GREECO

Territorial Potentials for a Greener Economy

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Case Study

Vol. 4.5. Rhur Area

EUROPEAN UNION
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Executive Summary

The Ruhr Area serves as an example for an ongoing regional transition from an old and heavy industrial base (coal, steel, etc.) to a modern high-tech and service oriented region with some potentials for green economic development. The regional structure ranges from high-density core cities of the agglomeration to rather rural counties forming the hinterland of the region. The region is endowed with some "natural" territorial capital, mainly in the rural parts (forests, agricultural land), but also in the high-density cores (open space, Ruhr landscape park). Also the numerous brownfields can be understood as territorial assets for development of green economic activities. Multiple forms of agglomeration economies and existence of several eco-innovation clusters do exist as well, with a strong university base with high-tech orientation and attached technology centres and parks. These assets are backed by a high awareness among political and economic actors for the potential of green economic activities for the development of the region. Several political initiatives and programmes at different governance levels have been established for green transition of the economy. Two green economic sectors are analysed in detail in the case study, the water and the energy sector.

Regards the water sector, a relic of the coal mining times, the Emscher River System, was still in place. This is an up to 3 meters deep open sewer system with concrete shells. The renewal of the Emscher River system is one of the largest infrastructure projects in Germany with an investment of about 4.5 billion Euro and lasting for about 30 years up to 2020. The renewal includes the construction or modernisation of four decentralised wastewater treatment plants, the construction of more than 400 km of large scale underground sewers along the Emscher River and its tributaries to collect the wastewater of 2.2 million people and the reconversion of the rivers as such. This results in a green belt crossing the Ruhr area which is a "new green engine for regional development" with new open space quality, leisure activities, new attractive residential areas and economic activities. Eventually, the renewal of the Emscher System contributes to a new green image of the region gradually replacing the old grey one.

Regards the energy sector, it was analysed to what extent a conversion to renewable energies is possible in high-density urban agglomerations and what specific potentials old-industrialised regions have for this. It is demonstrated that the uptake of renewable energies has also happen in such an agglomeration and that there are huge potentials, in the densest parts of the region particular in electricity production from solar panels. Specific recourses of the Ruhr area for renewable energy production are the availability of brownfields and stockpiles for wind parks or solar power plants, the energy production from mine gas, landfill and sewage gas or even former coal pits that might be converted into underground pumped-storage stations.

1 General description of the Ruhr area

1.1 Geography

The Ruhr area in North Rhine-Westphalia is located in the western part of Germany in North Rhine-Westphalia. It covers an area of 4,435 square kilometres. The population in the Ruhr area is 5.135 million, i.e. a population density of 1,157 inhabitants per square kilometre. The Ruhr region is the largest agglomeration in Germany and together with the metropolises Île-de-France, Moscow, Greater London and Istanbul one of the five largest urban areas in Europe (Metropole Ruhr, 2013 a). From an economic geography perspective the Ruhr area is one of the most important economic regions of north-west European due to its central European location, its close links with the centres of Europe and its large heavy industrial importance based on coal and steel industries The Ruhr region has got this importance because of the coal reserves and its long-standing know-how since industrialisation until today and became energy site no. 1 in Europe.

The historical spatial development of the Ruhr area from a rural and predominantly agricultural area into one of the densely populated areas of Europe with very different spatial structures and qualities inside was essentially dominated by the spatial logic of the industrialisation processes. The Ruhr region is crossed by three east-west flowing rivers, Ruhr, Emscher and Lippe (Figure 1.1). In addition, the medieval trade route of the Hellweg crosses the region also from east to west. Each of the four linear elements is forming the central corridor of four very different zones, the Ruhr zone, the Hellweg zone, the Emscher zone and the Lippe zone.

Two centuries ago, the industrialisation process of the Ruhr area began along the river Ruhr which constituted the name of the area. Here, the stone coal was almost at the surface and could be easily extracted. Further north, the coal was deeper in the earth. With the evolving technological progress, the mining industry was able to follow the coal northwards. Steam engines, later replaced by electricity driven engines and pumps allowed ablating the coal from several hundred meters below the earth's surface. The mining industry went north to the Hellweg zone and since the early 20th century to the Emscher zone and exploited the coal fields. Nowadays, the last remaining coal mines are in the Lippe zone outside the high-density core area of the Ruhr. Due to the availability of cheap coal-based energy and the development of inland waterways and railways, other industries were attracted to settle down in the Ruhr area, in particular iron and steel works.

With the spatial expansion and north-movement of the mining industry and the establishment of other heavy industries, many new settlements were built for miners, iron and steel workers etc. However, the spatial logic of the new residential areas did not follow the existing spatial structures with town and villages, but was strictly driven by the needs of the industries and legal aspects of land ownership. So, new housing areas were built near the places of work, mostly on former agricultural land without a close relationship to existing urban functions. This created a relatively uniform dispersed settlement pattern of large "industrial villages" which can be seen in the urban landscape of today. In addition, the cities of the Ruhr area have experienced also the common growth and suburbanisation processes comparable to other cities.

This very unique settlement development did not consume all open space. Even in the Emscher zone which experienced the biggest industrialisation process within the Ruhr area, agricultural land and other open space has survived. These green patches and corridors are forming together with the recreation areas of the Ruhr zone in the south and the Lippe zone in the north the backbone of a regional green space system, and thus positively influence the image of the "urban landscape" (Ruhrgebiet Regionalkunde, 2013c). Although the Ruhr region is one of the most densely populated areas in Europe with very compact settlement structures in the Hellweg and Emscher zones, it has also rather rural structures at its edges. Because of these natural assets in its hinterland, the Ruhr area has open space adding up to about 60 per cent of the total area.

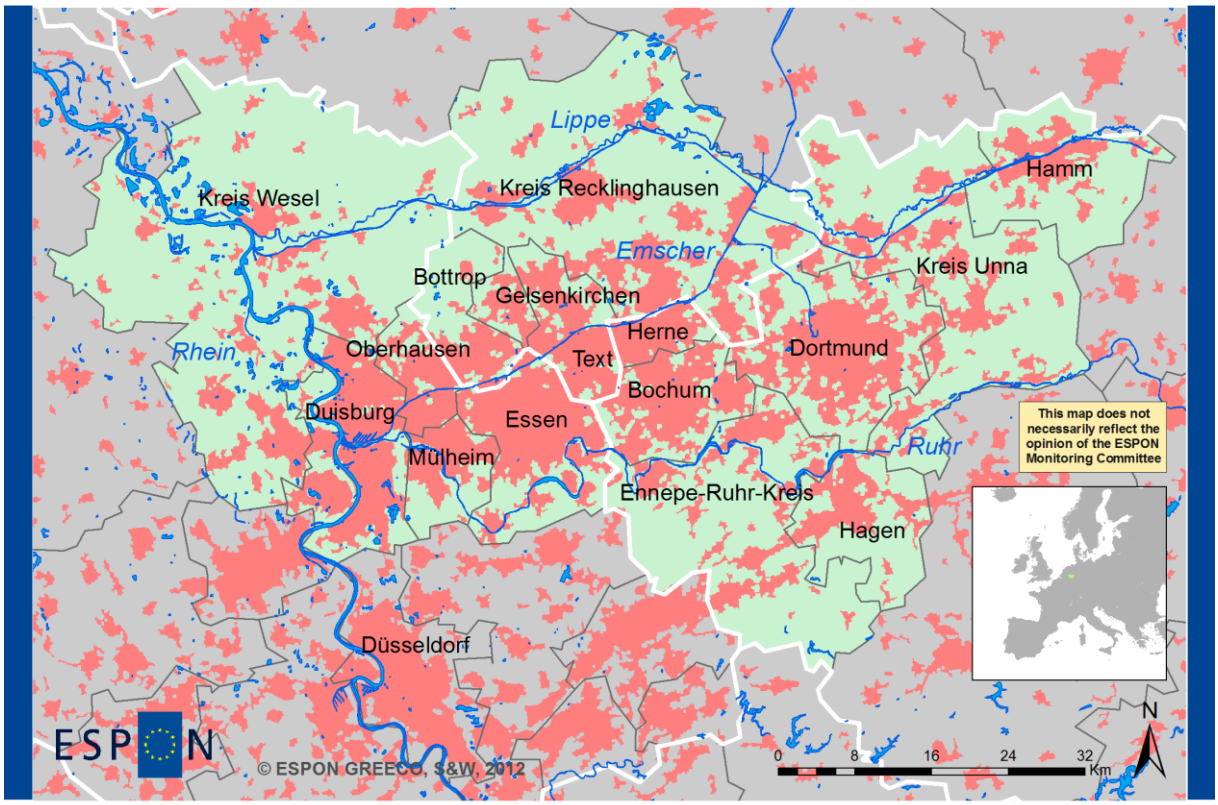


Figure 1.1. Settlement structure of the Ruhr area.

Already beginning in the 1960s the industrial base of the Ruhr underwent several economic crisis. Through the opening of the coal markets in the 1960s and widespread availability of other forms of energy such as oil and gas, but also cheap coal from other continents and negligible transport costs, prices fell on the energy markets. The outcome was that the number of mines and workers were reduced within a decade by half. A similar development happened from the 1970s onwards in the steel industry. Increasing international competition and lack of competitiveness on the global markets lead to concentration processes and the close-down of production sites. Consequently, the Ruhr has gradually lost its heavy industrial base and many of the former industrial sites were taken out of industrial use and developed into brownfields.

These economic structural changes enforced the necessity of the Ruhr area to depart from the "brown" industries towards an information and knowledge-oriented economy with future-oriented professions (Metropole Ruhr, 2013 c). One of the most successful policies for this was already implemented in the 1960s, the establishment of higher educational facilities which were almost not present in the area before. Nowadays, there are five universities, 13 universities of Applied Sciences and several other research institutions and technology centres which converted the Ruhr area into one of Europe's densest education and research region (Mercator Stiftung, 2010).

Later, during the 1990s, the new face of the Ruhr region was heavily transformed by the International Building Exhibition Emscher Park (IBA Emscher Park). In fact, the IBA was less a

traditional building exhibition but a regional strategy to deal with the industrial relicts and heritage by using this as a starting point for future economic and social development. As part of the IBA Emscher Park, the number of brownfield sites and the water and wastewater industry with their wastewater streams on surface were renaturalised and thousands of houses were rehabilitated. Moreover, the old industrial sites were upgraded and used for arts, culture, leisure and sport, or as office space. The IBA Emscher Park is being considered as a project of the century and one of the major structural projects in the history of Germany. It has shown how industry and culture can be fused together to forms an industrial culture. In addition, the Ruhr area was elected European Capital of Culture RUHR.2010 which highlights the massive structural change in the past decade (Metropole Ruhr, 2013 c).

To communicate the structural and image change of the Ruhr in Germany and in Europe there was an intensive discourse since the mid-1990s to establish a new and modern label for the region. Since, the region was called "Ruhr Metropolis" to communicate an urban and regional science-oriented understanding of metropolitan regions (Ruhrgebiet Regionalkunde, 2013d).

The structural change in the Ruhr area is far from being complete. However, it is facing constantly new challenges and tasks. In future, it is crucial how the region can compensate the decision from the Federal government to completely abandon the coal extraction in the Ruhr area by 2018 and to develop new local structures by using renewable energies.

1.2 State of infrastructure

The Ruhr area is covered by a narrow grid-like motorway and trunk road network formed by tree main east-west corridors and several north-south links. In consequence, a very high portion of 12.9 percent of the region's road network length is constituted by motorways and trunk roads. However, the proportion is only 7.4 percent in North Rhine-Westphalia and only 5 percent in Germany (Ruhrgebiet Regionalkunde, 2013e). The Ruhr area is well connected by road infrastructure to other agglomerations in Germany as well as to the Netherlands.

There is also a dense network of rail infrastructure. Rail transport of bulk goods was one of the backbones of industrialisation of the area from the second half of the 19th century onwards. The outcome was a dense mixture of rail infrastructure for freight transport including a lot of industry-owned private lines and terminals and for passenger services. In terms of rail freight volumes, the Ruhr area used to be the region in Europe with highest transport volumes as origin and destination for general and bulk cargo. Many of the freight lines were taken out of operation during deindustrialisation and partly converted into walking and cycling tracks. Current rail passenger services in the Ruhr are a mixture of regional and long-distance passenger services. However, because of capacity constraints, IC and ICE trains cannot be run with higher speeds than regional trains. The Ruhr area is fairly good connected to other agglomerations in Germany and abroad such as Amsterdam, Brussels or Paris.

The Ruhr area does not have an important international airport. There is one regional airport located in Dortmund which has some importance for serving touristic destinations and some connections to eastern Europe. However, air traffic for the Ruhr area is mainly handled by the international airports Dusseldorf and Cologne/Bonn. Good accessibility of the two airports by road and rail links is a crucial factor for the Ruhr region.

The Ruhr area got during industrialisation also a very dense inland waterway system with a huge number of ports. The ports of Duisburg and Dortmund have most central functions and are in terms of transport volumes the largest inland port (Duisburg) and channel port (Dortmund) in Europe. The Ruhr area has along its four inland waterways (Wesel-Datteln, Datteln-Hamm, the Rhine-Herne and Dortmund-Ems canals) and the river Rhine direct connections to the North Sea and the ports of Amsterdam, Rotterdam and Antwerp.

1.3 Demography

Since its peak in the early 1960s population has decreased in the Ruhr region from 5.72 million at that time to 5.14 million people nowadays, i.e. a population loss of more than half a million people during the last 50 years (Figure 1.2). Further population decline is forecast for the next decades. The base variant of the population forecast of IT.NRW shows, that population will go down to 4.97 in 2020 and to 4.75 million in 2030 (RVR, 2009).

The negative performance of the entire Ruhr area until the mid-1980s is partly a result of the long-lasting structural changes which has influenced the migration rates and the generative behaviour. Since the 1970s, birth rates decreased by the improved contraception, the so-called "baby bust". Population development between the rural areas and core cities were very different. While the effects of structural change were stronger in the cities the population increased by suburbanisation in the districts. Overall, the population has increased in the rural parts from 1961 to 2011; however, the population has decreased significantly in the core area during the same period (RVR, 2009).

