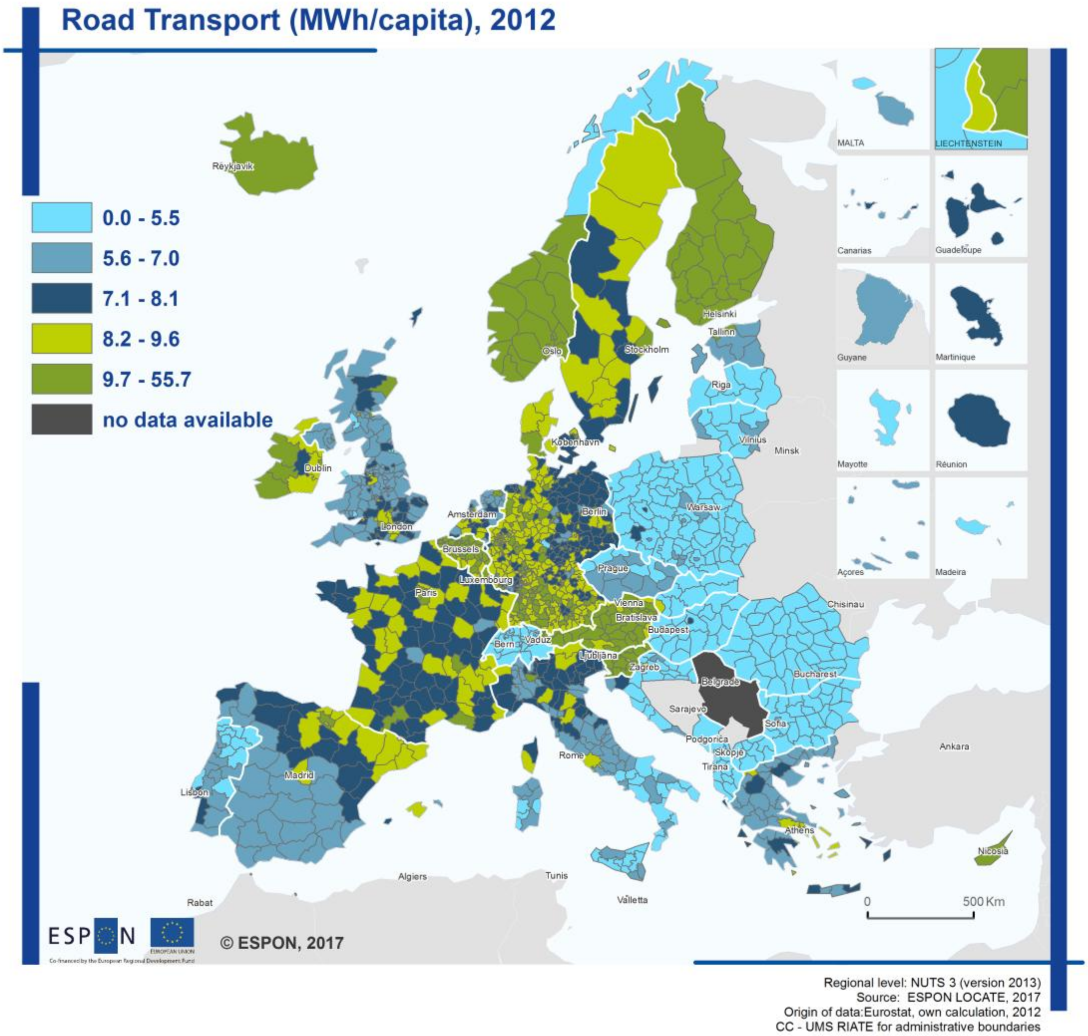


Total final energy demand of the agriculture and forestry sector has decreased since 2002. Furthermore, we see that the distribution of total final energy demand per capita largely remains stable until 2012.

1.2.2 Final energy demand for transport

Road transport energy consumption has the highest share of the total transport energy consumption. It includes diesel and gasoline driven passenger cars as well as diesel driven trucks, busses and off-road vehicles. Map 1.6 shows the results for 2012. Remarkable is the relatively high consumption per capital in Central and Northern Europe. Due to efficiency technologies the energy consumption per capita has declined in the period 2002 to 2012. The structural differences between Eastern and Central Europe have not changed.

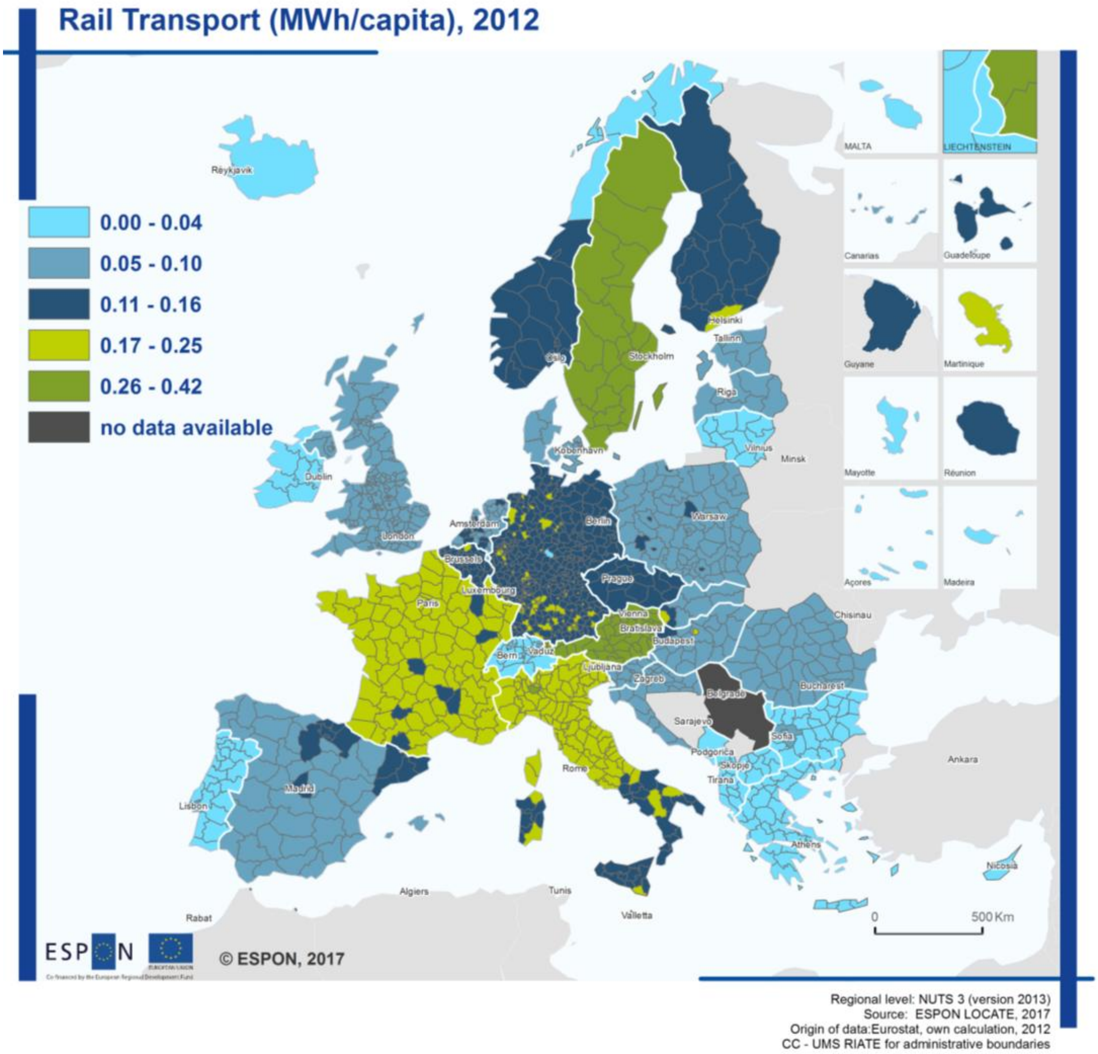
Map 1.6: The energy demand for road transport in 2012, MWh per capita



As for most countries, the modal share of rail is tremendously lower as the share of road transport, the *energy consumption of rail transport* per capita (Map 1.7) is only about one tenth of the road transport energy consumption.

A comparison of the results for the years 2002 and 2012 shows that also rail energy consumption has declined during the past decade. The main reason is the growing efficiency of passenger and freight trains. Compared to road transport energy consumption, there is no clear difference between Central and Eastern Europe especially Czech Republic and parts of Slovakia exhibit a similar energy consumption per capital as Central Europe.

Map 1.7: The energy demand for rail transport in 2012, MWh per capita



The results for *air transport energy consumption* are different compared to the other modes. Kerosene consumption is related to the aircraft movements at the airports. This leads to a selected number of NUTS 3 regions with relatively high energy consumption per capita whereas no energy consumption is accounted for in other regions. In general, the energy consumption of air transport has not declined in the same amount like the consumption of the other transport modes.

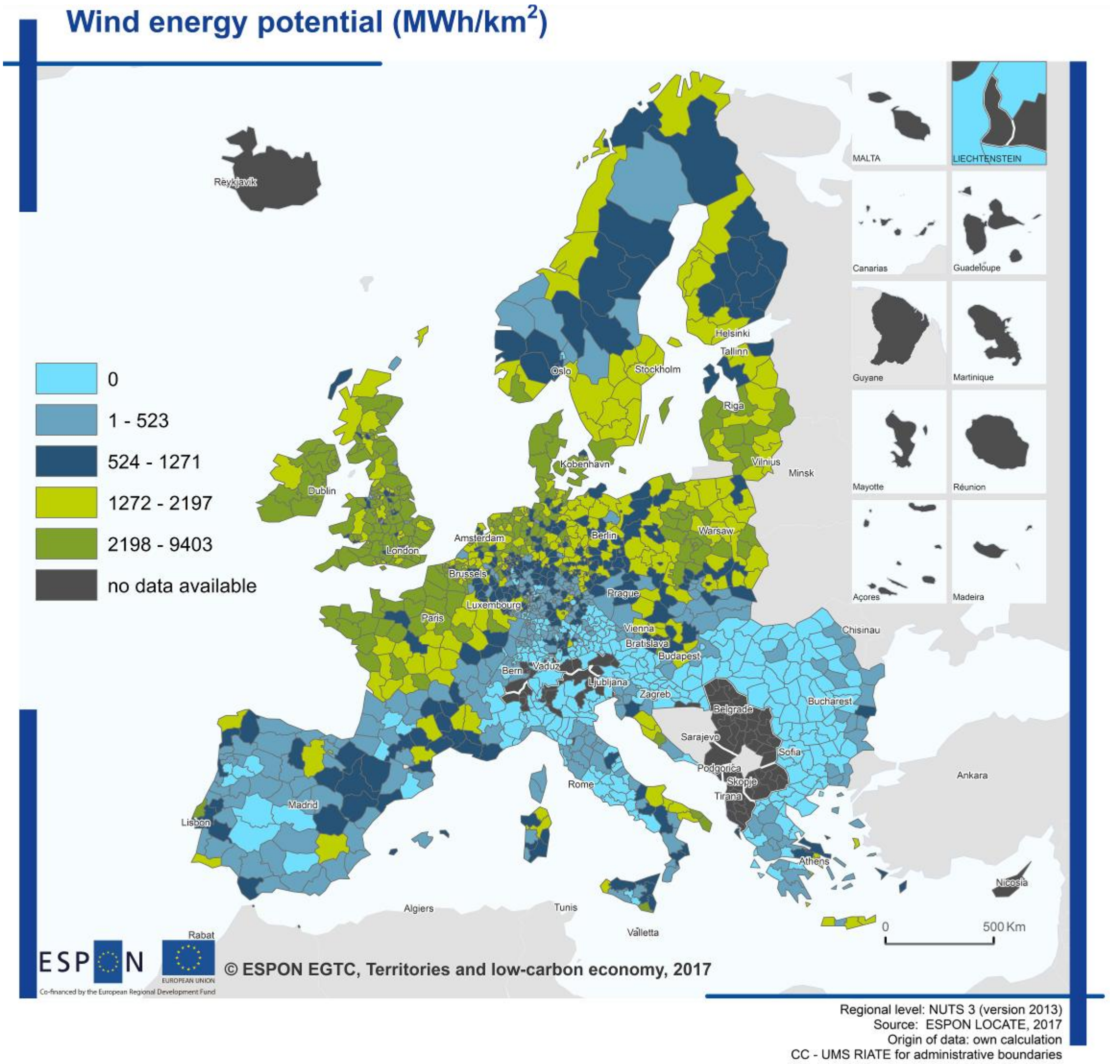
2 Task 2 – Identification of renewable energy potential and degree of exploitation

The objective of this task is the provision of an overview on the regional potential for generating and distributing renewable energy across Europe.

2.1 Wind power

The overview on supply potentials for the distinct renewable energy sources involves GIS-based analysis, combined with the application of the Enertile[3] electricity system model as well as desk research and processing of relevant data sources.

Map 2.1: Wind energy potential in MWh/km²

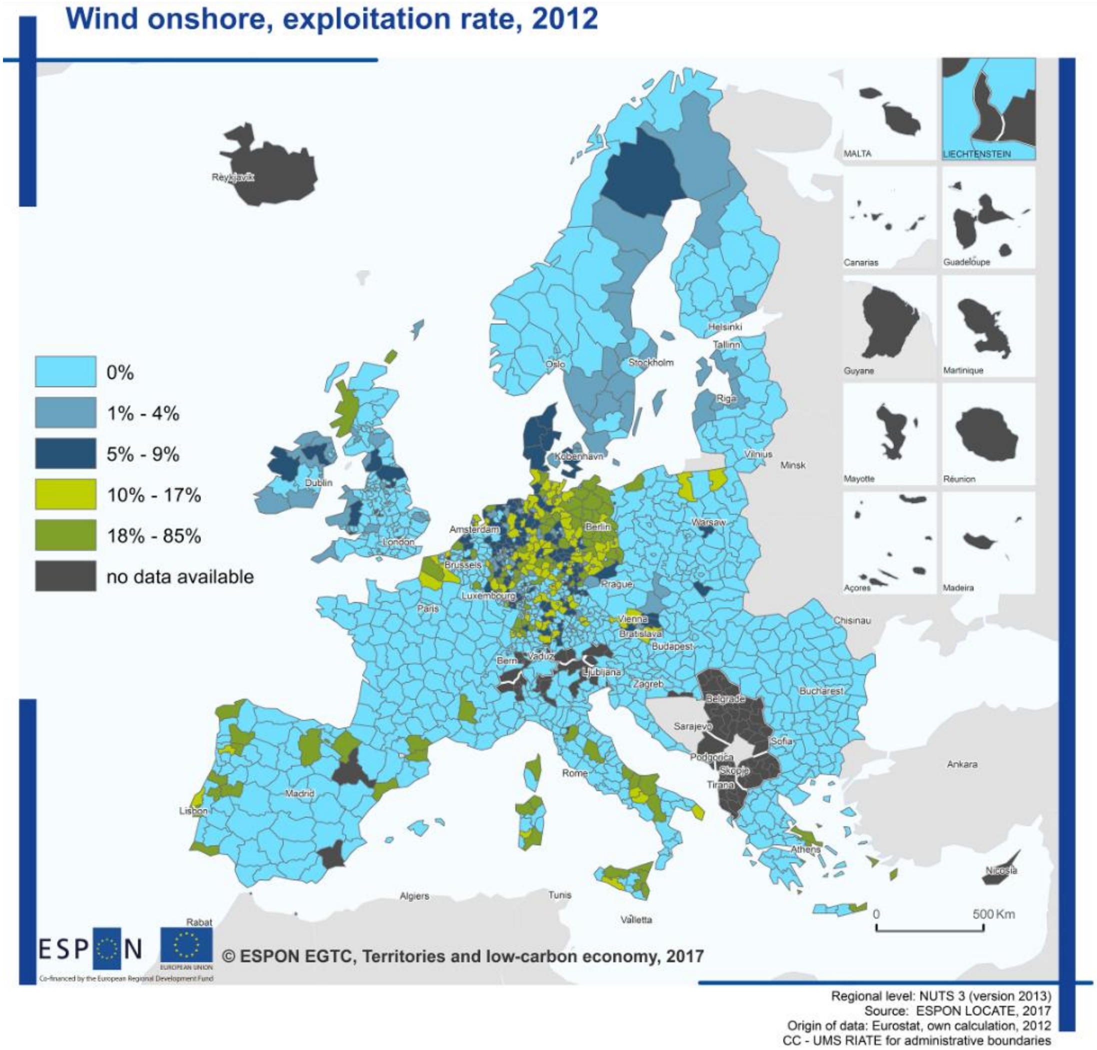


3 http://www.enertile.eu/

To achieve a reliable picture of detailed renewable energy potentials two complementary work steps are performed. The first step is the calculation of the land available for the deployment of renewable energy production. The second is the calculation of the renewable potential at the sites available determined by the prior work step. As a result, the technical and economic potential is derived. Map 2.1 shows the resulting wind power potential in Europe. The potential for wind energy depends strongly on average wind speeds and land availability for wind power installations. To account for economic restrictions, areas with low wind energy harvest (less than 1,800 full load hours are excluded from the potential).

The installed wind power capacity increased strongly between 2002 and 2012. The data on installed capacity is based on country specific data from Eurostat. The calculation of data for NUTS3 regions is based on a commercially available database for wind power installations[4].

Map 2.2 Wind exploitation rate 2012 in %



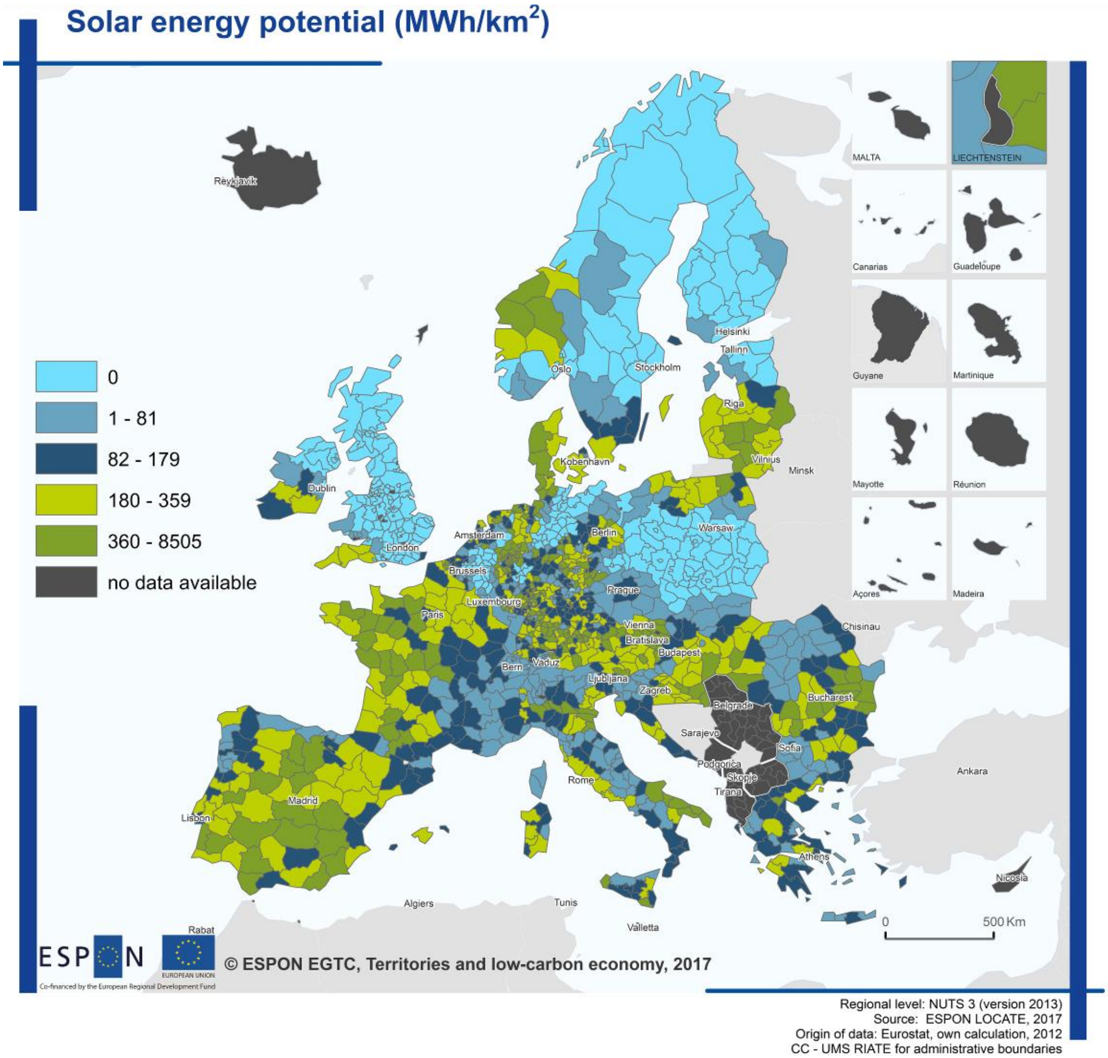
[4] The Wind Power Database. World wind farms database. (2017)

2.2 Solar

Solar energy developed even faster than wind energy between in the 2000s and 2010s. While in the beginning of the 2000s it was a mature technology, a strong decrease in investments followed the market take up in Europe, especially in Germany.

Map 2.3 shows the solar power potential in Europe on a regional level. To account for economic restrictions, areas with low solar energy harvest (less than 900 full load hours are excluded from the potential). Nevertheless, the potential is displayed in potential electricity harvest per area, and does not show the investment necessary to exploit the potential.