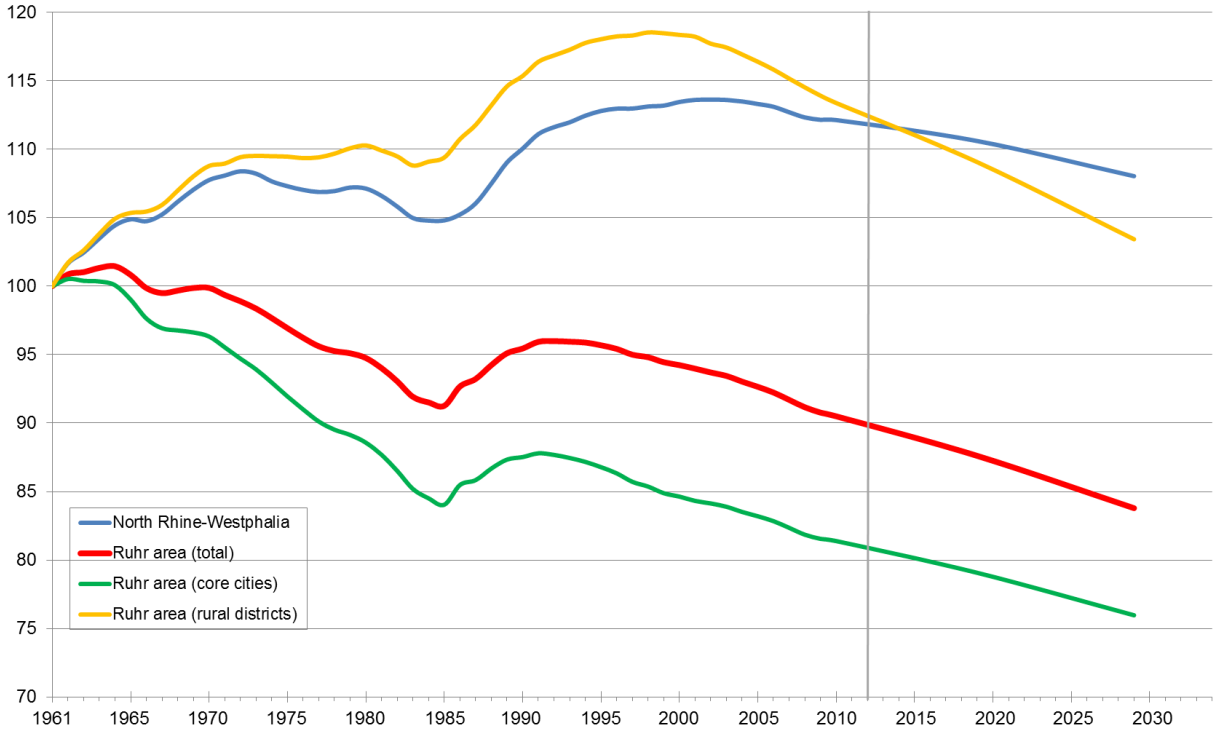


Figure 1.2. Population development, 1961 – 2011, forecasts for 2020/2030

Between the mid-1980s to the mid-1990s the Ruhr area experienced an extremely dynamic migration period which was mainly characterised by high migration flows from East Germany and eastern Europe (Figure 1.3. At the same time immigrants came from abroad to the Ruhr area, which fled from crises and wars in their home countries such as from the former Yugoslavia. However, the latter migration flows were significantly reduced by a revised version of the asylum law in 1993. This is particularly evident by the decrease in migration surpluses in the Ruhr (RVR, 2009).

Since the mid-1990s, the migration balance has fluctuated between negative and positive values in the whole Ruhr region. These fluctuations are result from the fact that since the mid-1990s to the millennium net migration extend positive in the rural districts and in the municipalities are

outflows of population. From the turn of the millennium there was a reverse picture. Now, the larger and central municipalities are more strongly in the focus of the immigrants, however, the the rural districts have experienced negative net migration trends for the first time since 20 years. Based on this development, intra-regional reurbanisation processes are visible.

Also crucial for overall progress of the population in the Ruhr region is the negative natural population growth. Since the early to mid-1990s, the negative natural population growth has increased continuously. Here, the districts and the municipalities has similar negative trend in their growth rates.

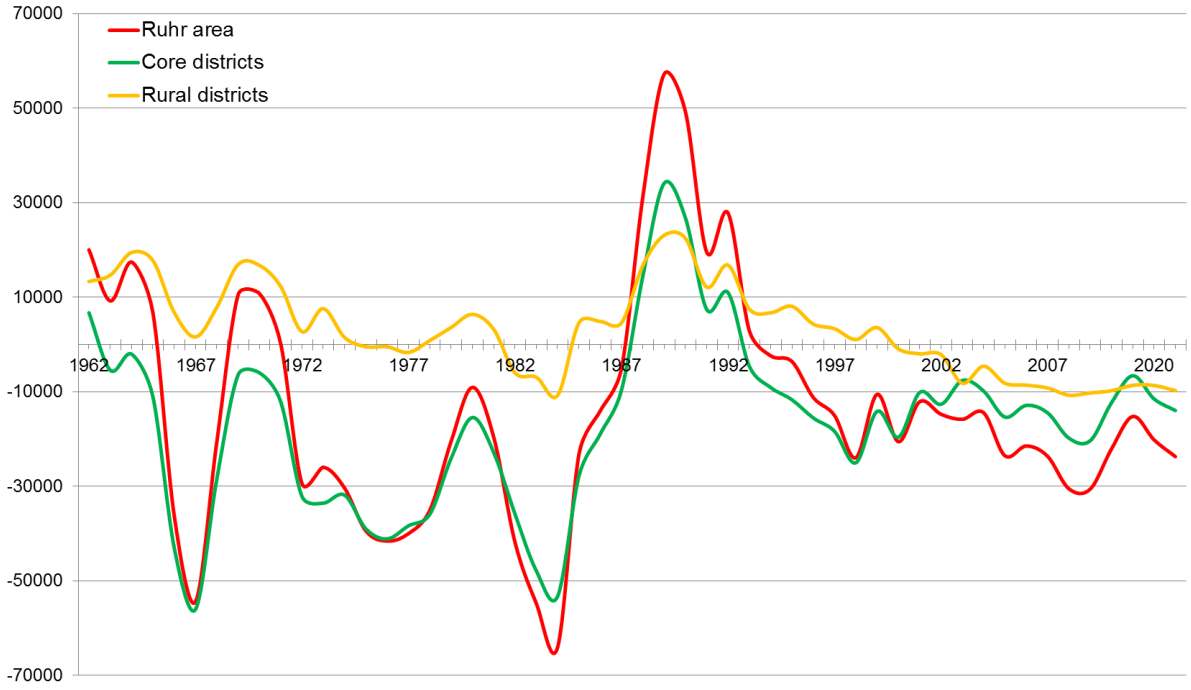


Figure 1.3. Migration balance in the Ruhr area, 1962-2011,forecasts for 2020/2030

The overall development of the annual rates of change runs in the rural districts and core cities for similar tendencies. For the overall development of the population in the rural districts is less bad. Because they had positive migration flows more than many years (RVR, 2009).

As already mentioned, the Ruhr is one of the most densely populated regions in Europe. Almost nowhere so many people live so close proximity to one another. Therefore, the Ruhr area has a very high population density of approximately 1,160 inhabitants per km2. Thus, large differences between the urban districts and the districts are identified. The population density in the counties located roughly between 2000-3000 Inhabitants/km2. So that the population density of the core cities is above the Ruhr area specific average. However in the rural districts especially in Wesel few people live on a relatively large area, so the population density compared with the entire Ruhr area relatively low (Figure 1.4).

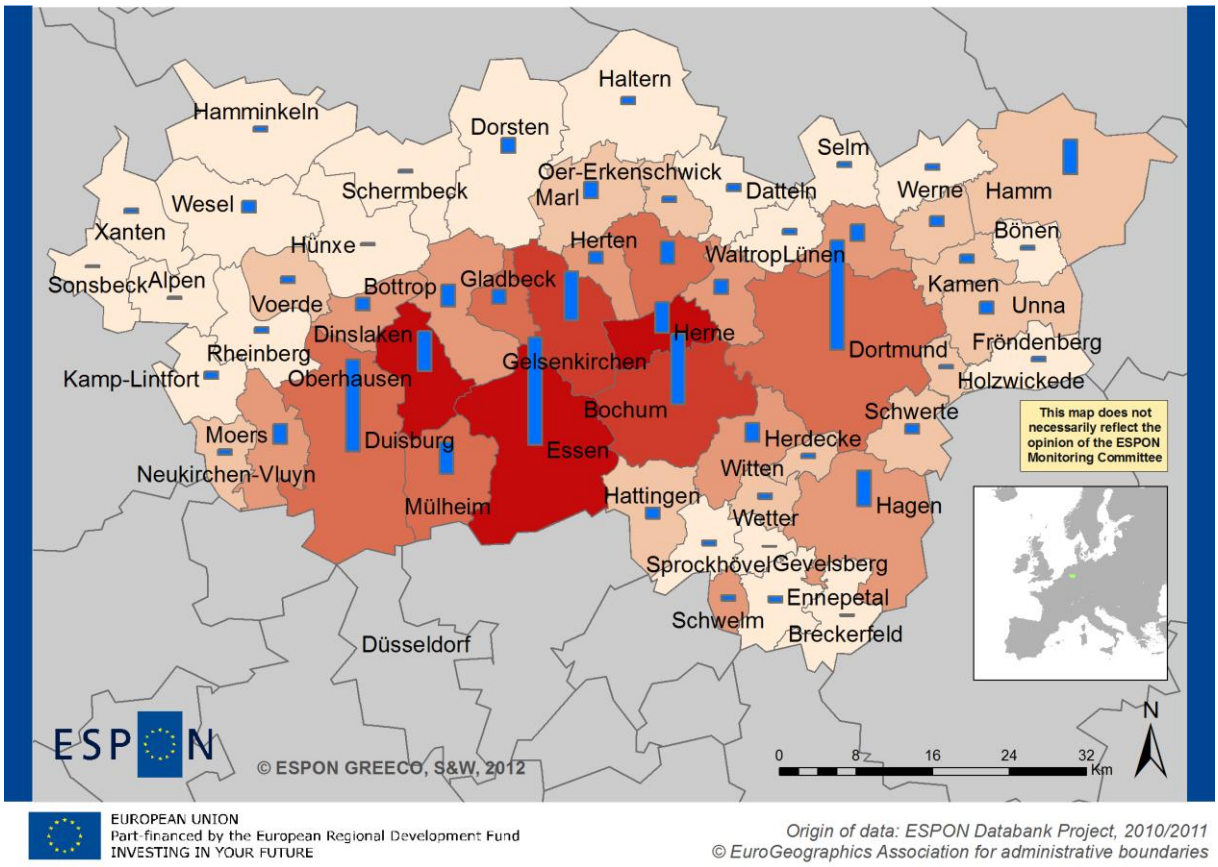
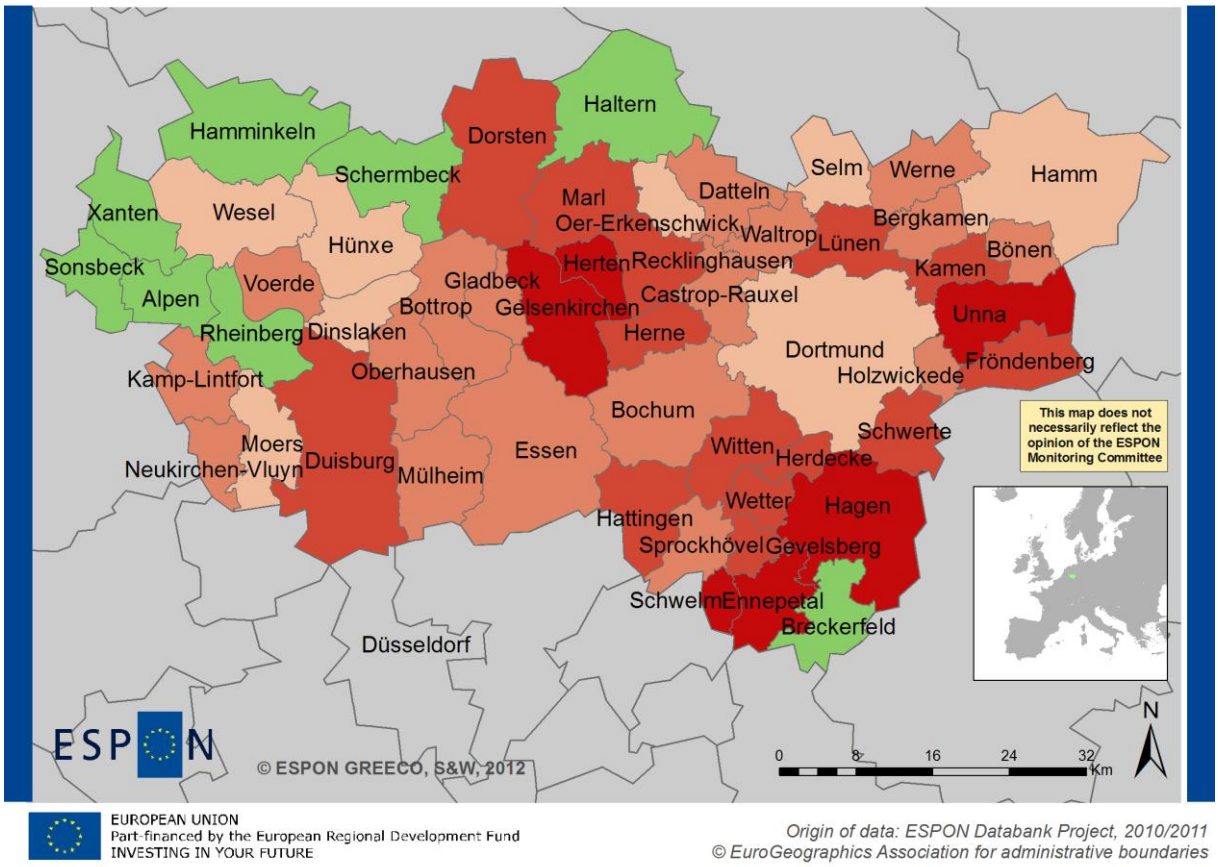


Figure 1.4. Population 2011

The following map shows that in almost each township in the Ruhr area is observed negative population growth between 2000 and 2011. Especially the core city of Gelsenkirchen and some communities belonging to a rural district of Ennepe-Ruhr and Unna have population losses of up to 10 percent. Only a few communities, mainly from the rural district of Wesel and the community Haltern have a positive population balance.



Map 1.5. Population change in the municipalities of the Ruhr area, 2000 – 2011

1.4 Administrative structure and governance

2 Regional economy

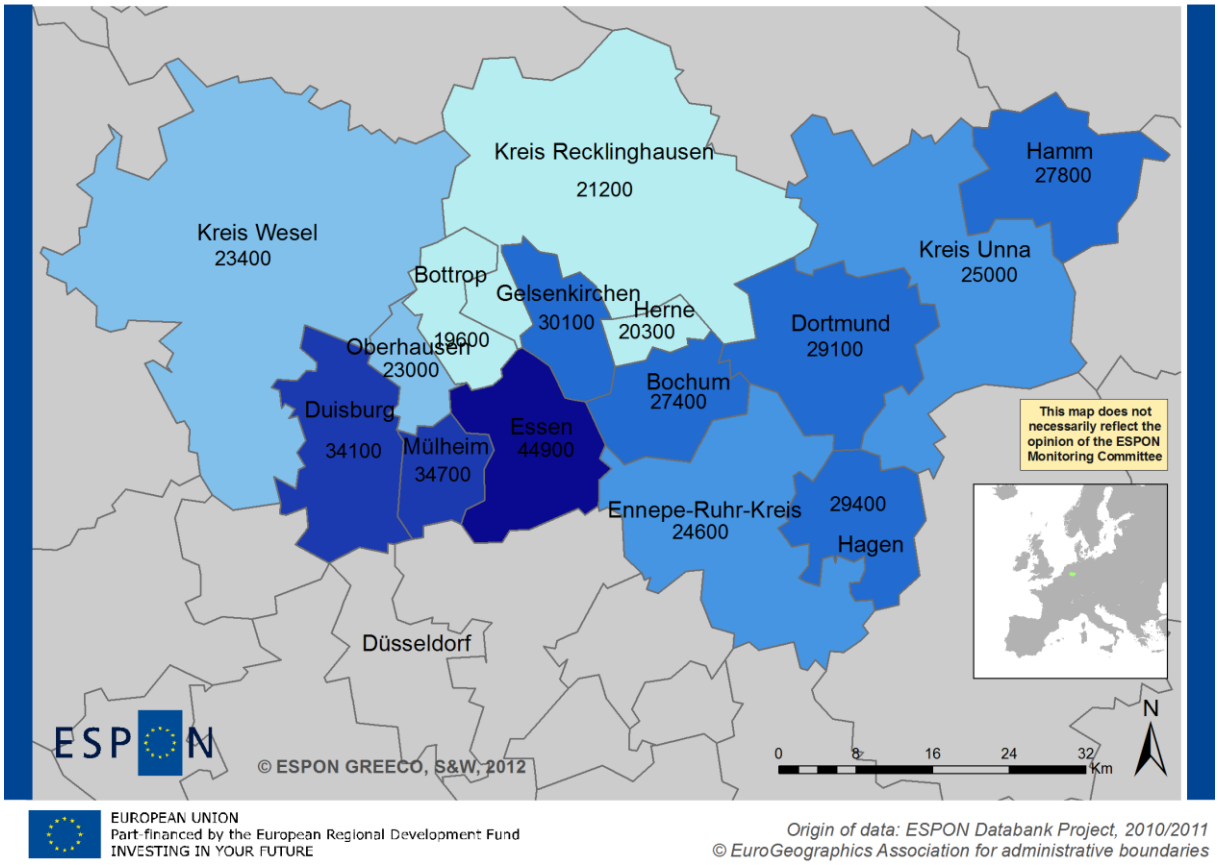


Figure 2.1. GDP per capita in the Ruhr area, 2010

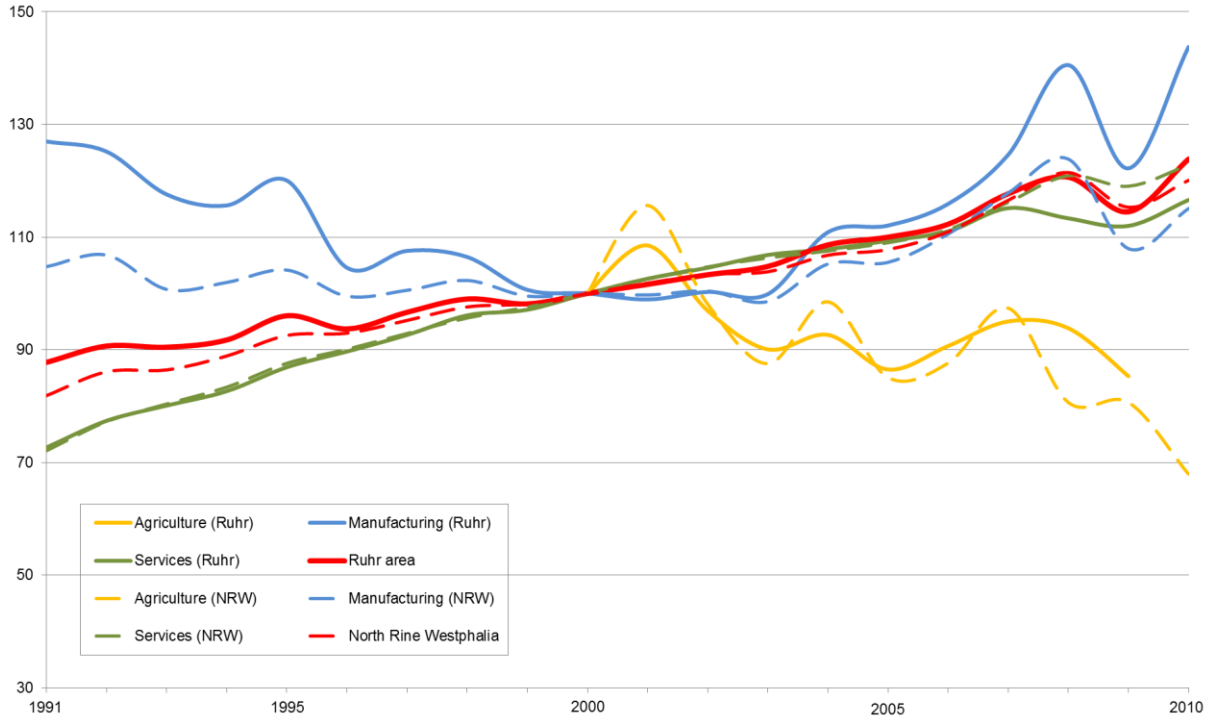


Figure 2.2. Gross value added in the Ruhr area by main economic sector, 1991-2010

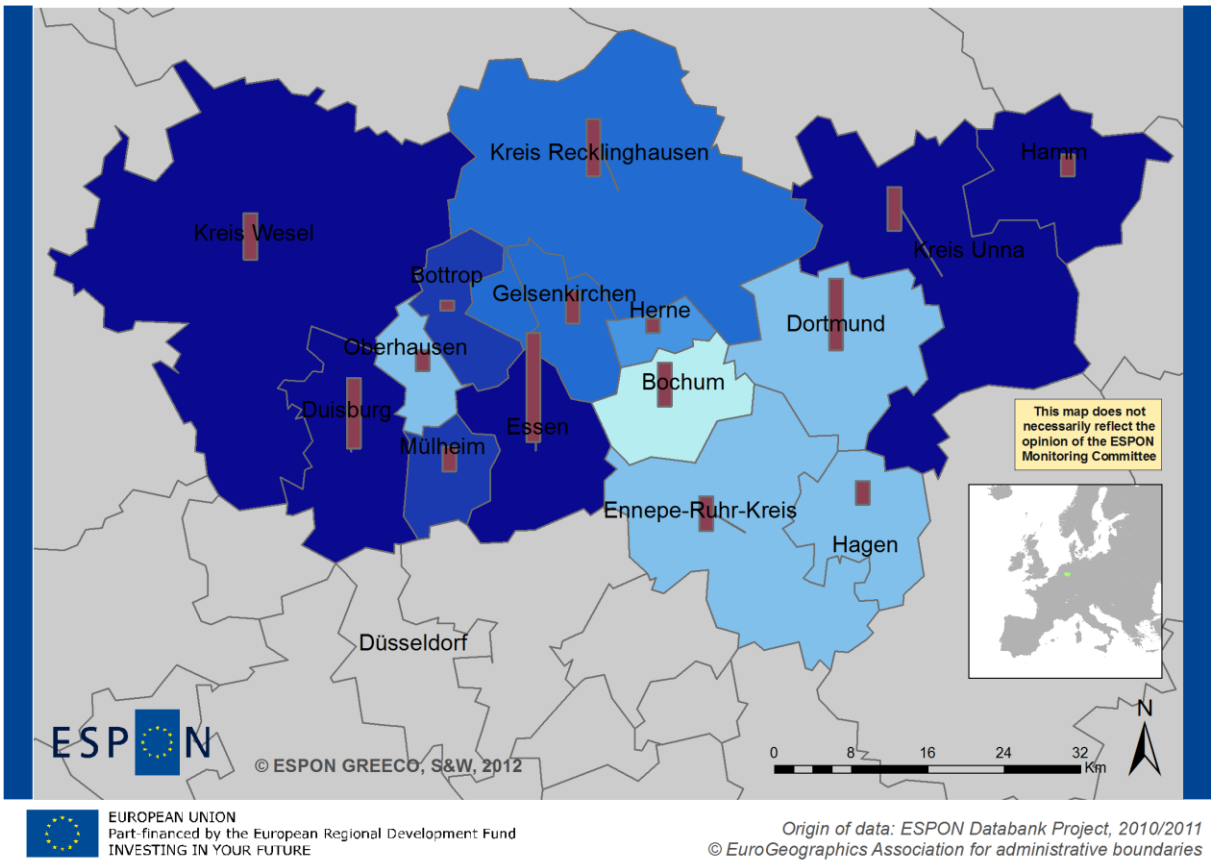


Figure 2.3. Change of gross value added in the Ruhr area, 2000-2010

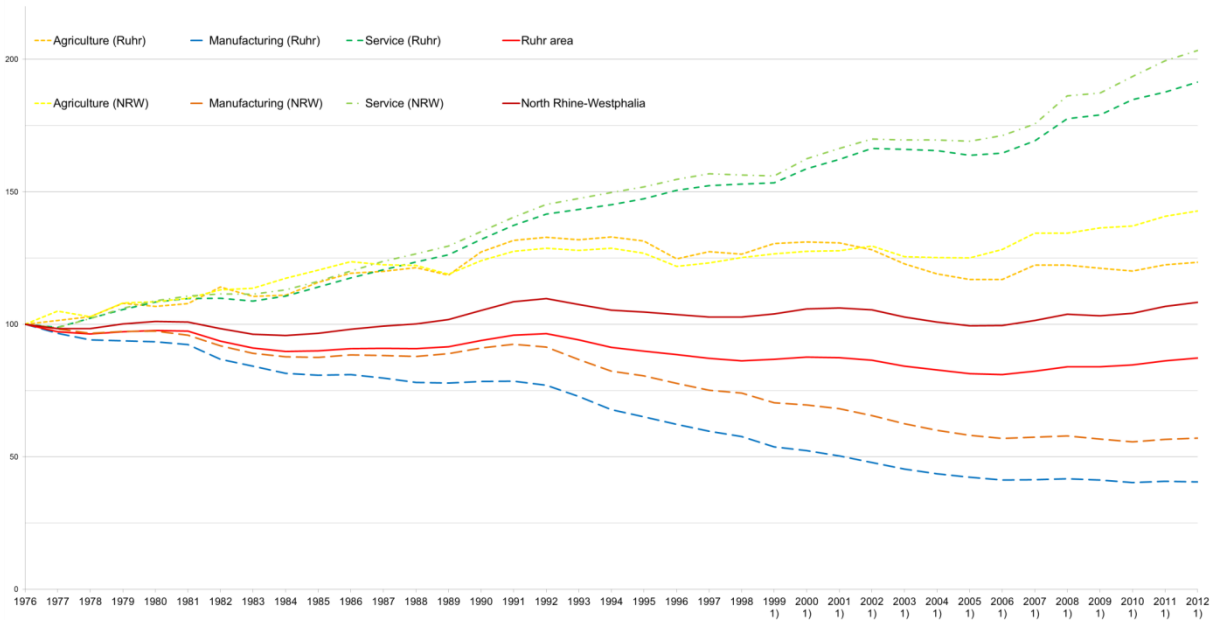


Figure 2.4. Development of employees in the Ruhr area by main economic sector, 1991-2010.

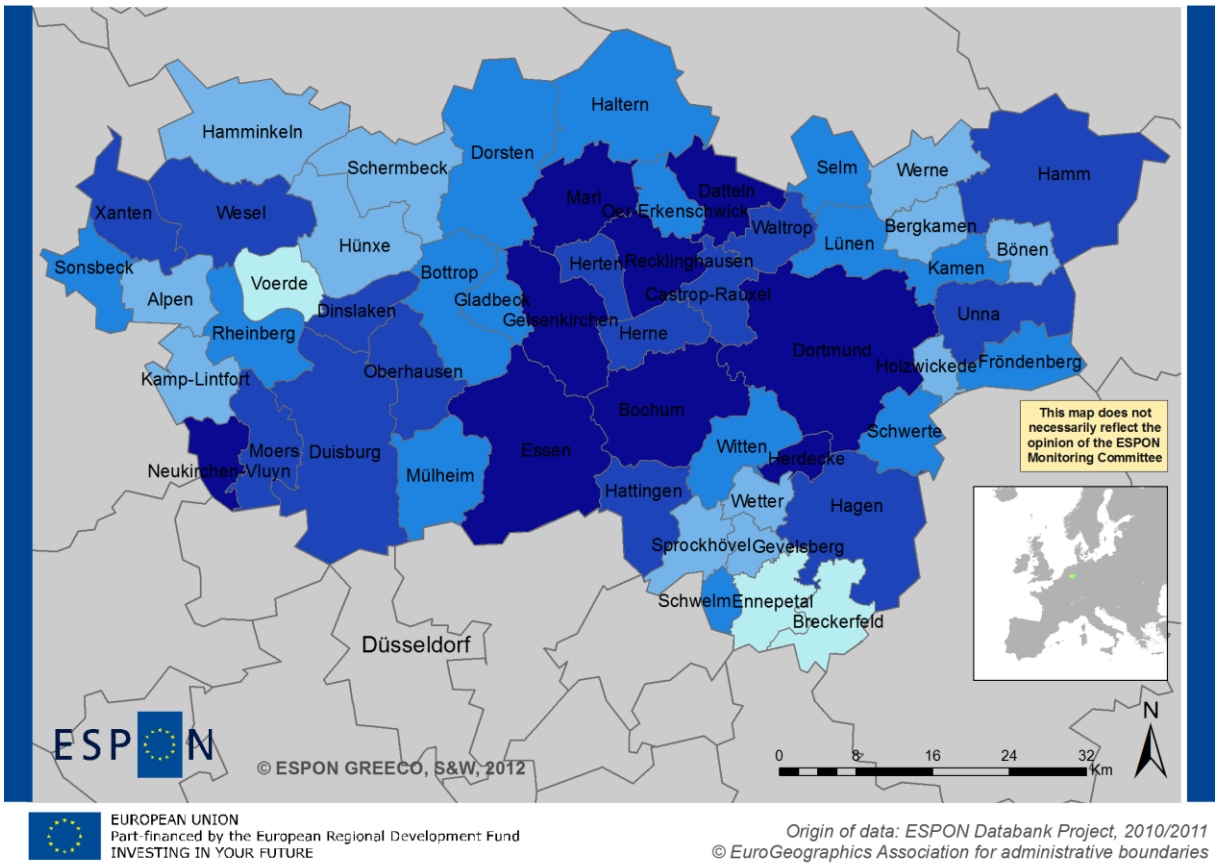


Figure 2.5. Share of employees in the sector "Other Services" in the Ruhr area, 2012