Map 2.3: Solar energy potential in MWh/km^2



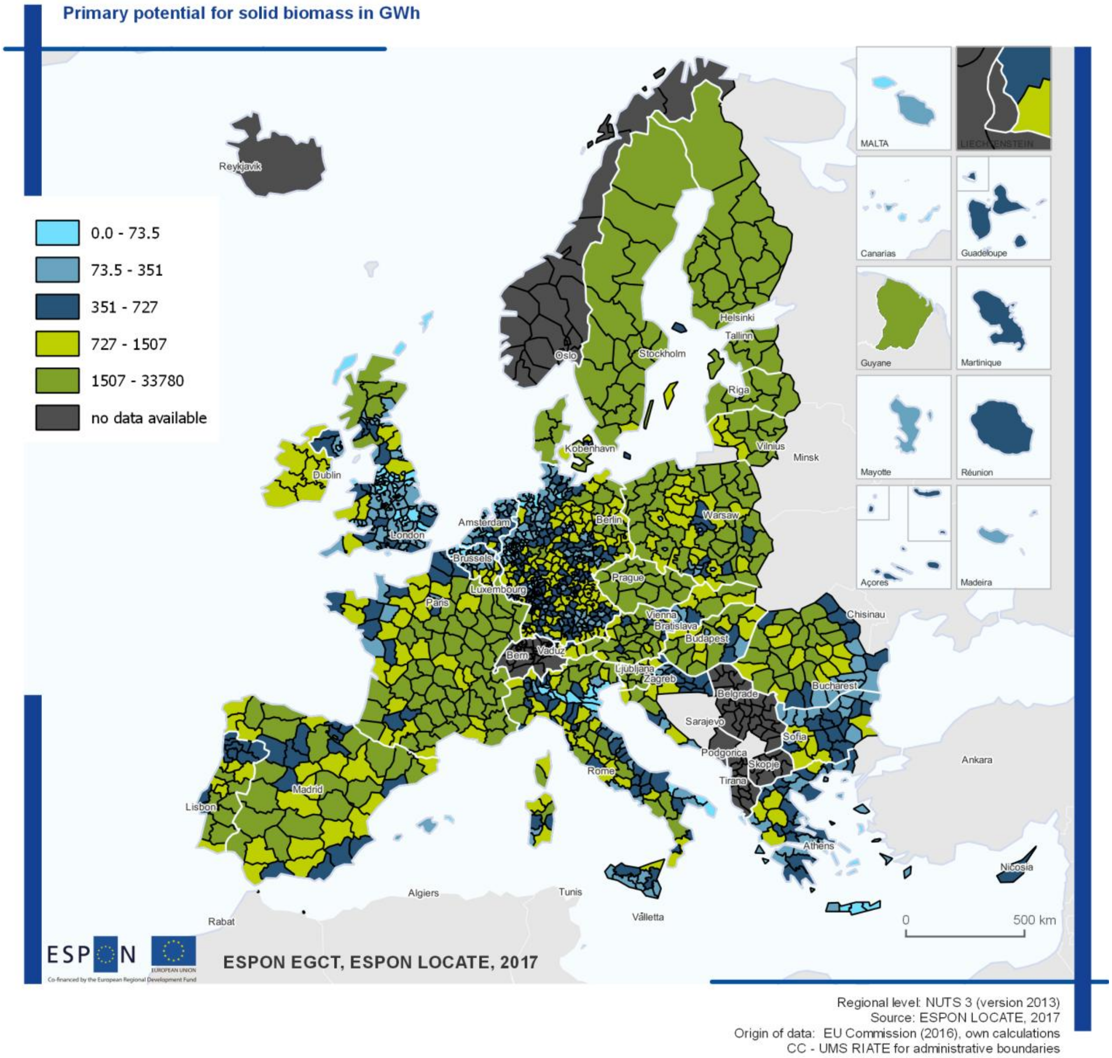
2.3 Biomass

This study makes use of the existing classification of biomass feedstock in the Green-X model of the TU Wien. It distinguishes three main types of biomass feedstock categories, consistent with the Biomass Energy Europe (BEE) project:

- Forest products and forests residues (see Map 2.4)
- Energy crops see (please see map in the annex)
- Organic wastes (please see map in the annex)

Map 2.4 shows the primary energy potential of solid biomass. Please refer to the long version of the report (Annex) for a depiction of energy crops and organic waste potential.

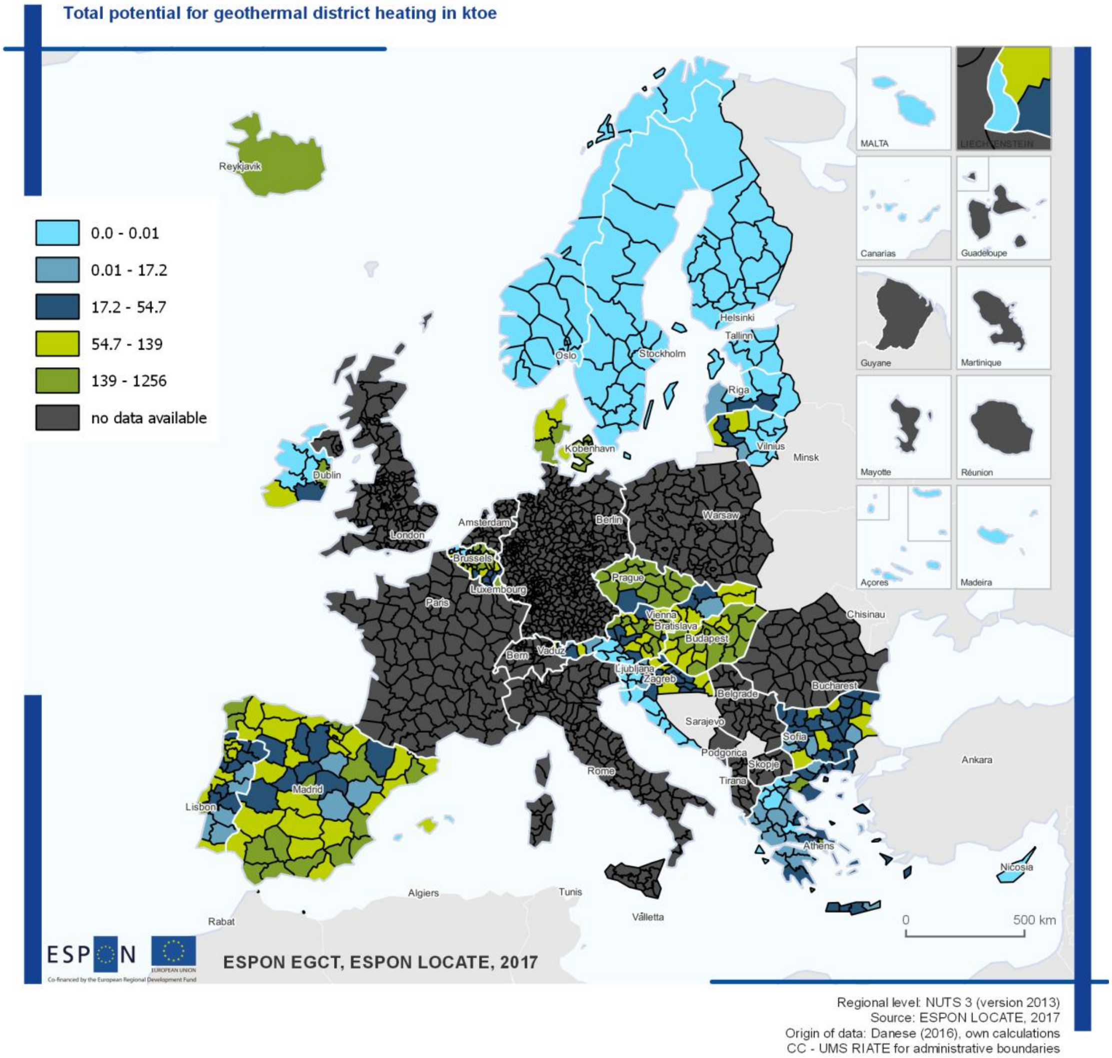
Map 2.4: Primary potential of solid biomass in GWh



2.4 Geothermal Energy

The potential of geothermal energy is assessed based on existing studies as geothermal energy potential depends very strongly on local conditions. In many cases, a temperature level of 60-100°C of geothermal sources is sufficient to supply district heating grids. However, even if there is potential in every European country, only a portion of its population live in areas that can be supplied by geothermal district heating.The existing literature about the potential for geothermal district heating in Europe covers selected European countries. Please note, that data for some countries is not included in Map 2.5 as of today. The regionalization of the geothermal potential data could not be finished at this point in time, but it will be included in the final report.

Map 2.5: Total potential of geothermal district heating in ktoe(thermal)

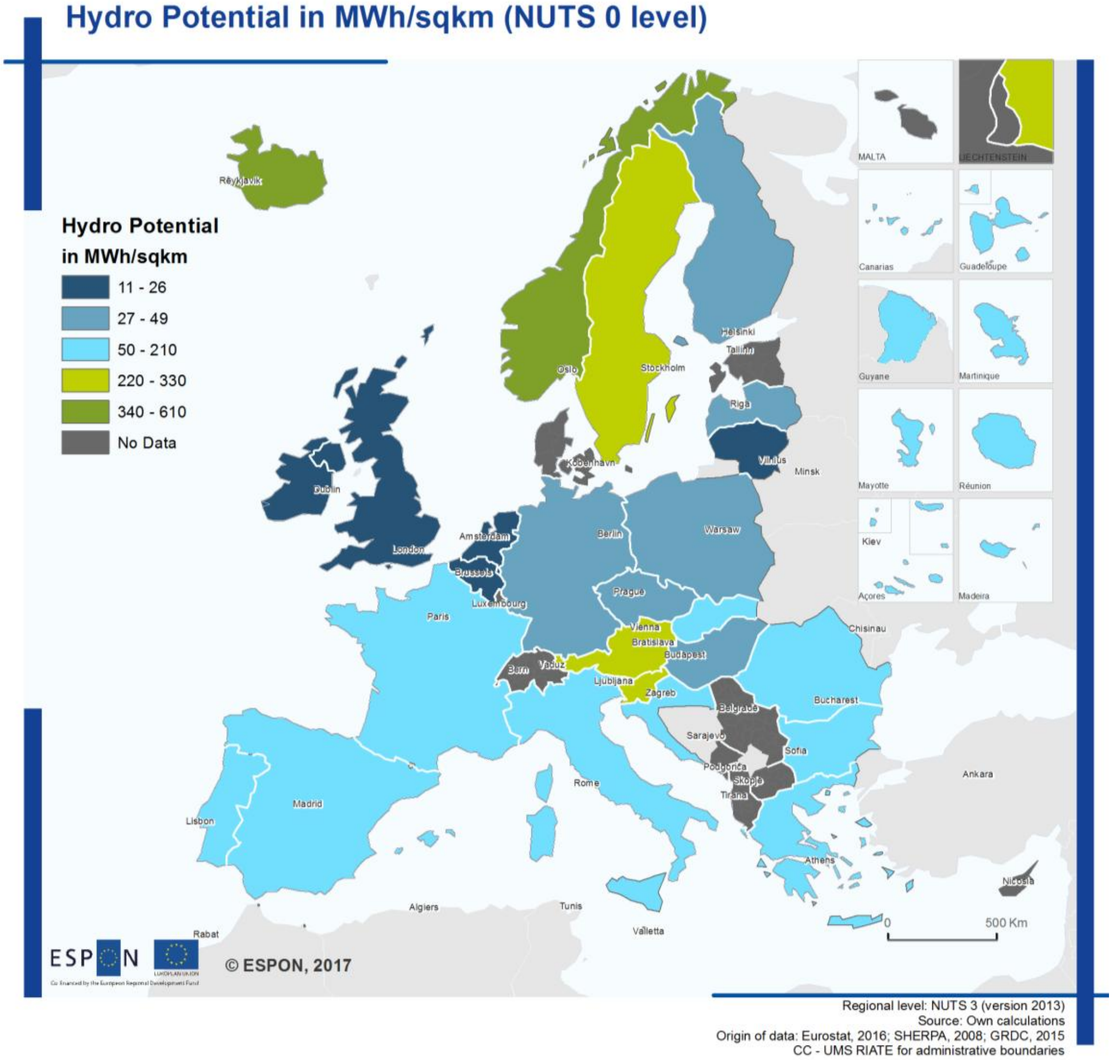


2.5 Hydropower

While large hydropower (>10 MW) is used in Europe to a high extent, the potential of small hydropower (<10 MW) remains untapped in various European regions.

Map 2.6 shows the overall technical hydro potential in Europe. The highest density of hydro power can be found in Norway, Sweden and Austria with above 220 MWh/year/km^2. The total generation potential is estimated to reach 819 TWh. The highest potential can be found in Norway 206 TWh and Sweden 127 TWh.