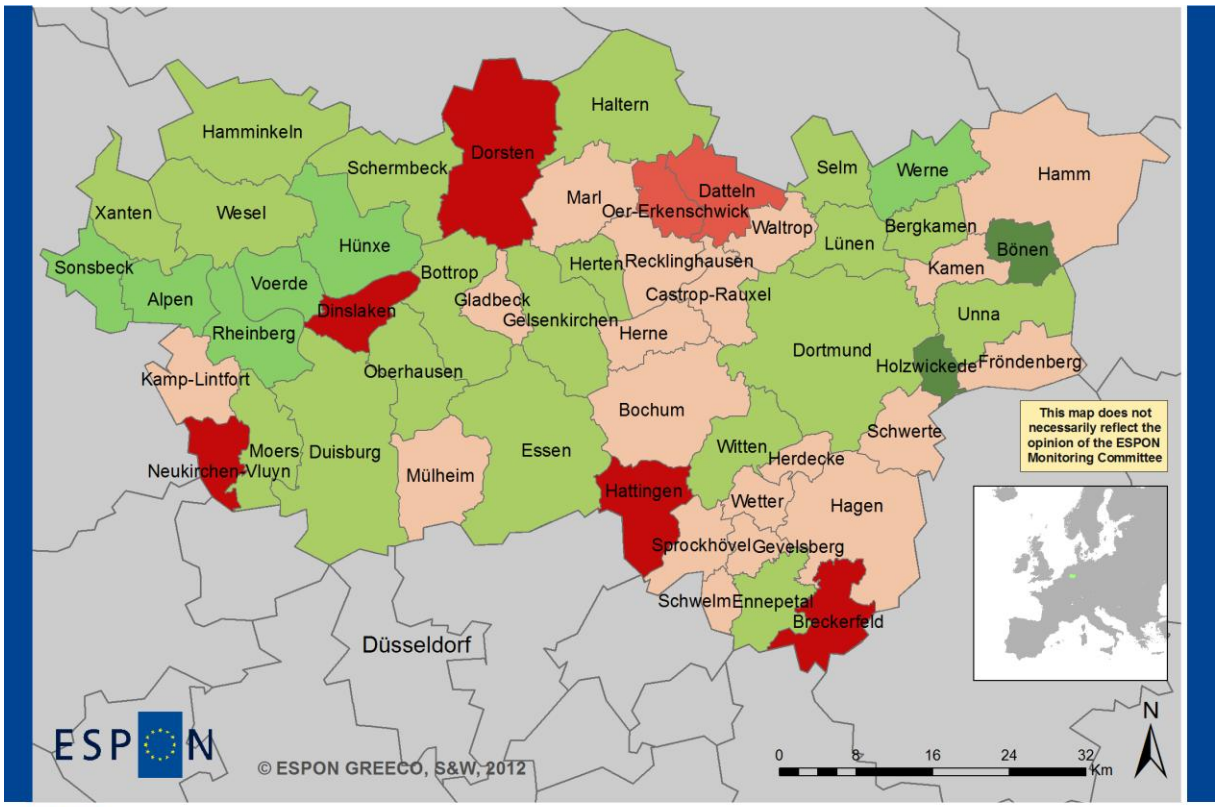


Figure 2.6. Employment change in the Ruhr area, 2000-2012

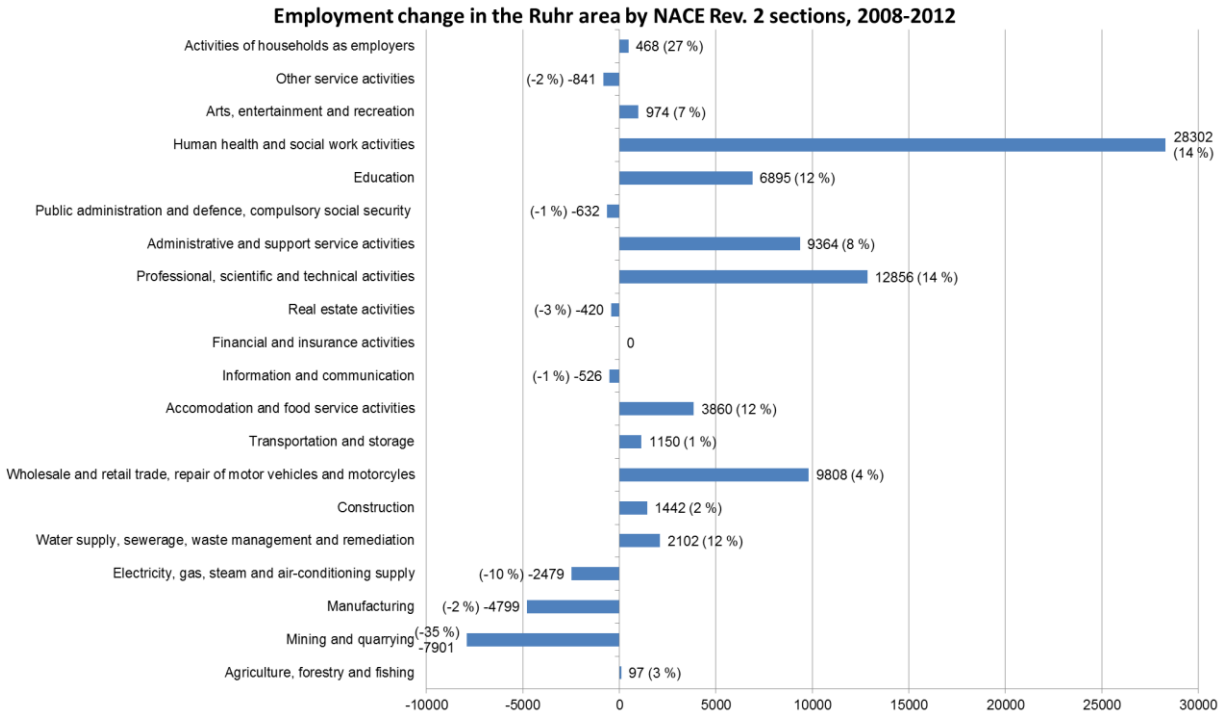


Figure 2.7. Employment change in the Ruhr area by NACE Rev. 2 sectors, 2008-2012

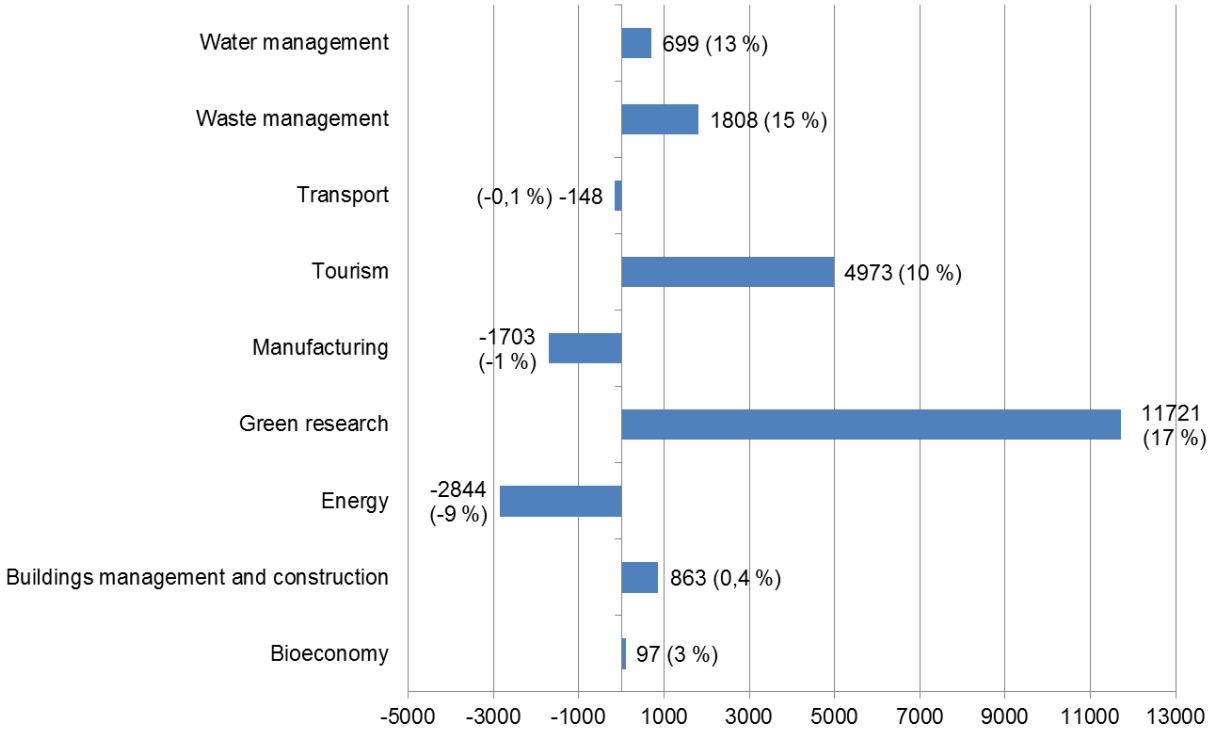


Figure 2.8. Employment change in the Ruhr area by GREECO sectors, 2008-2012

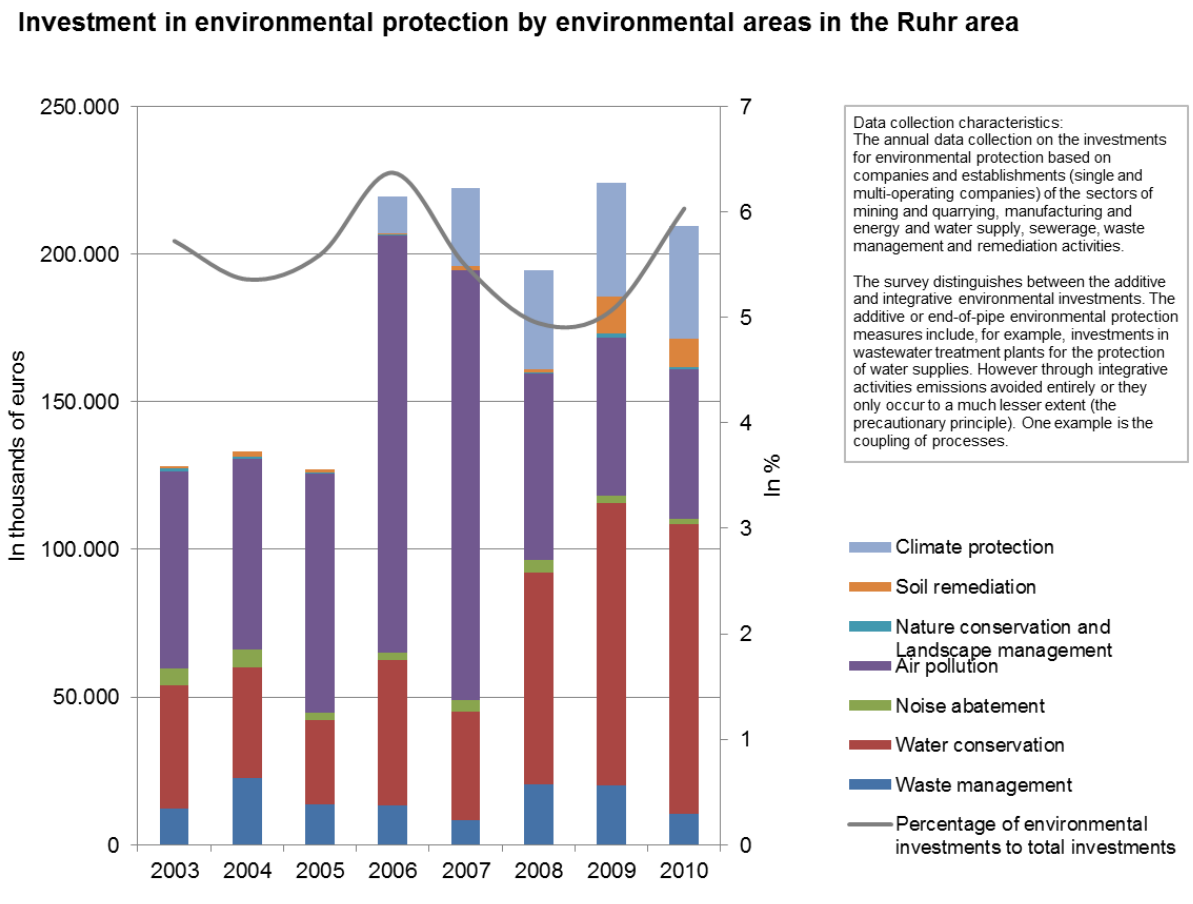


Figure 2.9. Investments of enterprises in environmental protection in the Ruhr areas

3 Water as key sector for the green economy in the Ruhr area

3.1 Performance of the water sector:

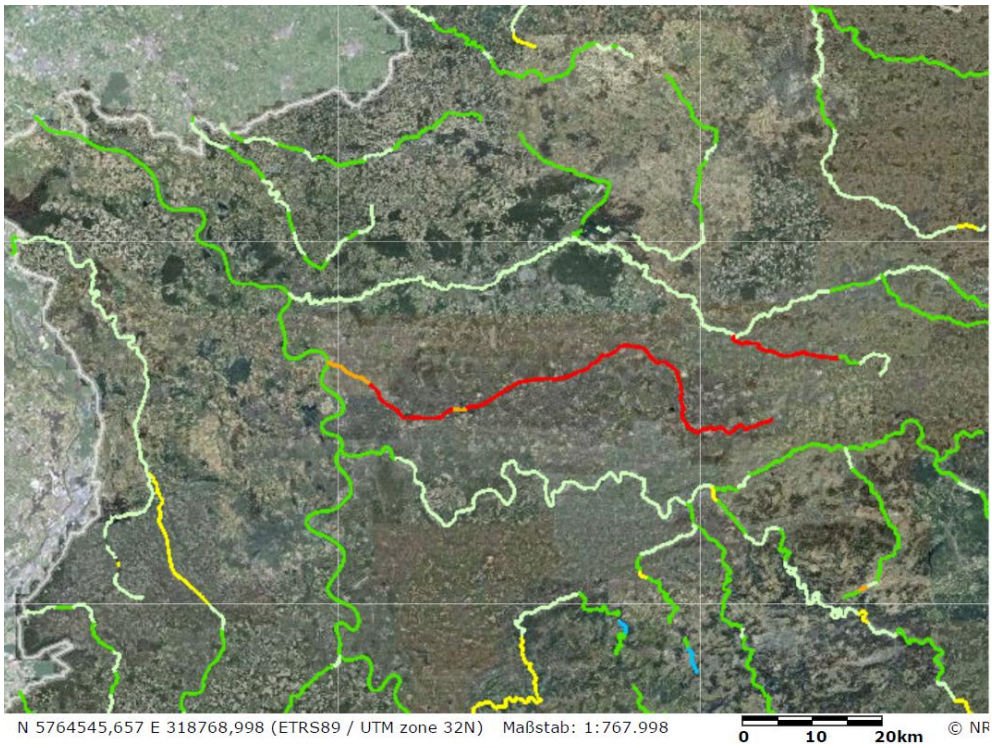


Figure 3.1. Water quality of flowing rivers in NRW (MKULNV, 2013)