Map 2.6: Overall hydro technical potential (NUTS 0), MWh/km²

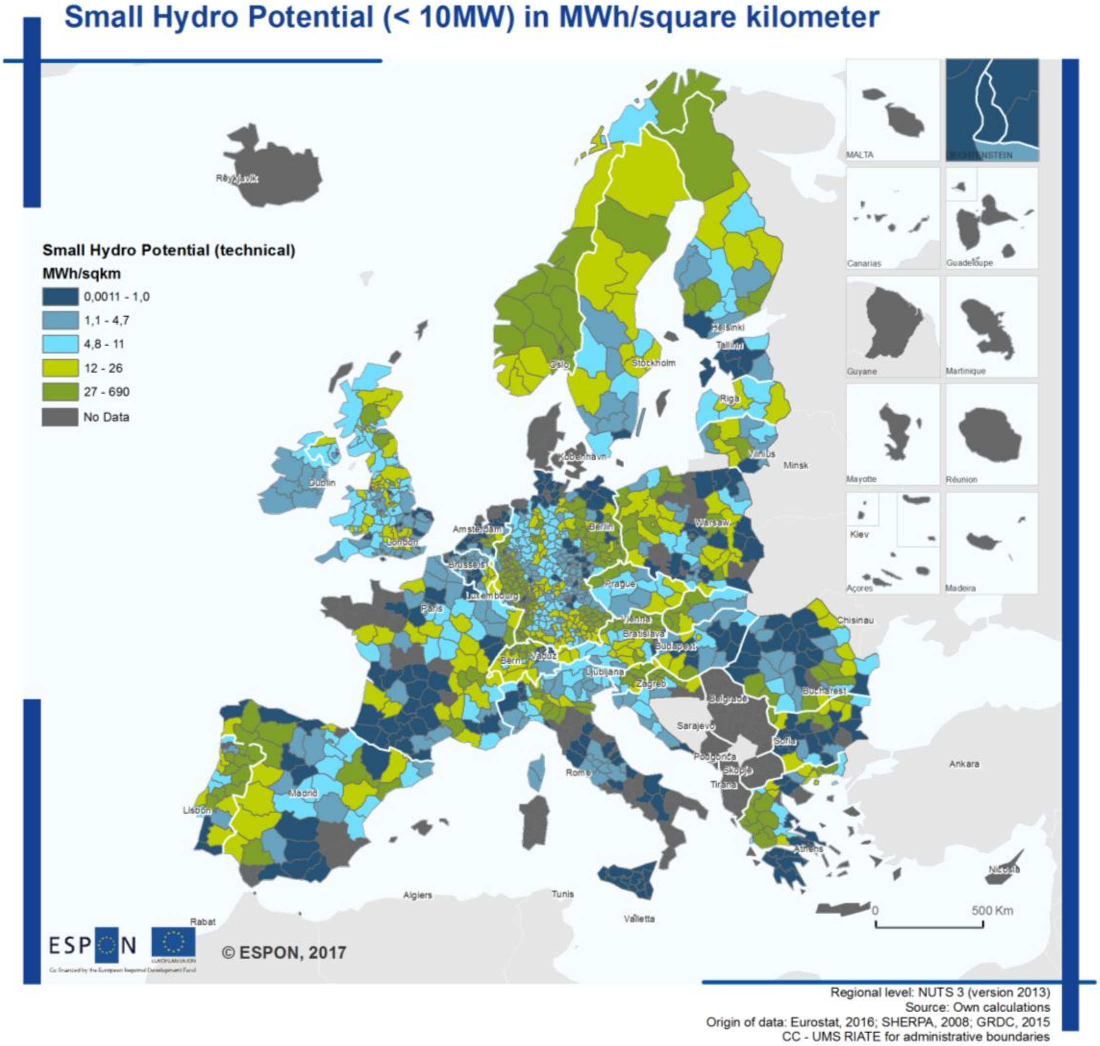


The hydro potential exploitation is already very high in several countries. In Germany it even reaches over 90% in 2002. Expoitation rates of 53 till 70% are reached in France, Italy, Austria, Norway, UK, Czech Republic and Slovakia. However, in some studies the small hydro potential is still considered to be widely untapped. The exploitation had not significantly changed by 2012. The capacity in the countries presented above has even increased from 113 GW in 2002 to 119 GW in 2012.

Small Hydro Power Potential

In the study, hydro power will be assessed using existing data and study results on Nuts 0 level in combination with our own methodology to distribute the potential on NUTS 3 levels. For the distribution of the potential, long-term mean monthly discharges of flow rate station have been used. Depending on the basins they are representing the overall potential is distributed on the different streams. The streams have been distinguished in large and small rivers/streams to distribute the small and large hydro potential accordingly. Using this approach, it is possible also to distinguish between small and large hydro. The following map shows the resulting technical potential, estimated to reach around 86 TWh/year.

Map 2.7: Small hydro technical potential (< 10 MW), MWh/km²



The small hydro potential varies between 1 and up to 690 MWh/year and km². The latter value is a peak value[5] in Austria. The average value[6] in all NUTS 3 areas is 19 MWh/year/km². Based on the technical potential the economic small hydro potential is derived. The overall economic potential sums up to 51 TWh/year and an average value of 10 MWh/year/km² per NUTS 3 area.

The mean exploitation rate of small hydro potential reached around 32% in 2002. With an overall generation of 48 TWh, considering the technical potential of 86 TWh, the small hydro potential remained untapped in 2002, reaching a value of nearly 55%. The highest exploitation rates can be observed in France and the basins related to the Alps. Relatively low exploitation rates can be found in middle and Eastern Europe as well as in Spain. Up to 2012 the exploitation increased especially in Germany and also other regions with an initially lower

[5] The data step is at 483 MWh MWh/year/km² in Norway (NO01)

[6] Standard Deviation 49,14 MWh/year/km²

potential exploitation, reaching an average rate of 36%. The total generation is summing up to 62 TWh, representing around 72% of the technical potential.

2.6 Tidal/Wave Energy

For tidal and wave energy potentials it is relatively difficult to be implemented and distributed on the NUTS 3 level. Therefore, only a rough estimation can be given within this report, as the focus is on the main technologies with the largest potential like wind, solar and hydropower.

The main tidal energy potential can be found in France and the UK. It is estimated to be 1 GW in France and 11.4 GW in UK[7]. However, the economic potential can hardly be estimated as most of the maritime technologies are not market-ready or are considered to be in the pre-market phase only. This is also shown by the low installed capacity. The amount of tidal energy capacity is only representing 0.002% of the total hydro power installed capacity of 15,005 MW. However, corresponding to the Platts database, 12 MW of tidal energy capacities had been deployed between 2003 and 2012. This indicates a recently more dynamic development.

The technical wave energy technical potential is estimated in Europe to be around 286 GW[8]. Several pilots are deployed in the last decade. In Europe the only significant installations existing are in the UK, with another single 2 MW installation in Portugal launched in 2008. In the UK a 3 MW installation has been deployed in Scotland.

Depending on local barriers and conditions, necessary measures to mobilise the exploitation of renewable energies will vary strongly. A detailed analysis of special conditions and barriers for small scale regions covering all NUTS3-regions in detail goes far beyond what appears feasible in this project. We will rather include a general representation of factors that appear beneficial to enhance an uptake of renewable energy potentials.

[7] http://atlantisresourcesltd.com/marine-power/global-resources.html

[8] Mork, G. et al. (2010): Assessing the global wave energy potential. In: OMAE2010 – 20473

3 Task 3 – Case studies on regions and cities shifting to a low-carbon economy

3.1 Context and method

Regions and cities can be important drivers of low-carbon development. Successful steering of development is depending on locational factors, regional economic conditions and structural factors. One of the major challenges is to combine governmental activities at national, regional and local levels in a coherent way. In addition, regions successfully stimulating private sector activities to complement their own efforts, are able to raise investment levels without necessarily enlarging public spending.

In order to provide with a large spectrum of information on regional low-carbon development in practice the case study work is based on two tiers of analysis: case study work on five selected regions and an additional meta-analysis of selected, thematically focused European initiatives and research projects providing with published case study results and regional experiences.

These two main sources of information will be evaluated in an integrated way, in order to make best use of available information. Task 3 is also closely linked to task 4 in terms of the identification of successful policy approaches and initiatives in the case study regions and task 5 concerning the relevance of cohesion policy.

3.2 State of affairs of case study work

3.2.1 Regional case study regions

As agreed in the kick-off meeting five regions from Austria, Bulgaria, Denmark, Spain and United Kingdom have been selected as case study regions. The regional case study reports (to date available as draft versions) provide interesting insights into these five regions in terms of their relevant background and governance systems, as well as energy strategies and implementation of low carbon development. Some of these findings are presented below (an in-depth analysis and comparative discussion including recommendations may be expected for the draft final report).

The specific type of the region is an important and settlement structures are important aspect for regional development, not only the question of urban versus rural areas, but also concerning the respective settlement structure within the region. Major differences can be stated even inbetween regions of rural type (e.g. Pazardzhik with several small cities and Burgos showing an extremely dispersed settlement structure). Also the urban type regions in that sample differ with Greater Copenhagen and Greater Manchester as urban regions with a number of larger cities within the metropolitan area on one side and the polycentric region of Rheintal with small cities and rural hinterland on the other side.

These differences are decisive for the energy use of a region e.g. concerning energy use for transport (options for public transport versus private traffic) or energy infrastructure, heat densities and efficient use of district heating networks. A first comparison presents the differences in terms final energy consumption per capita and concerning the share of renewable energy used actually as well as the most important renewable energy sources used in the regions.

Table 3.1: Regional case study regions, regional characteristics and energy use 2014/2015

Region	population 2015	area (km^2)	final energy consumption/ capita	RES share (%)	Main RES sources in use
Austria, Rheintal	289,734	727	24 MWh Rheintal 29 MWh Vorarlberg	31% Rheintal 40% Vorarlb.	hydro power (60%), wood/biomass (19%), biofuels 7%, renewable district heat (7%) Vorarlberg (NUTS 2)
Bulgaria, Pazardjik	266,549	4,332	14 MWh	5.5%	hydro power (49%), biomass and waste (34%), solar (9%), geothermal energy (8%)
Denmark, Greater Copenhagen	1,768,125	2,559	n/a	17.5%	waste (69%), wood/biomass (17%), wind (7%)
Spain, Burgos	362,913	14,291	34 MWh	n/a	wind energy (>90%)
UK, Greater Manchester	2,745,985	1,276	18 MWh	0.4%	wind

Source: Case study reports

Besides a number of others, these facts form important preconditions for future strategies and for the setting of priorities by regional stakeholders for future measures and activities in the regions.

3.2.2 Regional case study meta-analysis

The research started with an in-depth desk research and screening of actual homepages and internet sources on programs, initiatives and projects dealing with regional low carbon development and offering detailed information on selected regions by providing comprising regionnal case studies[9].

The search for case study reports providing with detailed information on specific regions has generated an information resource of more than 40 relevant regional reports from five sources: ESPON GREECO – Territorial Potentials for a Greener Economy (2014), CEP-REC – Regional Energy Concepts (2014), EU2020 going LOCAL (2012), MANERGY (2012) and Regions4GreenGrowth(2012/2013).

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[9] Screened sources: EU and European Commission initiatives and programs: EU Parliament ThinkTank, Europe2020 Monitoring Plattform, ManageEnergy, IEE projects database, DG Regio Policy Learning Database, EEA database, Smart Cities Info, Initiatives from various relevant stakeholders and NGOs: Covenant of Mayors (CoM) for Climate & Energy, FEDARENE, Climate Alliance, Under2MOU, homepages from research projects and project partnerships dealing with regional/local low carbon development: COOPENERGY, Region202020, 100% RES Communities, go100percent, smilegov, GREECO, ESPON CLIMATE, ESPON 2.1.4., ESPON Energy ReRisk, SPECIAL, Co-Power, EnercitEE and KEEP database, for identifying relevant projects from Interreg, Interreg IPA cross-border and ENPI/ENI cross-border cooperation programmes (www.keep.eu).

In order to extend the geographical coverage of findings, in addition, we analysed European research on regional low carbon development also from similar projects without providing with comprehensive regional case studies (in written reports), including: LoCaRe – Low Carbon Economy Regions (2013), ENERGY REGION (2014), ANSWER – A North Sea Way to Energy-Efficient Regions (2012), VISNOVA – Clean energy from rural regions (2014), GreenPartnerships – Local Partnerships for Greener Cities and Regions (2015), North SeaSEP – North Sea Sustainable Energy Planning (2013), recharge.green – Reconciling Renewable Energy Production and Nature in the Alps (2015), Coopenergy (2016). These conclusions and recommendations on the implementation at regional level will be taken into consideration together with findings from comprehensive regional case study work. By using these sources nearly full coverage of European countries' experiences will be achieved[10].

The reports are currently being analysed and interpreted concerning their findings for low carbon development in specific European regions which are relevant for the project at hand. However, the analysis of available case study reports shows that the main emphasis of reports differs considerably. Even if the topic in general is similar, different priorities in terms of themes and depth elaboration have to be taken into consideration. When reflecting on recommendations and lessons learned, the project team will have to bear in mind the specific background and aim of each of these projects. Furthermore, available regional case study reports mostly put the focus on future chances of regions often by elaborating scenarios of possible future development including recommendations. Only few reports focus on the collection of data about the recent development and provide with (written) explanations or interpretations of the past development within the region. Nevertheless, a number of reports also provides with very valuable information on experiences from the past.

The following table presents an overview on these findings. It shows the share of available regional case study reports providing with relevant information concerning important aspects of regional low carbon development and its background compared to the given content for the five case studies elaborated during the ESPON project at hand.

[10] The collected portfolio of available up to date European/international research projects providing with experiences from regional low carbon development does not cover experiences from Finland, Lithuania, Iceland and Liechtenstein.

Table 3.2: Meta-analysis: Overview on the share of available regional case study reports providing comparable information

% of reports providing with relevant information	CEP-REC	EU2020 gLOCAL	MAN-ERGY	R4GG	ESPON GREECO	All reports
General description of the region	80	23	55	48	67	52
Energy strategy, energy consumption and RES	80	48	85	49	56	60
Governance and regional policies	33	38	31	50	39	40
National and EU policy, complementarity	44	25	13	46	17	33
The role of cohesion policy for regional development	11	13	0	46	22	23
Good practices and successful approaches	0	0	0	15	0	5

Overall, regional case study reports from projects CEP-REC, MANERGY and R4GG – Regions for Green Growth seem especially promising for comparison and input for the resarch at hand, but we expect all reports to provide with some valueable aspects on the different regions. This will be the work of the coming in-depth screening of all reports in order to process and filter this information in such a way that makes it useful for introducing experiences from other regions.

3.3 First findings from draft regional case studies and meta-analysis

3.3.1 Availability and comparability of energy data for regions

As discussed widely as a challenge already for the issue of sustainable urban development and smart cities, recent and complete energy data is even more difficult to obtain at the regional level. From the first analysis of regional case study reports, we state:

- poor availability of regional energy data in general: energy data at sub-regional level is most difficult to obtain, even if local energy experts are involved. Information on energy consumption and renewable energy production often is based mainly on national data, sometimes also spatially more disaggregated data at the level of provinces is available, but often there is only scarcely data available for regions and smaller entities. As exemptions, in the UK, official statistical energy data is available for electricity and gas sales, total final energy consumption at local level all over the country[11] and the autonomous region of Castilla y Leon (EREN) publishes yearly energy reports containing detailed information and data on its provinces (including Burgos)[12].
- lack of continuous data on past development: data describing the development of a region in terms of energy consumption and production is another challenge even for selec-

[11] UK Government BEIS, EnergyEfficiency.Stats@beis.gov.uk,online at: https://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics-2005-to-2011, https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level-2005-to-2010

[12] EREN Ente Público Regional de la Energía de Castilla y León, statistical information available under: http://www.energia.jcyl.es/web/jcyl/Energia/es/Plantilla66y33/1261039021854/_/_/_

ted regions and difficult to obtain as information on regional energy demand and production often is based on surveys, data collection and field research for the most recent point in time (often no time series).
- lack of comparability of regional energy data between regions: even if quantitative information is given by reports and studies, this is mostly compiled from different sources and elaborated by breaking down data for larger regions or by extrapolating information from local level (e.g. selected municipalities collecting data). As available datasets in general differ at all levels between countries/regions and there is no general common convention about collection and publication of such data (e.g. energy consumption with/without transport or with/without industrial demand underlying ETS), quantitative comparisons between regions based on benchmarks (derived from different sources) are very difficult and widely arguable even for few key indicators.

3.3.2 Regional governance

Certainly, the respective situation of regional governance is decisive for the way regions are able to steer their common development – also in terms of energy. From the draft versions of our five case study reports and a first look through the available sample of regional case study reports, we may state that only few regions dispose of formal competences and common structures for at (sub)regional level. As Greater Manchester with its city-region as statutory metropolitan government is one of those regions, we will have the opportunity to learn about experiences in such governance structures in detail.

In most regions putting together municipal competences forms the basis of regional development activities. In these cases,

- either municipalities use their room for action and their competences together in order to cooperate and trigger a common development (in the case that added value is expected), this might be due to a tradition of (informal) cooperation between municipalities dealing with various issues (not only energy), which may be additionally supported by an energy department or energy agency from the government from the same regional level or a higher level;
- or regional energy development is triggered and supported by coordination and consultancy from a regional energy agency, engaging in a region in order to enhance municipal (and regional) measures for low carbon development.

Due to the different types of regions and varying situations of regional governance also the challenges for implementation differ between the regions. The following selected experiences from the implementation in our five case regions provide with an idea on the diversity of both, the understanding of the role of the regional level and the challenges for regional low carbon development:

- As in many rural regions, the example of Pazardzhik shows that smaller local adminisrations lack of administrative capacity needed for fulfilment the activities concerning energy efficiency demands, application of RES and energy planning. In order to support these activities, the regional energy agency (REAP) is an essential partner for working with municipal authorities and implementation of low carbon development.
- In the region of Greater Copenhagen, the implementation of renewable energy technologies is understood as a joint responsibility between several actors, in which municipali-

ties have a vital role in planning and coordinating these activities. In order to address different climate-related challenges, the region serves as a facilitator and “platform” by bringing together professionals and users.

- The ability for implementation of low-carbon development in Greater Manchester is based on the new style of local government by the definition of a statutory city-region, allowing strategic working across administrative boundaries and organisations. This regional government has officially published the GM Low Carbon Implementation Plan 2016-2020 which will hopefully give evidence to the claim “With more local control comes the enhanced ability to deliver” (GM Low Carbon Implementation Plan).
- The strong focus of Greater Manchester to address climate change and economic growth ambitions together also lead to a firm involvement of the private sector in regional governance through the Business Leadership Council and the Local Enterprise Partnership. These regional stakeholders advise the regional authority and provide a forum to have a single conversation with business leaders.
- In general, regional energy agencies play an important role within the low-carbon governance systems in many regions. They are supporting implementation and elaboration of strategies, providing with personal resources, contributing comprehensive knowledge and know-how and promoting the use of national or European funds.

3.3.3 Energy strategies, quantitative targets and monitoring at regional level

Due to different regional governance systems, regional energy strategies are elaborated and laid down by different actors and stakeholders with varying competences and powers. Together with national laws (and the way EU directives are implemented nationally) this governance background has a major impact on the way regional energy strategies are being formulated, their contents and definition of priorities, their time perspective (short-term action plans to long-term strategies), and on the decision of regional stakeholders whether to define (binding) quantitative targets and according monitoring activities or not.

Even though the importance of quantitative targets as an impulse for implementation and for keeping up activities is stated manifold, a lot of regions seem to hesitate from defining such measurable target figures. Quantitative regional targets and monitoring are (more often) laid down at the (sub)regional level mainly in following cases:

(1) In some countries it is mandatory for the regional level to strive for quantitative energy targets by law. This is e.g. the case in Bulgaria where regional energy strategies are mandatory (e.g. Pazhardzhik) or in Italy where the state has passed national targets on renewable heat and electricity targets on to regions which are now obligated to contribute by a binding regional targets (e.g. Friuli, according to CEP-REC);
(2) Some countries partly passed national obligations also to the local level. As e.g. in Slovenia the elaboration of local energy concepts aligned with national targets are mandatory but without top-down target setting per municipality/region (Savinjska, according to CEP-REC).
(3) Without such an obligation for regional/local targets, quantitative target setting is rather to be expected in the case of formal regional governance structures with competences and power for implementation at the regional level (e.g. Greater Manchester).

In contrast, municipalities/local authorities forming the regional governance system by cooperation, cooperative projects and initiatives usually hesitate to lay down binding quantitative targets due to a lack of regional power of implementation. This often leads to reluctance/prudence concerning the setting of quantitative measurable targets and their monitoring as single municipalities will not have opportunities to steer the development of the region. Accordingly, a lot of regions presented in case study reports, did not lay down quantitative, measureable targets for future development which are (officially agreed and published by the region).

3.4 Next steps for case study work

The regional case study authors are expected to conduct the regional case studies between October 2016 and April 2017. Meanwhile draft version of all case study reports have been delivered as an input for the interim report at hand. After a feedback on these drafts (end of February), authors will revise their drafts and prepare for exchange of regional expert knowledge and case study findings during a common workshop on conclusions from regional case studies and regional policies with involved partners and subcontractors (29/03/2017). This workshop will also allow for discussing potential requests from the interim meeting, posing cross-cutting questions and refining the final outcomes of regional case studies as well as of reports from tasks 3 to 5.

In a next step, the meta-analysis of available additional case study reports and relevant literature will further deepen the focus on lessons learned or recommendations relating to successful implementation of low carbon development. By deepening the analysis of most relevant regional case studies and making use of lessons learned of those research teams in a structured way we will be able to add valuable information to the findings from our five case study reports elaborated in the course of the project at hand.

4 Task 4 – Regional policy approaches and actions that facilitate the transition to a low-carbon economy

4.1 Work approach

This task aims to provide an overview and categorisation of policies and planning instruments as well as initiatives of regions and cities at different territorial and administrative levels across the ESPON space. These *Policies and Measures ("PaMs")* have been set up to support the transition to a low-carbon economy. It will also distinguish between different types of regional/city governance since different policy approaches and/or instruments have different effects depending on the type of region and the geographical context they are applied in. The study will also look at possibilities for private sector and civil society involvement in and contribution to regional/local low-carbon investments.

4.2 Stage 1: Literature Review and analyses of national PaMs

History of PaMs

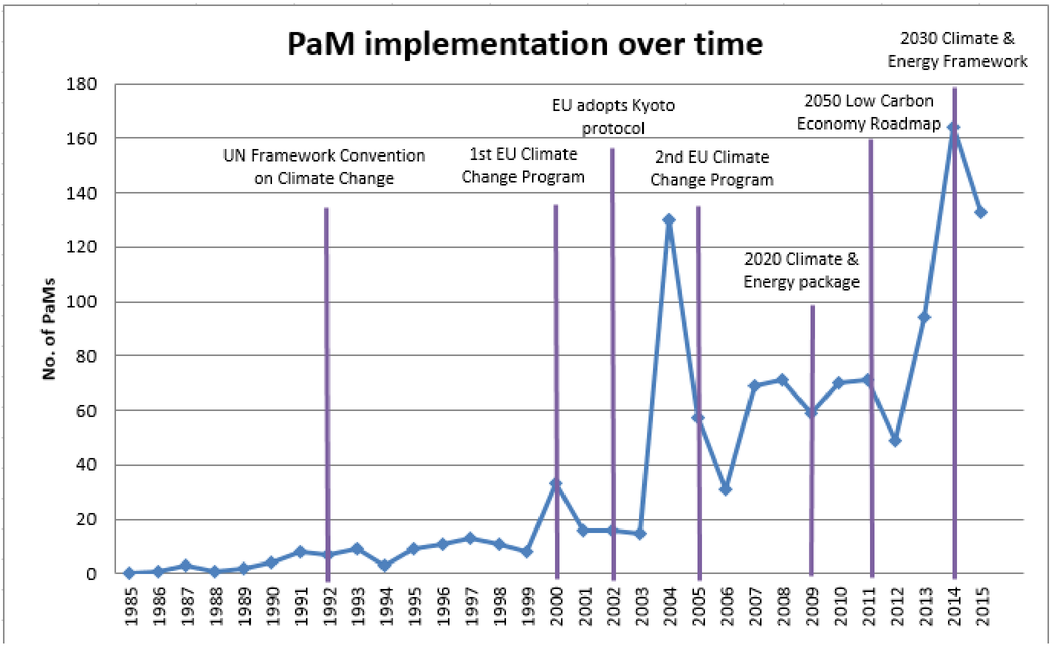
Following the EU ratification of the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, the EU member states have provided information on the types of PaMs that they have planned, adopted, and implemented to move towards a low carbon economy and hence climate change mitigation. The collection national data was formalised under the EU Monitoring Mechanism Regulation (MMR) in 2014 and the first set of data collected under MMR was published in 2015. The analyses in this report are based on the latest data (2016) which although not published at the time of writing, has been made available to the research team by the EEA.