3.2 Key milestones of the development of the water sector

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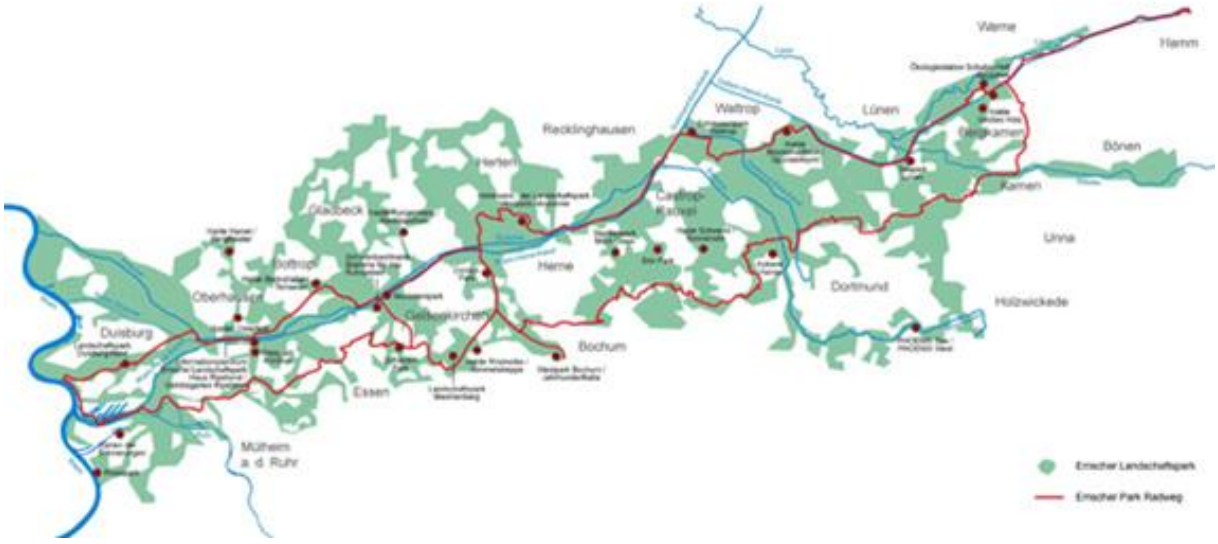


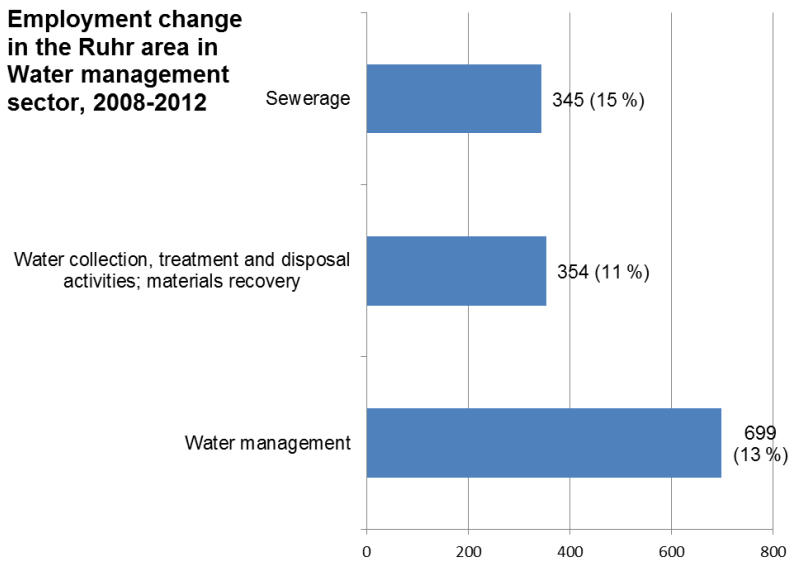


Figure 3.2: Employment change in the Ruhr in Water management sector, 2008-2012

3.3 Drivers, barriers and enabling conditions

3.4 Spatial dimensions of the development of the water sector

3.5 Links with other sectors

i

Individual projects: HYBRID power plant Emscher – Smart Area

- From the treatment plant to the power plant
- The Emscher sewage treatment plant is not gonna be just the wastewater treatment, but also in power production.
- Energy produced (heat production and electricity generation) from the waste such as sewage sludge and sewage (heat production and electricity generation).
- Solar and wind are used for the energy supply of the treatment plant.
- through this combination creates a HYBRID power plant
- Energy can be storage by sewage gas, hydrogen and biomethane storage

3.6 Potential for development of the sector

4. Energy as key sector for the green economy in the Ruhr area

4.1 Performance of the energy sector

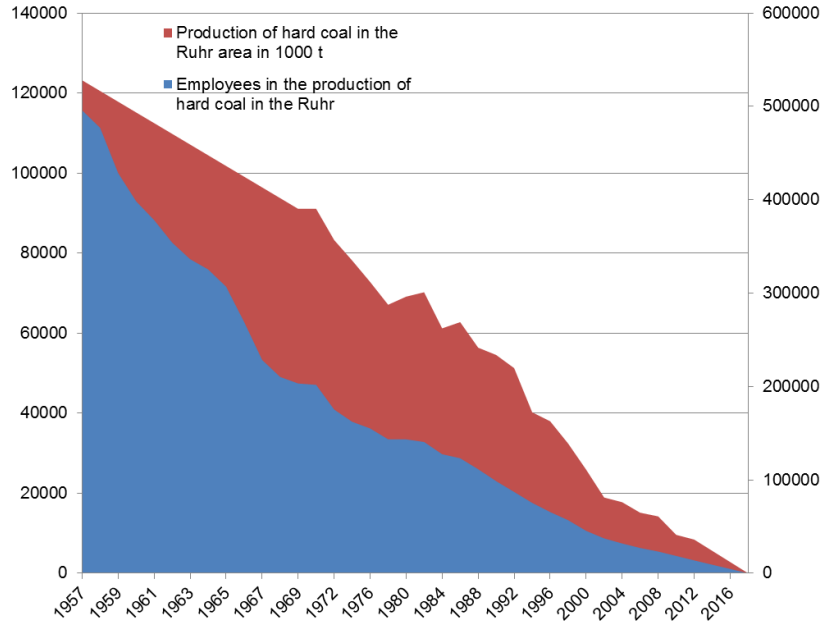
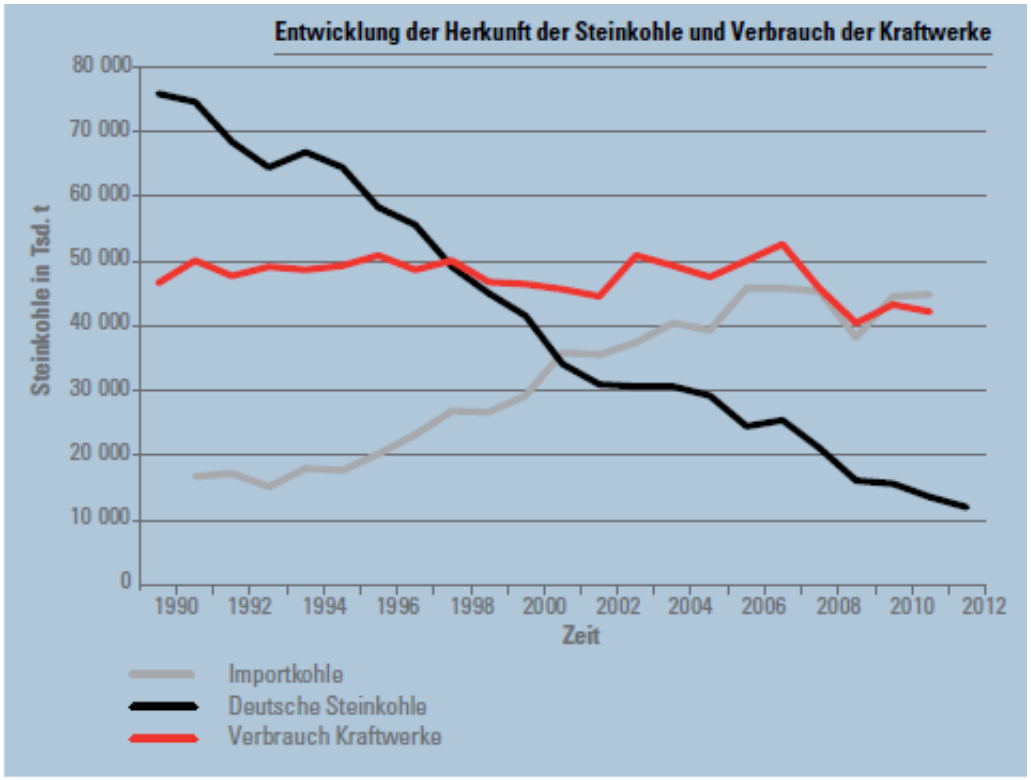
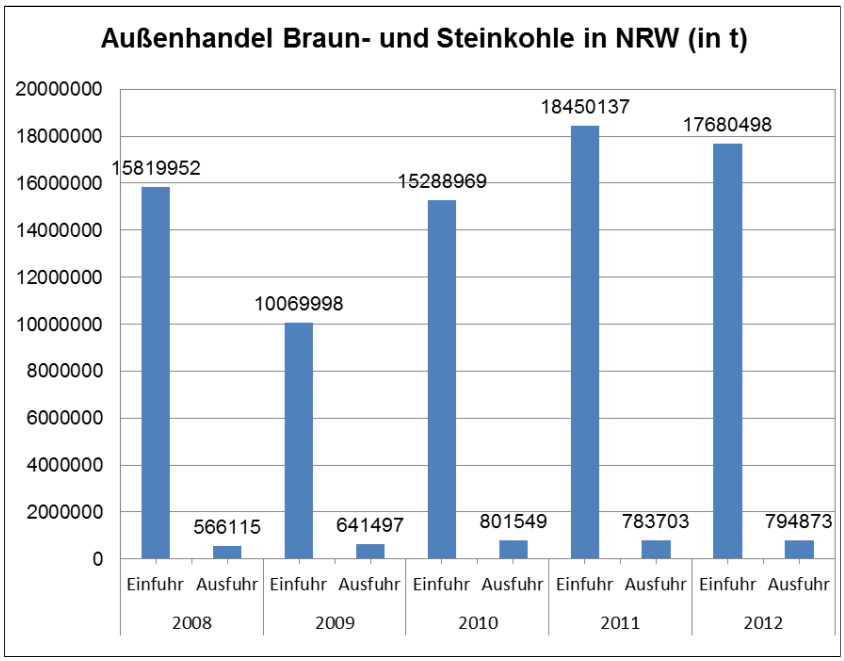


Figure 4.1: Production of hard coal in the Ruhr area, 1957-2018





Energy production

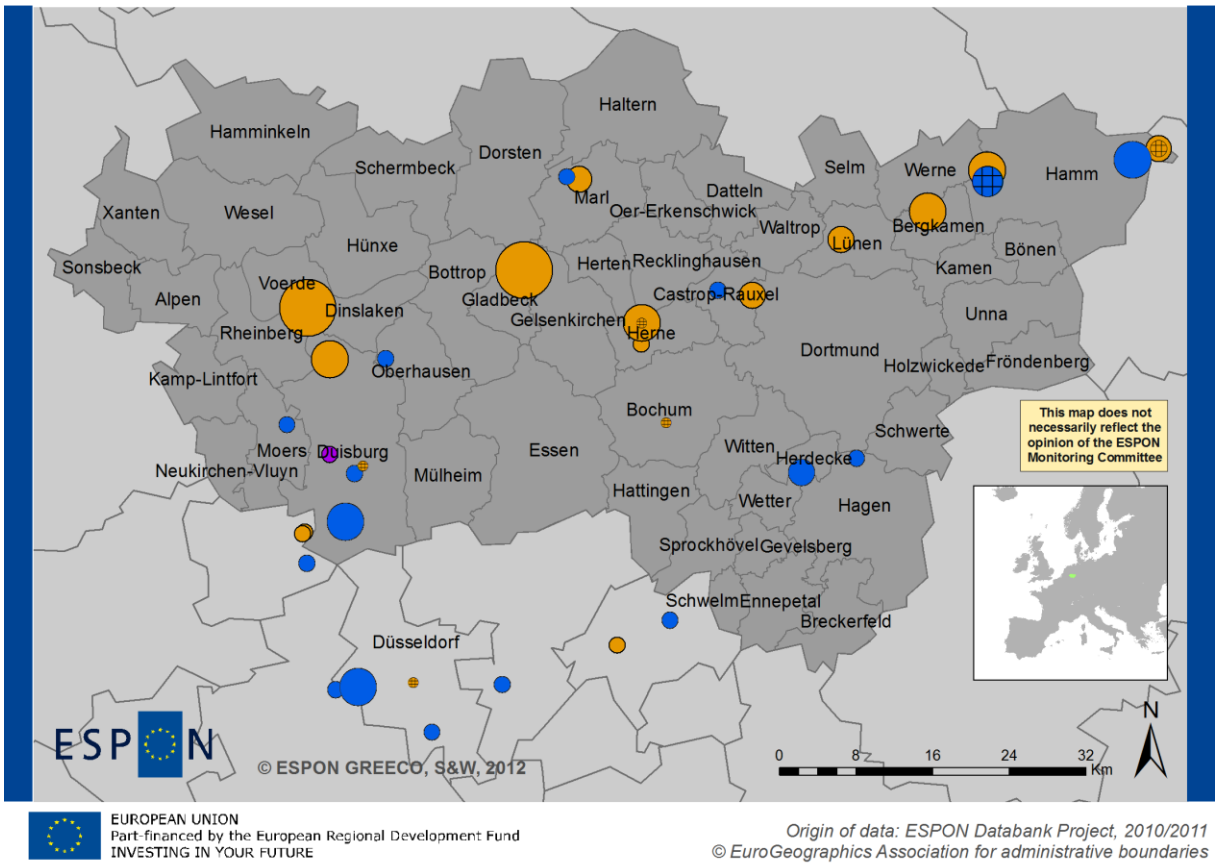


Figure 4.4: Power plant sites in the Ruhr area

Greenhouse gas emission

Electricity consumption

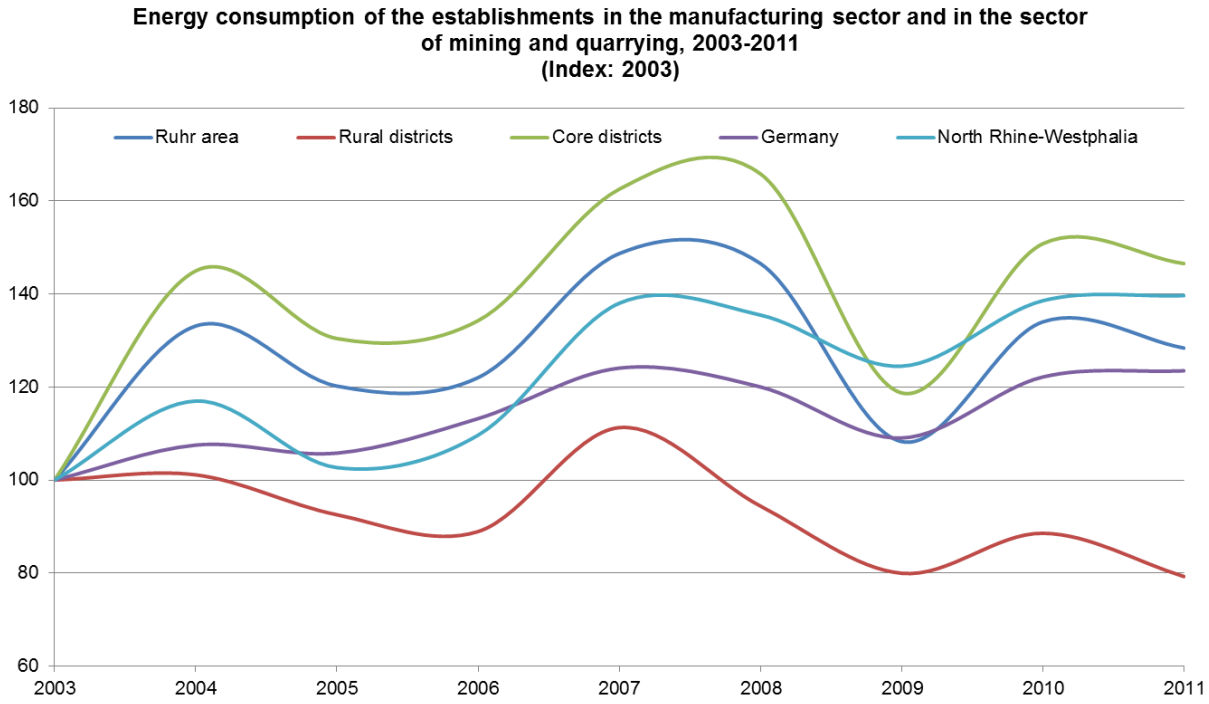


Figure 4.5: Energy consumption of the establishments in the manufacturing sector and in the sector of mining and quarrying, 2003-2011