Figure 4.1 shows how the number of implemented PaMs has fluctuated over time with two peaks in 2004 and 2014. Whilst it is difficult to speak of a direct cause and effect relation, the fluctuation might be due to policy initiatives.

The period between 1985 and 1999 shows a very low level of PaM implementation averaging only 9.4 p.a., reflecting the relatively low profile of climate change in the international policy arena. The first significant increase in PaM implementation coincided with the first EU Climate Change Program and the negotiations surrounding the adoption of the Kyoto Protocol in 2000. The EU formally ratified the Kyoto Protocol in 2002 arguably leading to the first peak in PaM implementation in 2004. The 2014 peak could be due to the significant enlargement of the EU and hence the addition of the new member states' PaMs to the overall PaM implementation numbers.

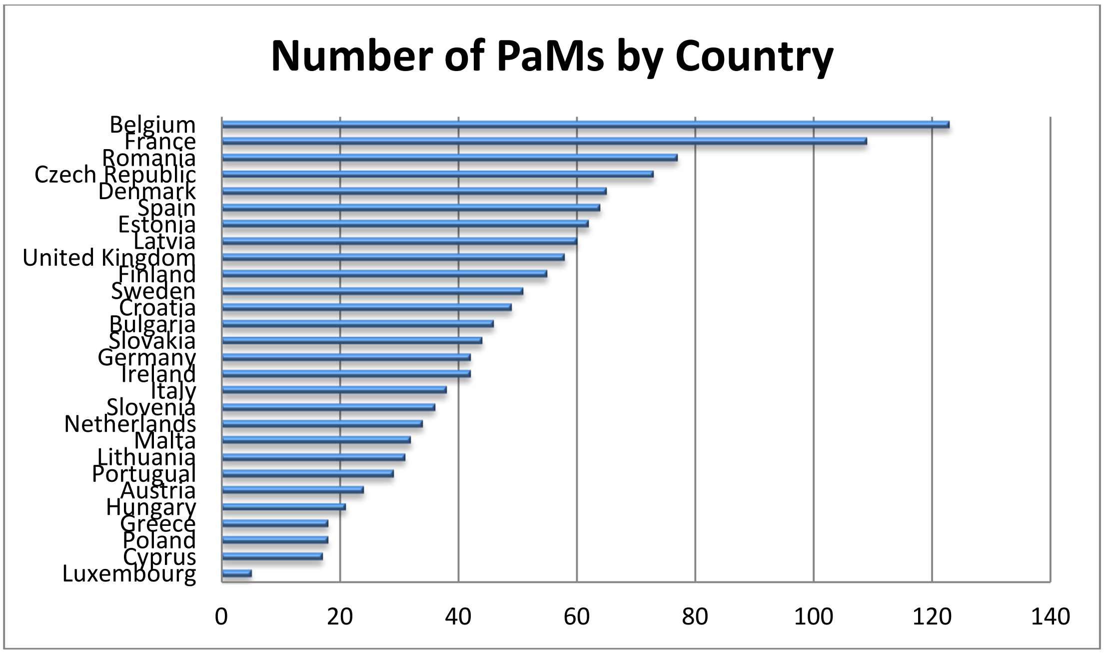
The period between 2005 and 2016 shows a much higher level of PaM implementation with an annual average of 83.2. Even accounting for the inclusion of 10 new members and their PaMs, this shows a step change in activity since 2004. Climate change and the growing awareness of its potential impacts have almost certainly provided the necessary spur for national governments to change their attitude to the implementation of PaMs. This analysis shows the importance of international and EU initiatives in driving the climate change agenda. Within the EU there has been a clear mechanism, through the EU Directives and Climate Change Programs to transmit this urgency down to the national level.

Figure 4.1: PaM implemention over time



Source: Author based data provided by EEA

Figure 4.2: Number of PaMs by Country



Source: Author based data provided by EEA

Overview of PaMs

By 2016, there was a reported total of 1,323 individual PaMs across the 28 member states. As Figure 4.2 shows, there is a significant range between the lowest, Luxembourg which has introduced only 5 PaMs, and the highest, Belgium which has introduced the highest number of single PaMs at 123, followed by France and Romania. While the size of country seems to be a factor, there remain exceptions. For example, two large countries, Greece and Poland have introduced only 36 PaMs and are the 3rd & 4th from bottom on the list in this regard.

Types of instruments used for implementation of PaMs

The IPCC Report on Climate Mitigation has since 2007 provided a classification of policy instruments and measures that are used to enable transition to low carbon economy. This includes: economic instruments, regulatory approaches, information programmes, government provision of public goods, and voluntary agreements. While in principle these policy instruments are capable of dealing with the entire low carbon economy, in practice they are often targeted to particular sectors or industries. Drawing on this classification, the PaMs report use 8 types of policy instruments (EEA: 2015: 25).

Overall, Economic and regulatory instruments are the most often used form of instrument accounting for 61% of all PaMs. Research and other category least frequently used. Economic and regulatory instruments, are also dominant across most Member States (21 member states use them in over 50% of cases).

A small minority of countries seem to favour a particular type of instrument. The most extreme case is Luxembourg, which is more skewed towards informal PaMs. On the other hand, Bulgaria has very few informal PaMs and favours financial and regulatory PaMs. In Spain, planning is dominant as a policy instrument (EEA, 2015). However, many policies in Spain appear to be installed by the central government but then need further implementation by regional or local authorities. These policies have been characterised as planning instruments. It should be noted that in countries such as Sweden where planning regulates the waste sector, building and infrastructure, the PaMs are classed as “regulatory”.

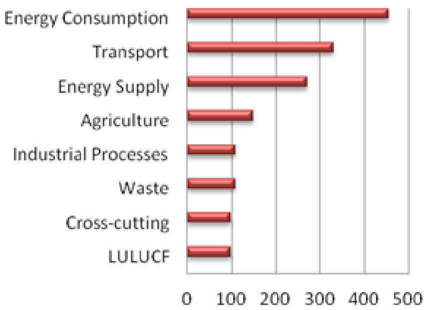
Sectors targeted by PaMs

There are seven economic sectors that are targeted by PaMs: energy consumption; transport; energy supply; agriculture; waste; land use, land use change and forestry (LULUCF); and industrial processes. It is possible that a PaM targets more than one sector so each PaM can have more than one sector associated with it. It is also possible for a member state to report a PaM that targets more than one sector as being cross-cutting.

The vast majority of PaMs (2/3 of all) target: energy consumption (26%), transport (23%) and energy supply (10%) sectors. These three sectors are the most important sources of carbon emission in Europe. Sectors that are least targeted by PaMs are LULUCF (5%), waste (7%), agriculture (9%) and industrial processes (5%). These sectors make a relatively smaller contribution to total carbon emissions. Most PaMs aim to improve the energy efficiency of buildings (18%) and increase the share of renewable energy (11%). Figure 4.3 gives the overall distribution of sectors targeted by PaMs.

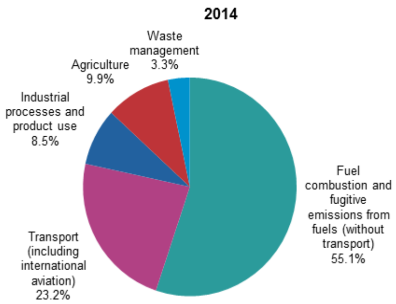
Figure 4.4 shows key sectors that produce greenhouse gases in 2014, with Transport, Fuel Combustion and fugitive emissions from Fuel accounting for 78.3% of all GHG emissions. There is therefore a logical relationship between the number of PaMs targeted at a particular sector and that sector's contribution to total GHG emissions.

Figure 4.3: Distribution of PaMs by Sector



Souce: Author based data provided by EEA

Figure 4.4: Greenhouse gas emissions, by source sector, EU-28[13]



Source: http://ec.europa.eu/eurostat/statistics-explained

However, the overall distribution of sectors targeted by PaMs masked some significant differences between the individual countries and the sectors they target. Most countries have a similar pattern to the overall pattern of all member states, with the main sectors targeted being Energy Consumption, Transport and Energy Supply. There are however a number of countries which target different sectors, for example Estonia has a significant proportion of PaMs targeting the LULUCF sector. These differences perhaps reflect the specific physical situation of a country which means it makes more sense to target a particular sector which is an important contributor to GHG emissions.

4.3 Stage 2: Development of regional typologies

The degree to which member states delegate powers to regional authorities differs significantly across the 28 countries within the ESPON area. It also in a constant state of flux, with authority being granted or taken away from sub-national institutions in parallel to the creation and abolition of regional governance institutions.

As was shown in the previous section, it is clear many national and supra-national policy initiatives are promulgated down through the various governance levels as they are being implemented. It therefore follows that a key factor in the success, or otherwise of the policy initiative is the effectiveness of the governance institutions that are responsible for its implementation. In this section we seek to examine the nature and structure of the governance institu-

[13] Source http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Greenhouse_gas_emissions,_analysis_by_source_sector,_EU-28,_1990_and_2014_(percentage_of_total)_new.png

tions and processes adopted by countries within the ESPON area. The aim of the analysis is to differentiate the regions within the countries by the degree to which those regions have autonomy. In the first section the nature of the differentiation of territorial governance is investigated. The section then proceeds to introduce the Regional Authority Index (RAI) which will be used in the study to categorise the degree of regional autonomy within each of the countries within the ESPON area.

Regional tiers and differentiated regions are evaluated on the same scale. We evaluate five dimensions of self-rule: institutional depth, policy scope, fiscal autonomy, borrowing autonomy, and representation. We evaluate five dimensions of shared rule: law making, executive control, fiscal control, borrowing control, and constitutional reform.

The Regional Authority Index (RAI)

It is a difficult task to produce a quantitative measurement of something that is inherently subjective and contingent on a number of socio-economic factors. The team behind the Regional Authority Index has attempted to do this in an open and transparent way. Not only is their underlying data available for analysis, but they have also produced a comprehensive discussion on the rational of their method, the ontology and epistemology behind its construction. For the purposes of this project tit therefore offers an important framework for the reliable differentiation of regions within the ESPON Space. In the next section we will set out the terminology used in the RAI and the definitions of the relevant terminology. The section then proceeds to provide an overview and analysis of the regions within the ESPON space and their relative autonomy.

What is a region?

This is not always a straight forward question to answer. In federal states such as Germany this is a relatively easy question to answer with the Länder being the regional tier of government. In many countries there is no recognised regional tier of government or at the opposite end of the scale more than on tier of sub-regional government. The RAI draws the boundary for regional government at an average population level of 150,000. Below this population level it is assumed government is local. There are some exceptions to this rule mainly in relation to autonomous islands such as Åland or Gran Canaria.

Next steps in Stage 2

The *next step* of the process is to collate a regional green economy typology using the outputs from Task 1. This will allow Table 4.1 below to be fully populated and provide 9 regional clusters according to the two factors: regional Performance and regional Governance. From the matrix of 9 regional clusters, we will select 3 clusters (as highlighted in Table 4.1) for further in-depth study. These three clusters represent the most interesting extremes of the matrix. Cluster 1 and cluster 7 compare regions with high performance on the transition to the low-carbon economy but different levels of regional governance authority. Cluster 1 and Cluster 3 show the reverse, as both clusters have high levels of regional governance authority but different performance on the transition to a low-carbon economy.