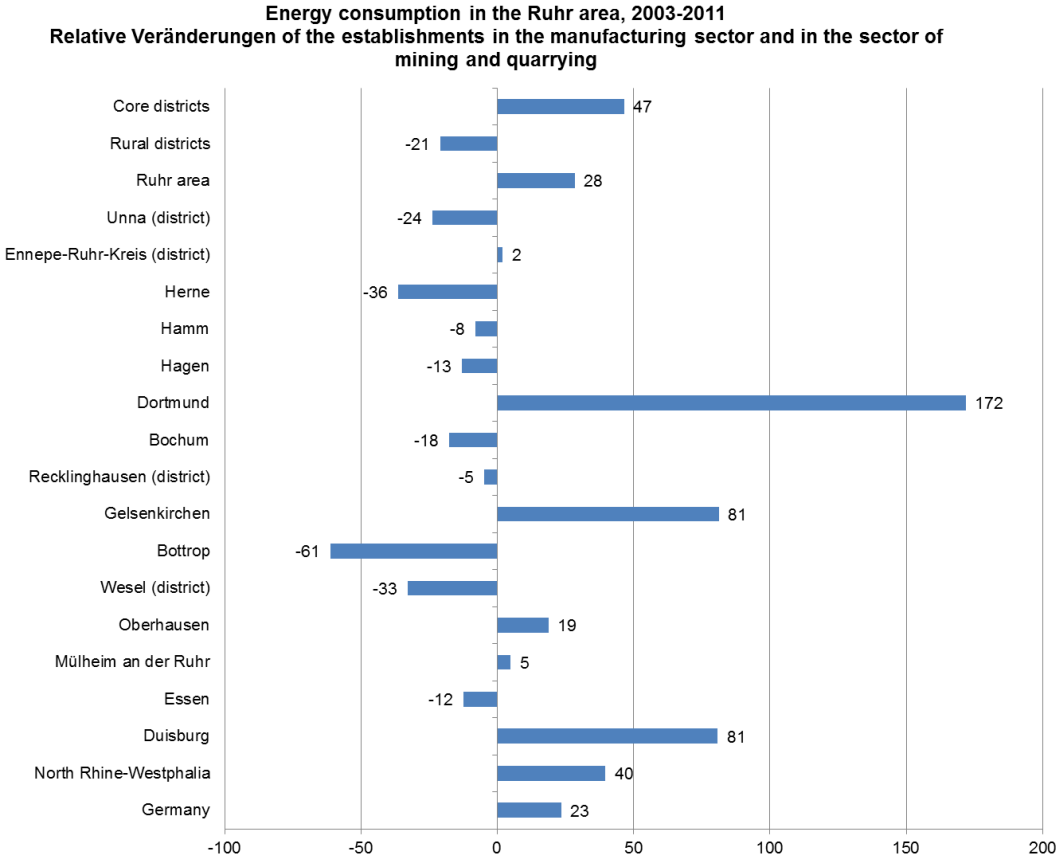


Figure 4.6: Energy consumption in the Ruhr area, 2003-2011

4.2 Key milestones of the development of renewable energy sources

Natural assets suitable for RES generation

Wind energy

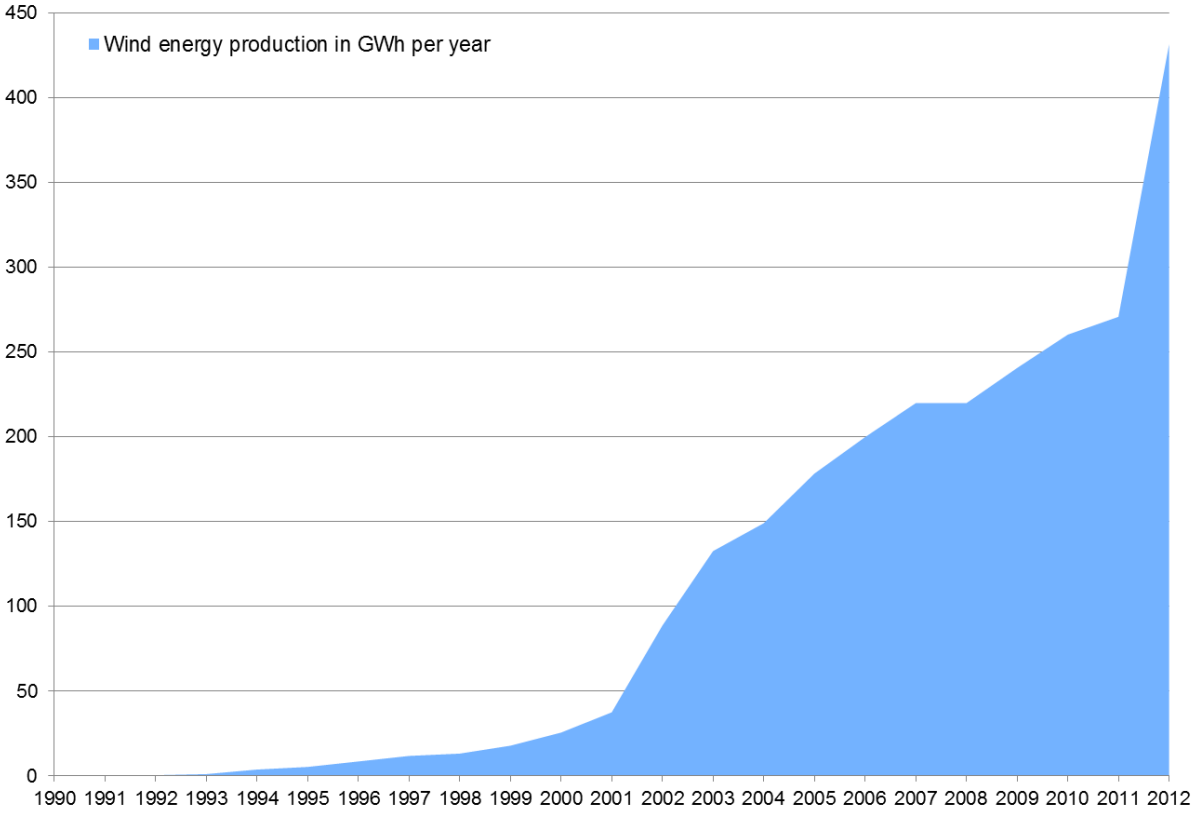


Figure 4.7: Electricity production from wind energy in the Ruhr area, 1990-2012

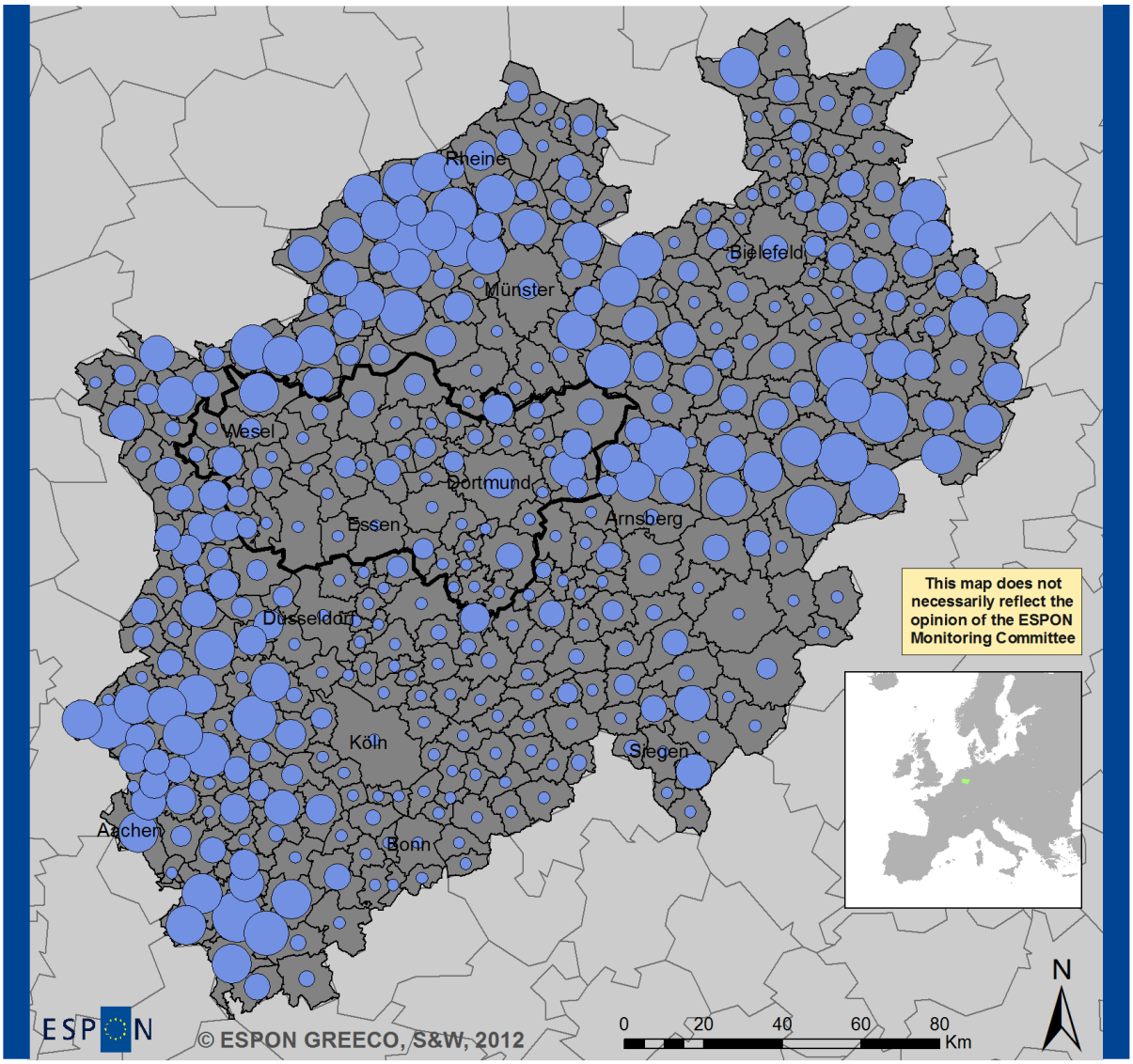


Figure 4.8: Electricity production from wind energy 2012 (GWh)

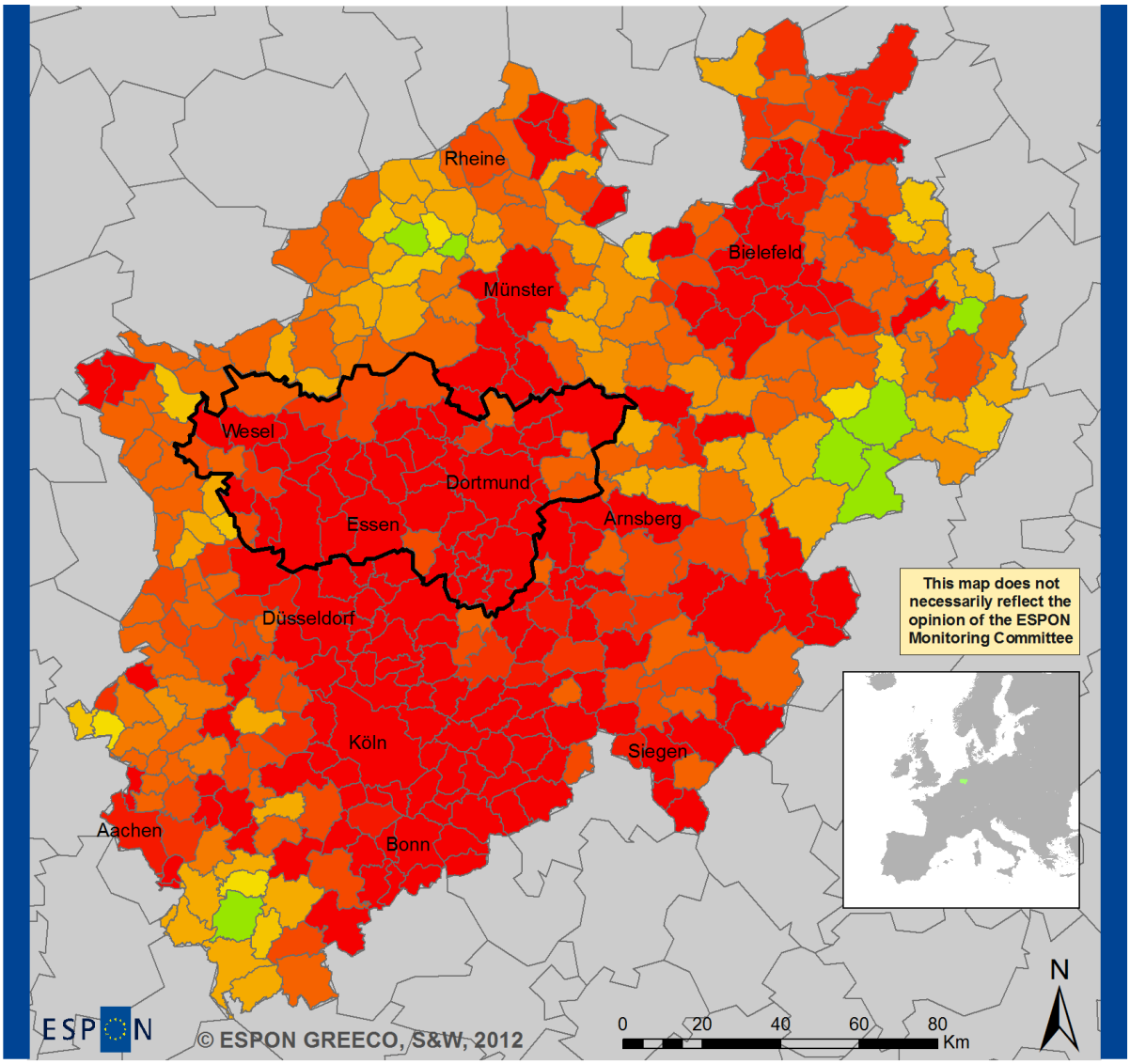


Figure 4.9: Electricity production from wind energy 2012 of electricity consumption 2011 (%)