Table 4.1: Methodology for the selection of regional clusters

Reg Performance (from Task 1) / Reg. Governance (RAI)	High performance	Medium performance	Low performance
High authority	Cluster 1 regions	Cluster 2 regions	Cluster 3 regions
Medium authority	Cluster 4 regions	Cluster 5 regions	Cluster 6 regions
Low authority	Cluster 7 regions	Cluster 8 regions	Cluster 9 regions

Findings from Stages 2 & 3

From the data analysis of the PaMs and the review of the Regional Authority Index there is a clear link between international initiatives, EU policy and national policy on climate change. What is not as clear is the extent regions are able to shape and deliver policies to move to a low carbon economy. Evidence in relation to PaMs highlight the dominance of national government in implementing PaMs. The analysis has shown some differentiation in the approaches taken by individual countries in relation to the type of instruments used and the sectors targeted. What is not clear from this data is the extent to which the regions are able to adapt the national policies to their particular circumstances. The analysis of the RAI has shown the diversity in regional governance across the ESPON Space. The degree of control over fiscal, regulatory and informal policies and measures varies greatly. The next stage of this work package will seek to understand how this variation in regional governance influences the ability for regions to transition to a low carbon economy and translate national PaMs to practical steps to transition to a low carbon economy.

4.4 Outlook on Stages 3 and 4

Outlook on Stage 3: Selection of illustrative examples

After the selection of 3 clusters in Stage 2, we will use the outcome of PaM analysis in Stage 1 to select 9 illustrative examples. This will consist of 3 examples: one from each of the 3 regional clusters and representing a country with: highest number of financial instruments, highest number of regulatory instruments, and highest number of informal instruments.

Outlook on Stage 4: In-depth study of illustrative examples

The final selection of the 9 illustrative examples will be done in consultation with ESPON EGTC. We will ensure that the selected examples represent a territorial balance both geographically and with regards to other relevant territorial specificities. By drilling down into individual illustrative regions within each cluster it will be possible to gain a richer understanding of the drivers and barriers to implementation of PaMs at the regional and sub-regional levels. Particular emphasis will be put on innovative initiatives, notably in involving and partnering with the private and voluntary sectors and communities, lessons learned and the potentials for transferability.

5 Task 5 – Potential support by EU Cohesion Policy

5.1 Identifying experience from program evaluation, case study results and expert knowledge

5.1.1 Context and conceptual framework

A framework strategy for a resilient Energy Union with a forward-looking climate change policy was adopted by the European Commission on 25/02/2015. The strategy aims to reduce energy dependency, promote the free flow of energy across borders, boost energy efficiency and support the transition to a low-carbon economy.

Cohesion Policy is supposed to play a strong role in delivering the Energy Union on the ground, through projects that bring real benefits to citizens. Under the broad theme of “Low-Carbon Economy”, the European Structural and Investment Funds (ESI funds, i.e. including EAFRD and EMFF) invest in a range of investment priorities and union priorities to support the shift towards a low-carbon economy in all sectors. Conceptual framework task 5

According to the ToR, the emphasis of task 5 is put on cohesion policy which actively supports the transition to low-carbon economy in the current funding period 2014-2020. Striving for recommendations on how to bring (additional) added value to the regional implementation will be based on detailed information about ongoing practices at European level as well as the assessment of experiences with these instruments at the level of regions.

5.2 Experience from the 2007-2013 period of Cohesion Policy

5.2.1 The scale of Cohesion policy relating to GDP and government spending

In order to gain experience from the previous period 2007-2013 it is essential to look at the financial and spatial dimensions of EU Cohesion Policy, with focus on the ERDF and Cohesion Fund spending across Europe’s regions. Since the overall ambition of CP is to reduce the economic development differences between Member States and regions, the system has been designed in a way to provide assistance money for development projects with predominantly in less developed regions. A number of indicators, with particular emphasis on GDP per capita, is forming the basis for the classification of EU regions in order to be eligible for ERDF or Cohesion Fund money. Since the Cohesion Fund has focused on less developed regions, providing assistance for infrastructure as well as for business development, administrative capacity building and research, the assistance contribution per capita by the EU is substantially higher as compared to the more developed regions and MS. As a result, most of Cohesion Policy money in this period was spent in new MS and in Southern regions in Greece, Spain, Portugal and Italy.

As a conclusion, in the period 2007-2013 the contribution of Cohesion Policy in the new MS (EU-12) and in southern regions (Convergence Regions) reached significant levels, in some

MS and regions nearly half or even more than half of public money financing capital formation in infrastructures and businesses came from EU Cohesion Policy. Only a small part of that money, however, was addressing energy and low carbon-relevant projects and measures (see below).

5.2.2 Ex-post evaluation of programme implementation 2007-2013 – conclusion

The evidence set out in the ex-post evaluation synthesis report[14] demonstrates that Cohesion policy, though operating in a very difficult environment in 2007-2013, worked effectively and produced tangible results. It has made a major contribution over the period to jobs and growth, to the pursuit of both the Lisbon priorities and the Europe 2020 strategy as well as to the reduction of regional disparities. The evidence produced by evaluations on the ground point to this and it is complemented by the results of the macroeconomic models which indicate the added-value of the policy in terms of the additional GDP generated in all Member States.

5.2.3 Ex-post evaluation of programme implementation 2007-2013 – focus on the priority theme energy efficiency, co-generation and energy management

Only a small part of Cohesion Fund money went to energy-related projects and measures – the share of the priority theme energy was 4.5% in the EU-27, with more developed regions in the Competitiveness programmes having a higher share of 6.6%.

In the regions falling under the “Convergence” objective, the European Regional Development Fund and the Cohesion Fund could support trans-European energy networks with the objecttive of improving the security of supply, completing the internal market, integrating environmental considerations, improvement of energy efficiency and development of renewable energies.

For both Convergence and the Regional Competitiveness and Employment objectives an important ERDF priority was to stimulate energy efficiency and renewable energy production and the development of efficient energy management systems.

In the framework programmes for 2007-2013, EU allocations of € 4.8 billion have been made for projects in renewable energies (wind, solar, biomass, hydroelectric and geothermal), € 4.2 billion for energy efficiency, co-generation and energy management and € 1.7 billion for investment in traditional energy sources of which € 674 million is allocated for investment in Trans European energy networks in electricity and gas.

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[14] Ex Post Evaluation of Cohesion Policy Programmes 2007-2013 – WP1: Synthesis report focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF); Applica and Ismeri Europa, August 2016.

Within this framework, there was a great variation in national (and regional) strategies towards a low-carbon energy future. This variation was reflected in both, the priority given to the energy theme in the individual programmes (overall intensity of funding) and in terms of the focus given to RES and energy efficiency.

5.2.4 Focus evaluation on energy efficiency in public and private buildings

While the ex-post evaluation provided a good overview on the general picture relating to the main objectives of Cohesion Policy in that period, the rather complex theme of energy transformation was covered in only one special segment, energy efficiency in public and residential buildings. As has been seen from the variation between MS in allocating funds to the priority theme energy, this also holds true for the energy efficiency segment – the variation between MS is high, with funds allocated to energy efficiency between 0.5% and 6.5% of total.

The recommendations from this specialized evaluation study illustrate the challenges in general: The question is, how do EU programmes fit into the overall regime of support schemes and institutions, regulatory schemes and energy transformation strategies – do EU funds help to get things done on the ground, in an effective way ?

The authors of the ex-post evaluation on energy efficiency in public and private buildings noted as recommendations[15]:

(1) Programmes need to spell out clearly the rationale for the use of EU funding to support investment in energy efficiency in buildings in relation to national energy policy and support schemes
(2) With the long term energy cost reduction for building owners, loans are likely to be preferable to grant support, awareness-raising campaigns might be needed.
(3) Energy audits should be a standard part of project selection criteria
(4) Financial support should be complemented by advice and guidance, certification schemes and building regulations.
(5) Indicators need to be more widely, and uniformly, applied to monitor the results of support.

5.2.5 Energy-related allocation of ERDF and CF funding in EU NUTS-3 regions, 2007-2013

The database for the previous programming period 2007-2013 allow – for the first time – to analyze the concrete regional distribution of ERDF and Cohesion Fund resources at NUTS 3 level relevant for increasing energy efficiency and expanding the production and use of renewable energies.

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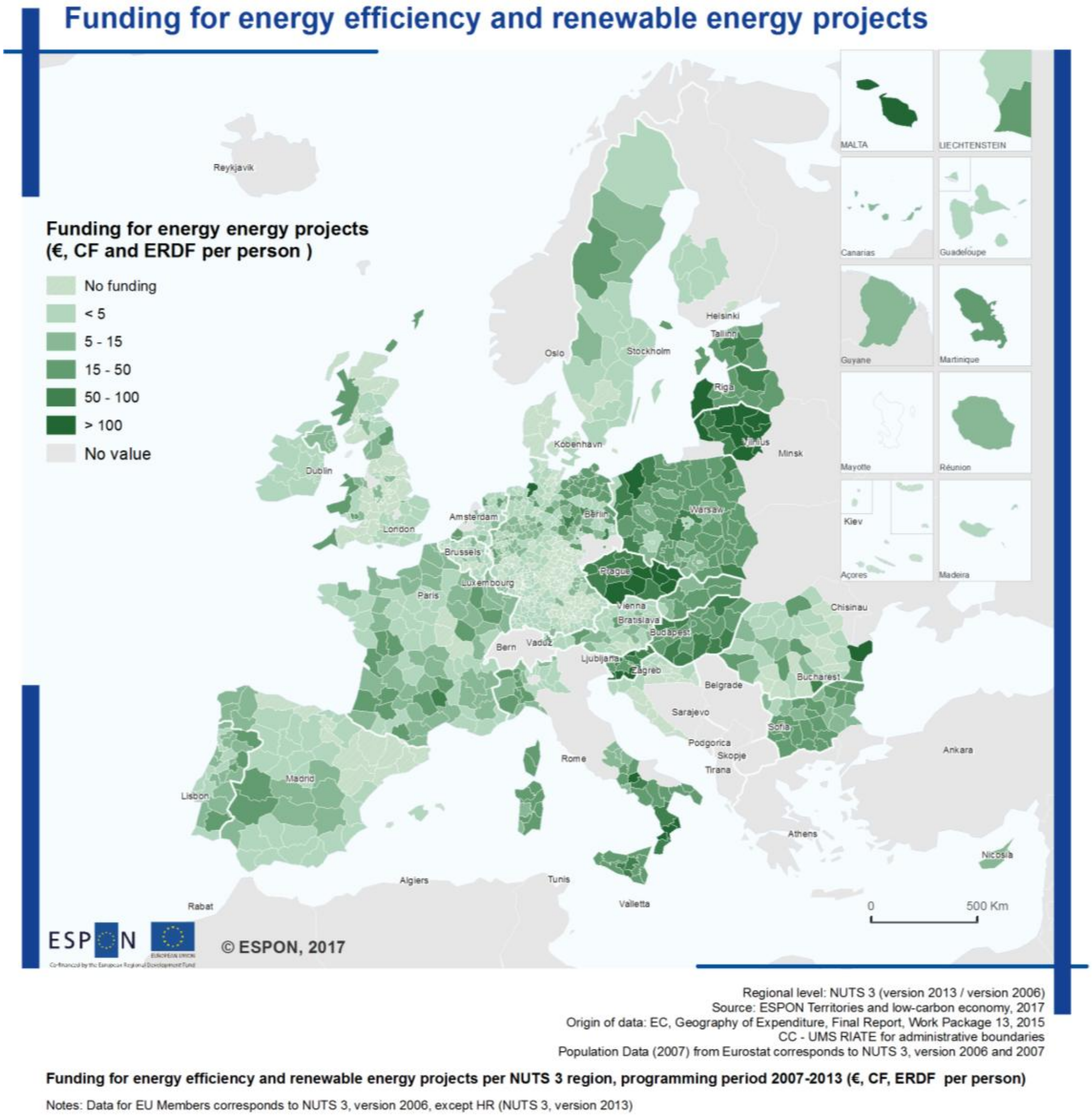
[15] Brussels, 19.9.2016, SWD(2016) 318 final: COMMISSION STAFF WORKING DOCUMENT Ex post evaluation of the ERDF and Cohesion Fund 2007-13

Map 5.1: Funding for energy efficiency and renewable energy projects per NUTS 3 region in € per person, programming period 2007-2013 (CF and ERDF) 16 [17]



The data on the regional distribution of Cohesion Policy funding indicate quite clearly, that

- most of the funds for energy related projects on efficiency and renewable is being spent in EU-12 countries and in Convergence Regions in the South of the EU (reflecting the Cohesion Policy regime) – in absolute terms and very significantly in funds per capita (Map 1.1)
- the relative share of funds to efficiency and renewable energy projects, however, is highest in EU-15 countries like France, Italy, Germany, UK, Austria, while there are some exemptions in Lithuania, Romania and Greece
- there are some regions in Poland, Romania and Greece with significant money allocated to fossil fuel projects, most regions in Europe did not use EU Cohesion Policy money for fossil fuel projects

[16] Categorisation codes 39 to 43.