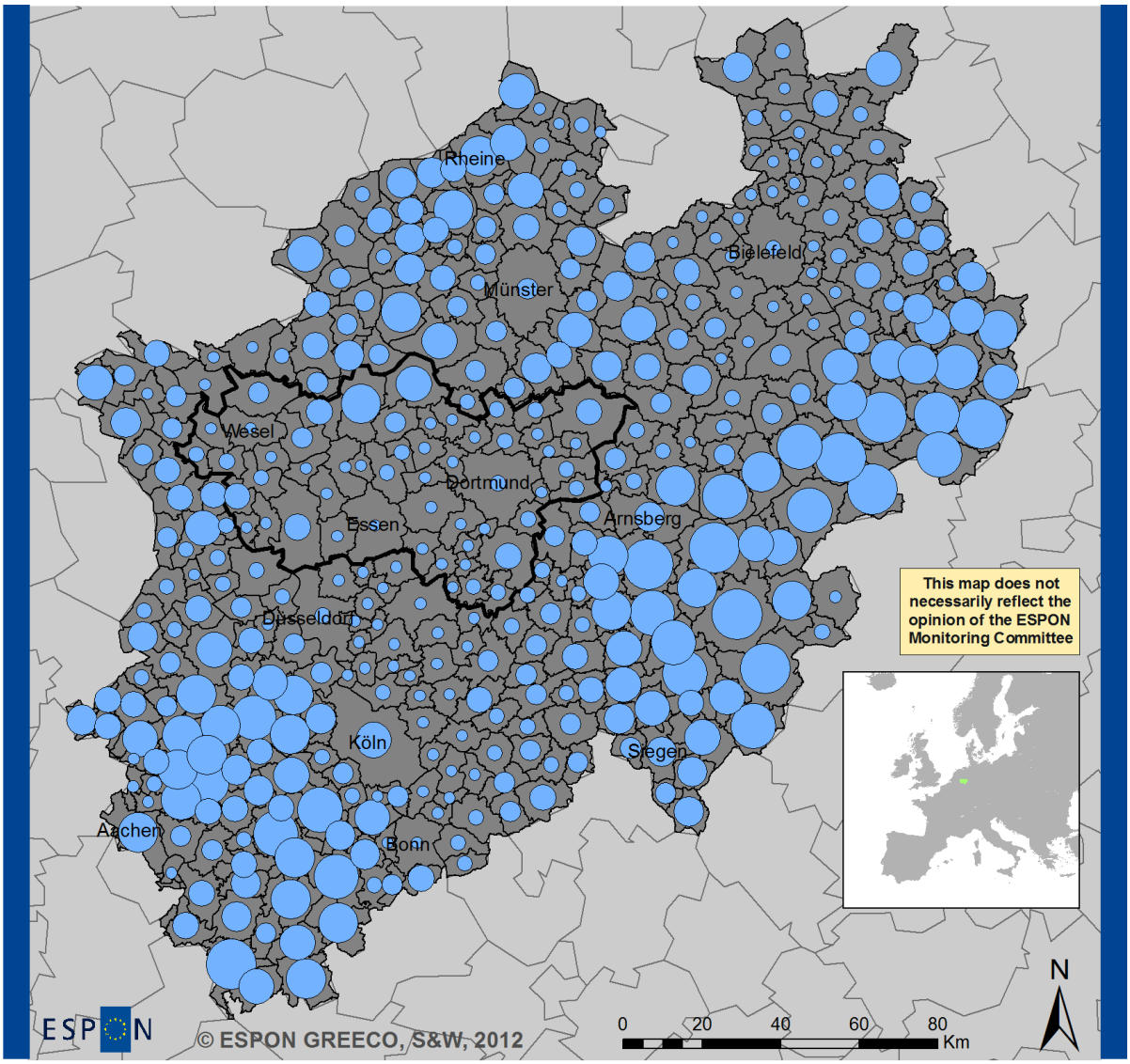


Figure 4.10: Wind energy potential for electricity production (GWh)

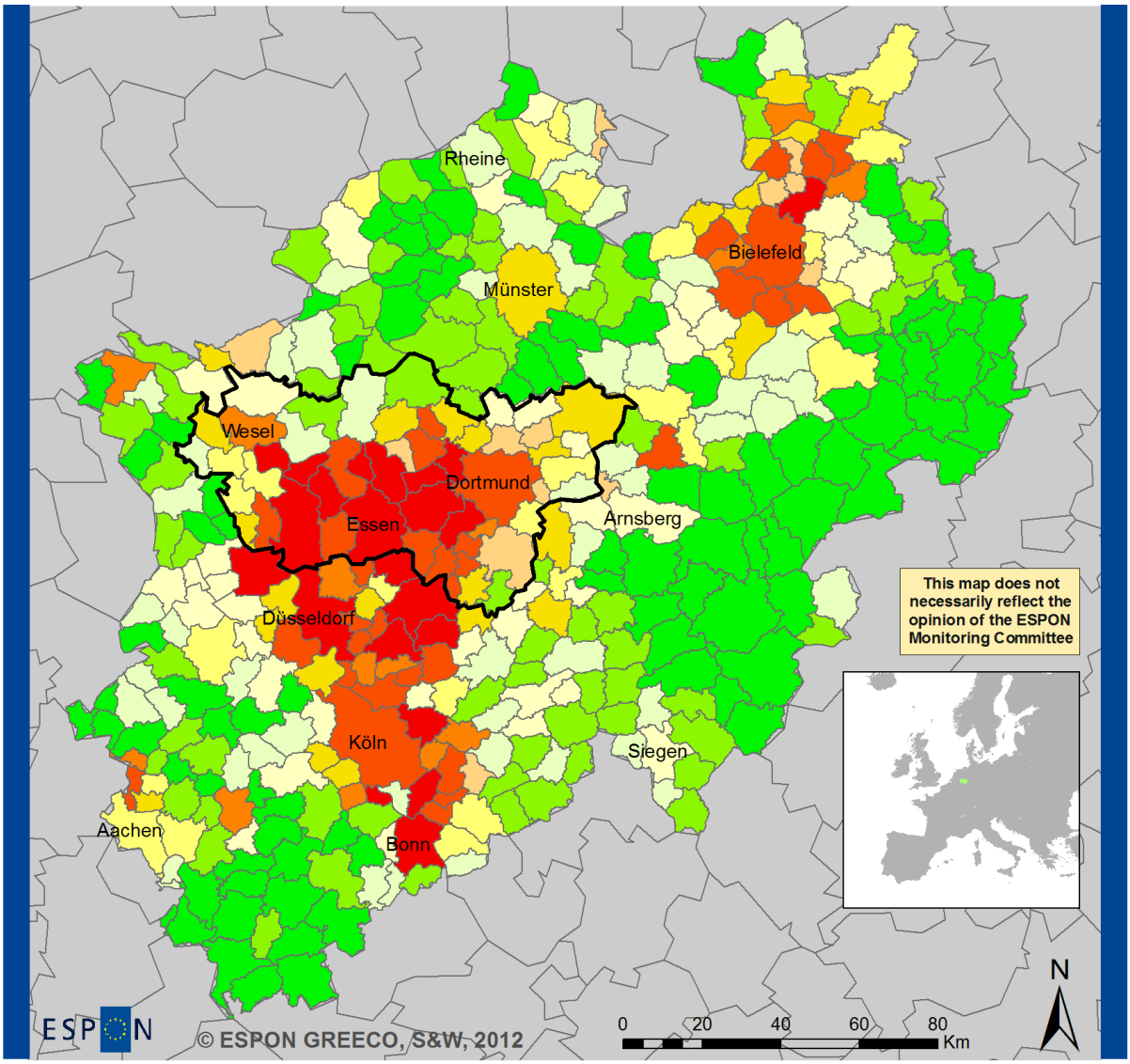


Figure 4.11: Wind energy potential of electricity consumption 2011 (%)

Solar energy

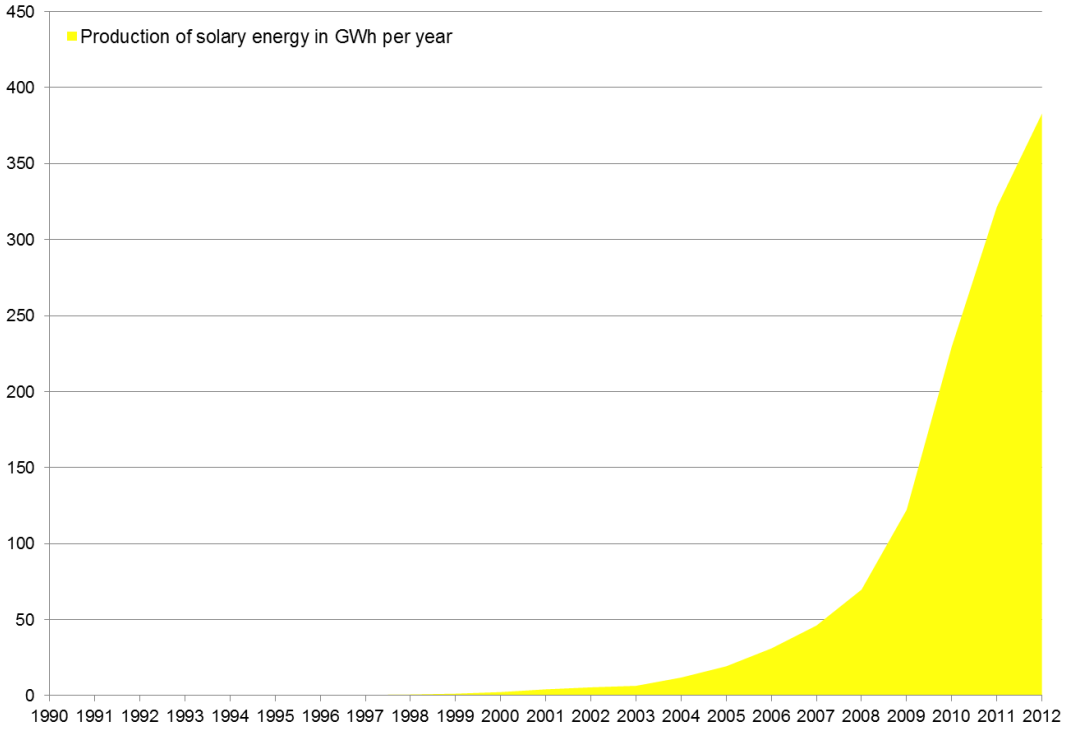


Figure 4.12: Electricity production from solar energy in the Ruhr area, 1990-2012

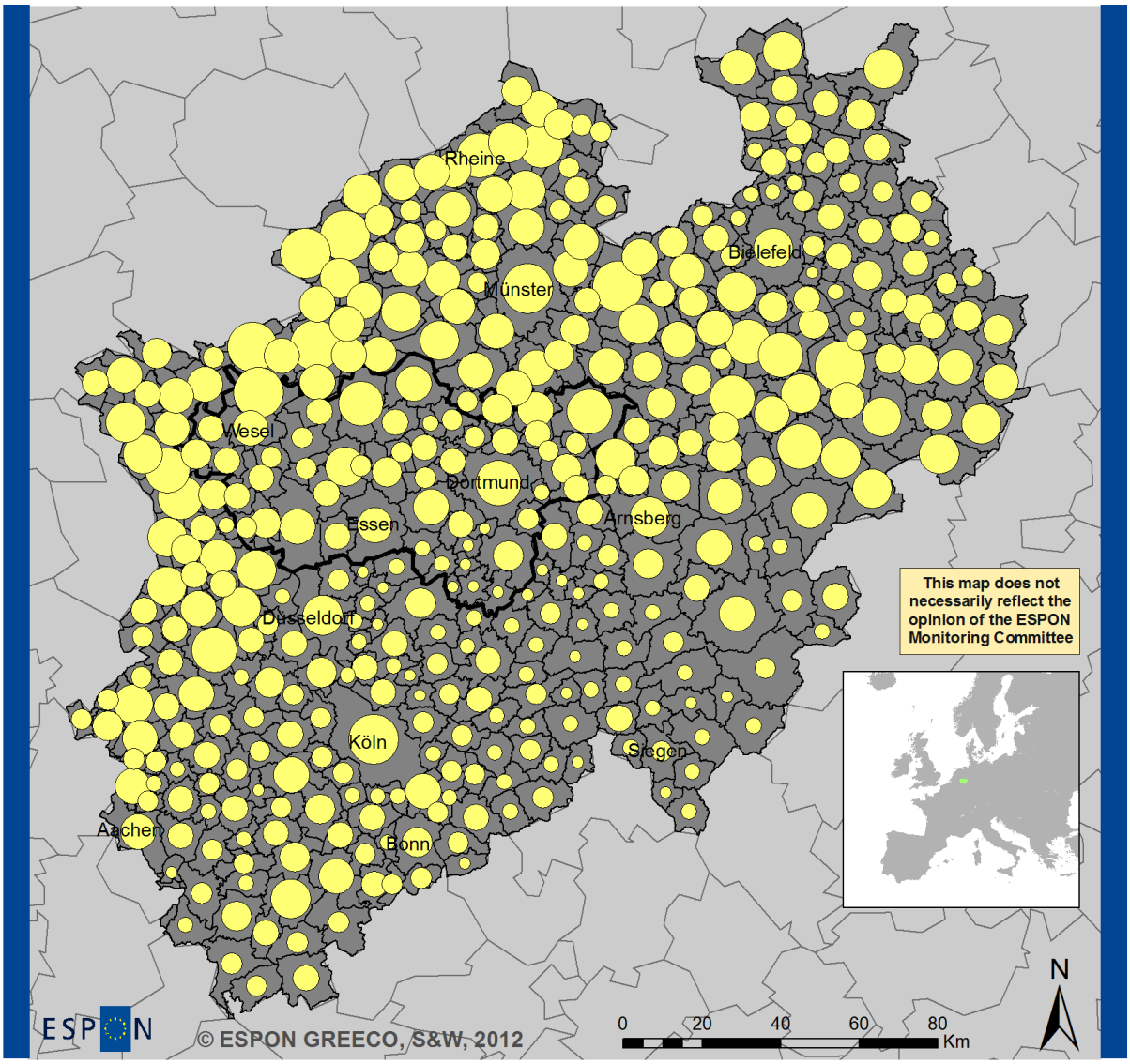


Figure 4.13: Electricity Production from photovoltaic 2012 (GWh)