[17] For some regions this indicator could not be calculated, due to changes in the attribution of population and funds in some NUTS-3 regions.

- and in only a handful of regions in Poland and Rumania the funds going to fossil energy projects were higher than to efficiency and renewable projects.

Overall, these spatially detailed data and mappings display where EU Cohesion Policy can have a significant impact in fostering energy efficiency and renewable energy production and use. While the general picture looks quite coherent with the EU objectives, it can be assumed that there would be the potential to increase the share and also the efficiency of EU funds in many regions – in the subsequent (current) period.

5.3 Cohesion Policy in the current 2014-2020 period

5.3.1 The shift from programming period 2007-2013 to the new objectives and guidelines for period 2014-2020

The Europe 2020 Strategy is a ten-year economic strategy introduced by the European Commission in March 2010 [18]. Its stated aim is to promote smart, sustainable, and inclusive growth. Identifying eight headline targets to be attained by the end of 2020, climate change and energy now is most prominently named. [19] [20].

The analysis of relevant regulations of EU cohesion policy (Common Provisions Regulation), eligible priority themes and beneficiaries as for the period of 2014-2020 shows that many of the lessons learnt have been taken up in the reform: Under the reform of EU Cohesion Policy agreed at the end of 2013, all Member States are required to allocate significant shares of Cohesion Policy funding to support the shift towards a low-carbon economy.[21].

Relatively stable remained the spatial dimension and the differentiation of funding intensity between EU-15 and EU-12 countries. While some of the Convergence Regions in the South were reduced, due to economic progress, the general spatial pattern remained as in the period before, with high EU support intensities in the East and the South of the Union. It was a specific innovation to stipulate a mandatory minimum spending for the low-carbon economy theme: 20% of national ERDF resources in more developed regions, 15% in transition regions and 12%[22] in less developed regions.[23]

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[18] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF

[19] http://ec.europa.eu/regional_policy/en/projects/ALL?search=1&keywords=&countryCode=ALL&regionId=ALL&themeId=68&typeId=ALL&periodId=2&dateFrom

[20] http://ec.europa.eu/regional_policy/en/policy/evaluations/ec/2007-2013/

[21] Structural and Investment Funds Open data portal, https://cohesiondata.ec.europa.eu/

[22] Increased to 15% if Cohesion Fund resources are also allocated to investments in this area.

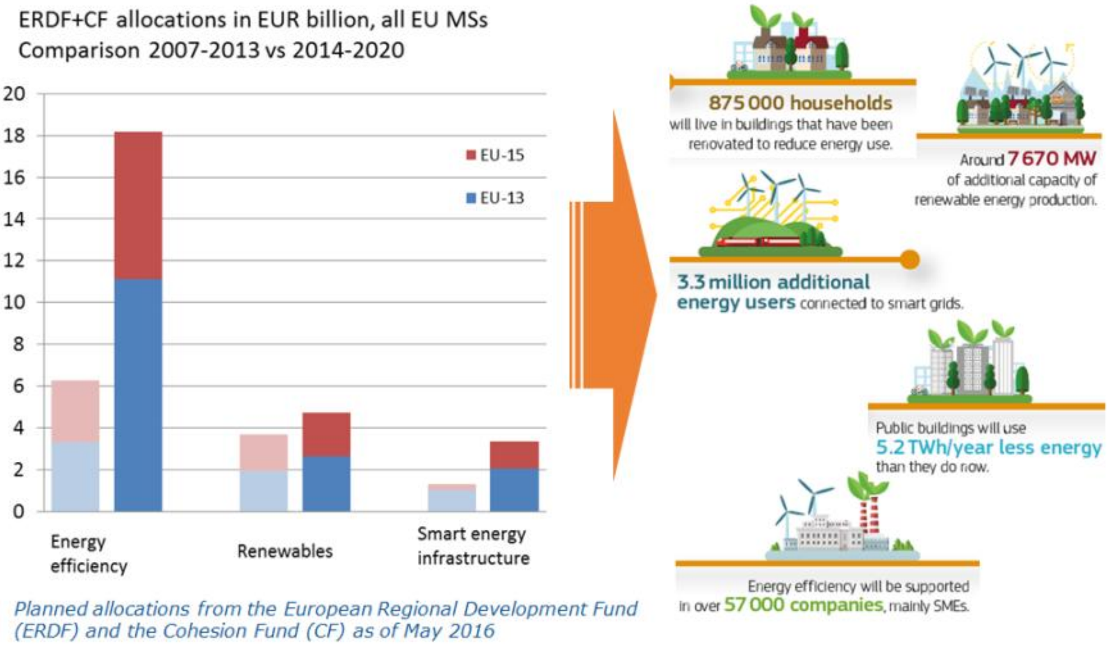
[23] How EU Cohesion Policy is helping to tackle the challenges of CLIMATE CHANGE and ENERGY SECURITY, paper by the European Commission's Directorate-General for Regional and Urban Policy, September 2014

5.3.2 Expected Impacts of Cohesion Programmes in the 2014-2020 period relating to the Thematic Objective "Low Carbon Economy" (TO LCE)

With overall changes in resources allocated to Cohesion Policy as a backdrop, and under consideration of the difficulties in comparing data from the two programming periods, an estimate has been made as to how much more money will go to low carbon investments in the current programming period.

Overall, the requirement of a minimum share of 12 to 20% for low carbon relevant projects has increased the allocations to energy efficiency, renewable and smart energy infrastructure projects substantially. This increase is especially significant in the energy efficiency sector and in the EU-13 countries: While energy efficiency allocations nearly tripled, from € 6 to 18 billion, the increase in the EU-13 countries was from about € 3 billion to over € 11 billion. The increase for investments in renewable energy projects, by comparison, was rather little, while smart energy infrastructure expenditures are planned to rise from € 1.5 to about 3.6 billion.

Figure 5.1: ERDF + CF allocations to energy efficiency, renewable and smart energy infrastructures 2014-2020 compared to 2007-2013

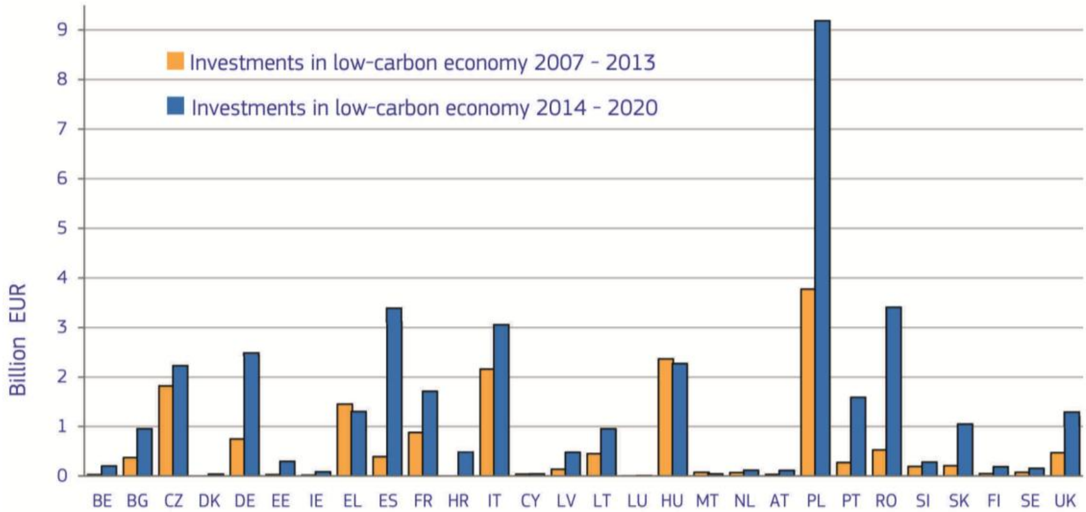


Source: Energy and Managing Authorities Network, Presentation: Maud SKÄRINGER (European Commission), Brussels, 22 November 2016.

As potential explanation for this allocation pattern can be stated that energy efficiency projects in private enterprises may form a new major focus in the current programming period, while investments in renewable energy production is dominated by national aid schemes and regulations, which also are varying greatly between MS.

The distribution of Cohesion Policy funding across MS in 2014-2020 reflects the eligibility criteria (similar to the previous period), with Poland as by far the greatest beneficiary (over € 9 billion).

Figure 5.2: Cohesion policy allocations to low-carbon economy investments 2014-2020 compared to 2007-2013 in € billion



The figure shows the ERDF and CF amounts allocated in the Partnership Agreements (PAs) to low-carbon economy investments 2014-2020, compared to an estimate of similar allocations in 2007-2013. Source: How EU Cohesion Policy is helping to tackle the challenges of CLIMATE CHANGE and ENERGY SECURITY, paper by the European Commission's Directorate-General for Regional and Urban Policy, September 2014, adapted by ÖIR according to the final allocation 2014-2020.

The allocation strategies, however differ widely between MS, as in the previous period. Some insights are:

- According to the programmed allocation of funds, it has been a successful undertaking by the Commission to significantly increase the share for the thematic objective Low Carbon Economy.
- The contribution of cohesion policy money is – as in general – most relevant in the New Member States and in the Mediterranean, while in most of the large MS and in the northern countries the economic impact of ERDF money is rather low in relation to national policies.
- In some new MS the increase, however has been substantial, as in Poland, Bulgaria, Romania, Slovakia, Croatia, Latvia, Lithuania, where LCE-allocated funds more than doubled; also in Spain and Germany, where allocated funds jumped.
- In addition to cohesion policy, there is some minor contribution to the TO LCE from EAFRD, varying largely between MS.

There also are great differences between MS and regions regarding the composition of the investment priorities selected – this is caused by varying economic and natural conditions as well as widely differing national energy systems and aid. As particularly prominent example, Germany has supported the development of renewable energy production through generous feed-in tariffs, contributing through this measure over 20 times more than through direct aid money for investment[24].

[24] Renewable Energy and Energy Efficiency of Housing, Synthesis Report, Terry Ward, applica sprl, 2011

5.4 Task 5: Further steps of work

Task 5 will also continue to work integrated with tasks 3 and 4, not only in terms of contents but also in terms of investigation of recent experiences, particularly relating to experiences in regions. As both tasks are mainly investigating at regional level and teams will conduct a considerable number of interviews and research in selected regions, this forms a relevant information source on concrete regional implementtation practice. These steps of work necessitate an integrated elaboration of tasks 3, 4 and 5.

Based on this background information, a series of in-depth interviews will be conducted with selected key representatives of national and or regional authorities (as managing authorities, program secretaries or other relevant experts working in the field of EU cohesion policy implementation at national/regional level. Overall, the recommendations shall focus on the possibilities for supporting the shift to a Low Carbon Economy through Cohesion Policy, based on the idea that ERDF and CF money can play an important role as catalysts in a more complex scheme of funding and regulating investments in new technologies and businesses.

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List of Annexes

Full reports on

- Task 1 – Analysis of energy consumption patterns in European regions and cities
- Task 2 – Identification of renewable energy potential and degree of exploitation
- Task 3 – Case studies on regions and cities shifting to a low-carbon economy
- Task 4 – Regional policy approaches and actions that facilitate the transition to a low-carbon economy
- Task 5 – Potential support by EU Cohesion Policy

ESPON 2020 – More information

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