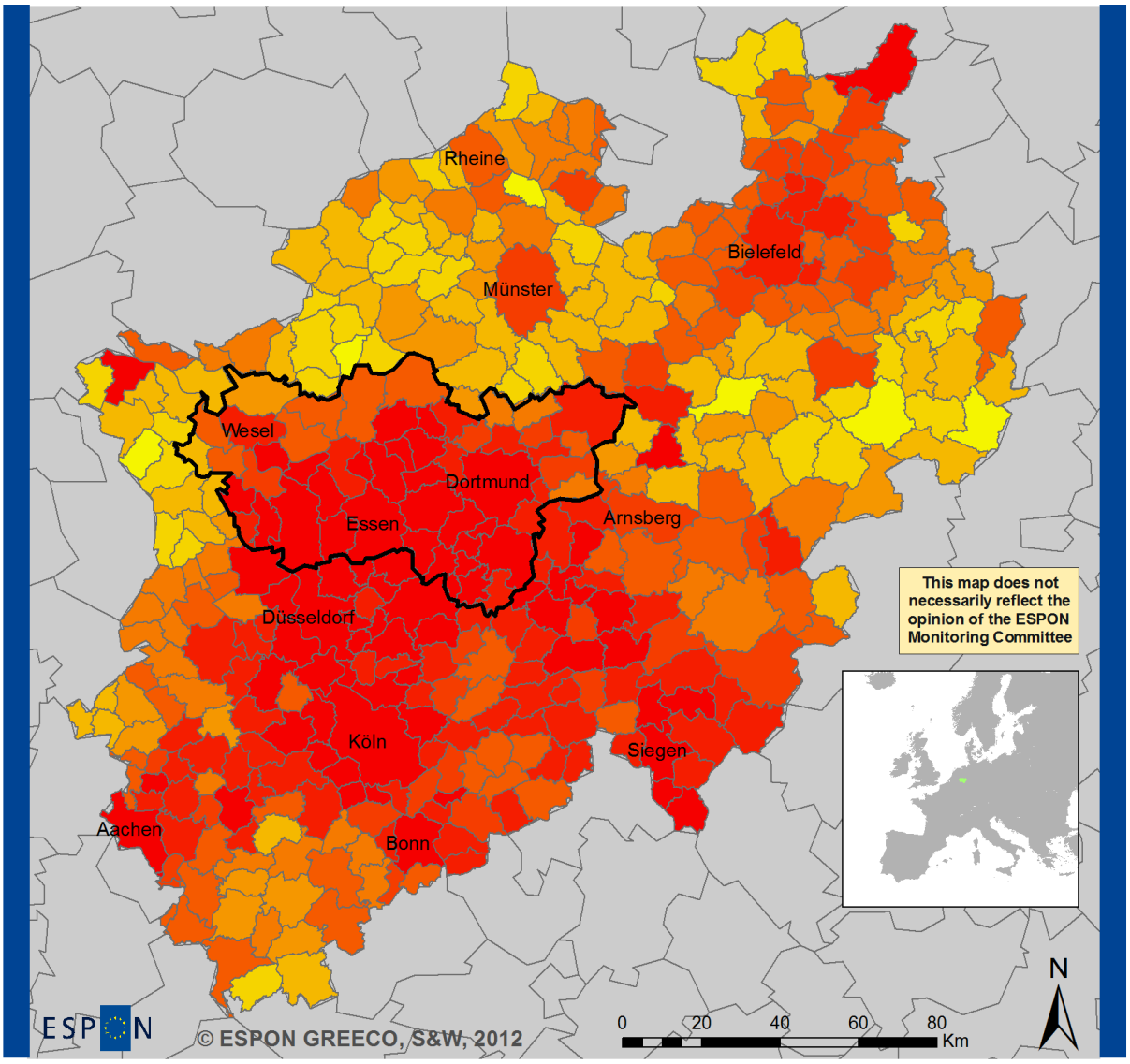


Figure 4.14: Electricity production from photovoltaic 2012 of electricity consumption

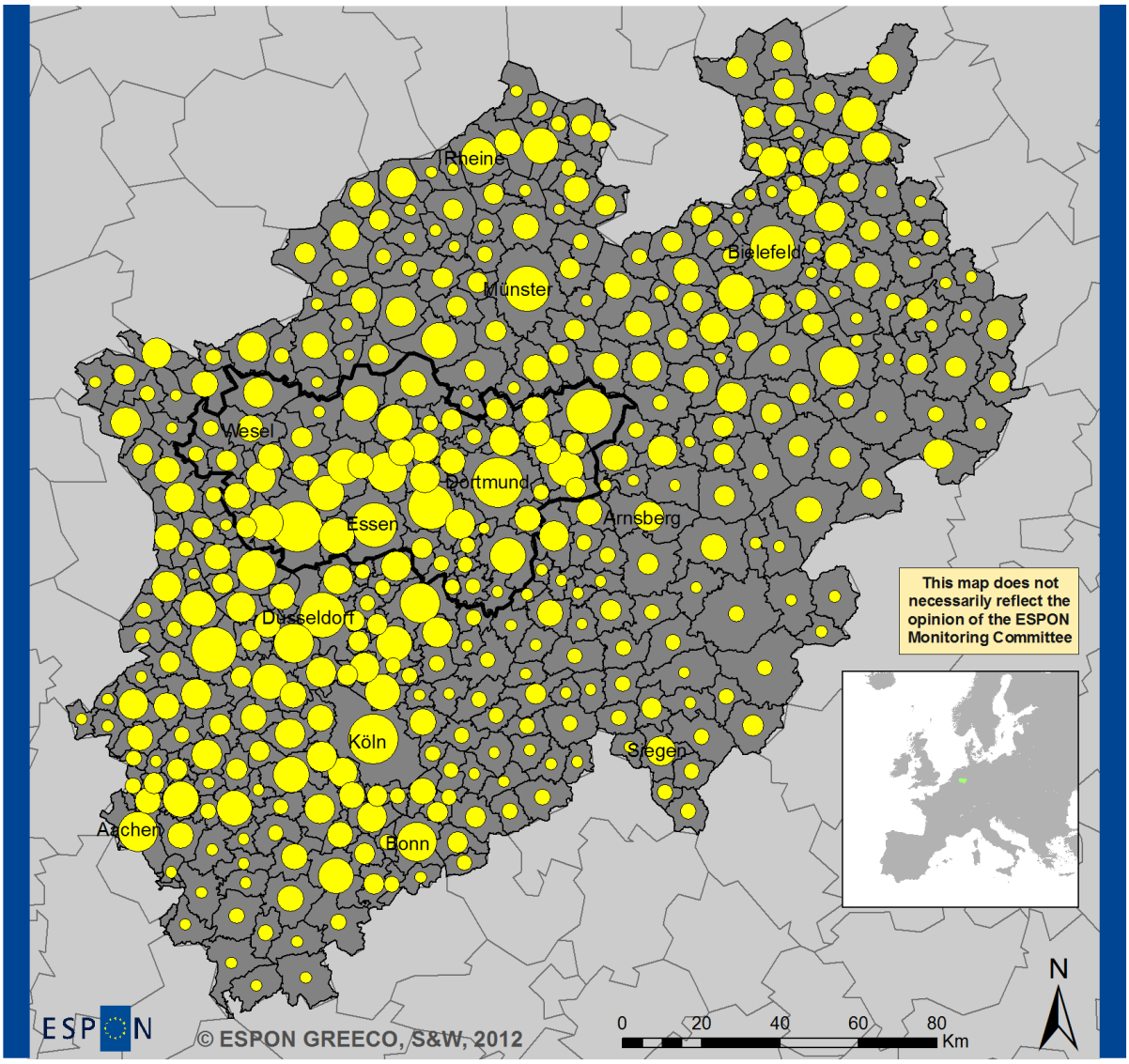


Figure 4.15: Photovoltaic potential for electricity production (GWh)

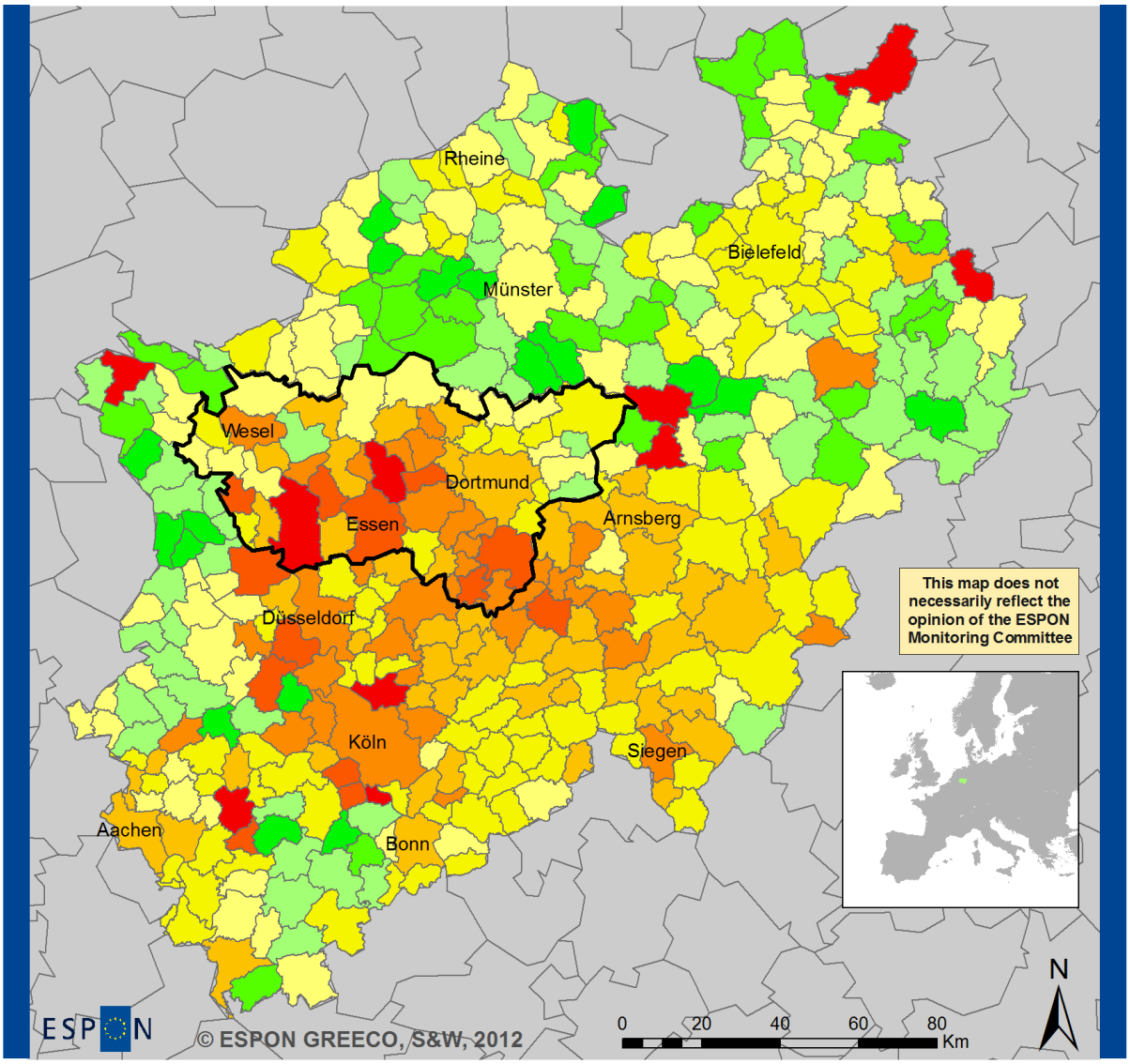


Figure 4.16: Photovoltaic potential for electricity production of electricity consumption 2011

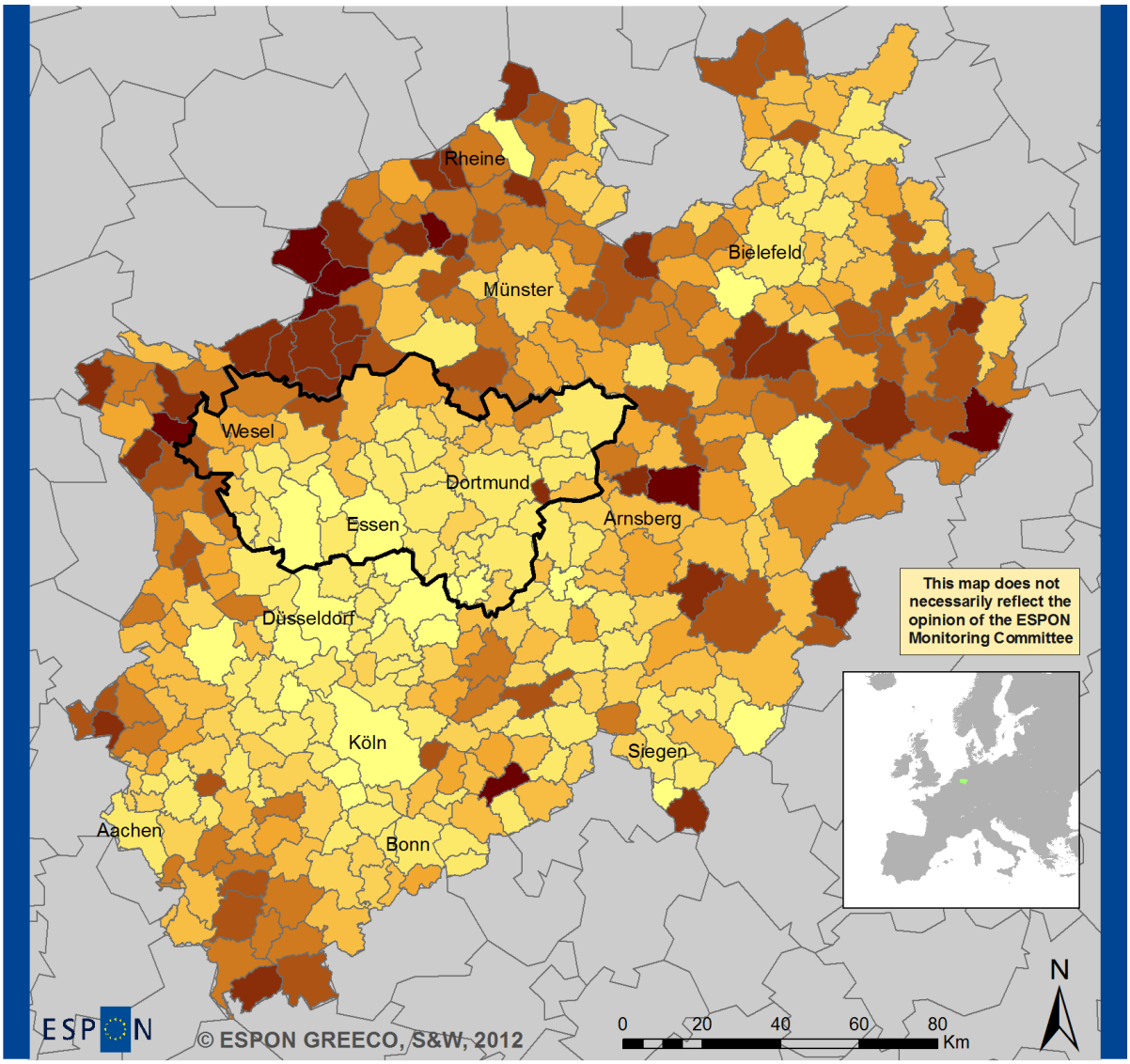


Figure 4.17: Already realised potentials

Biomass

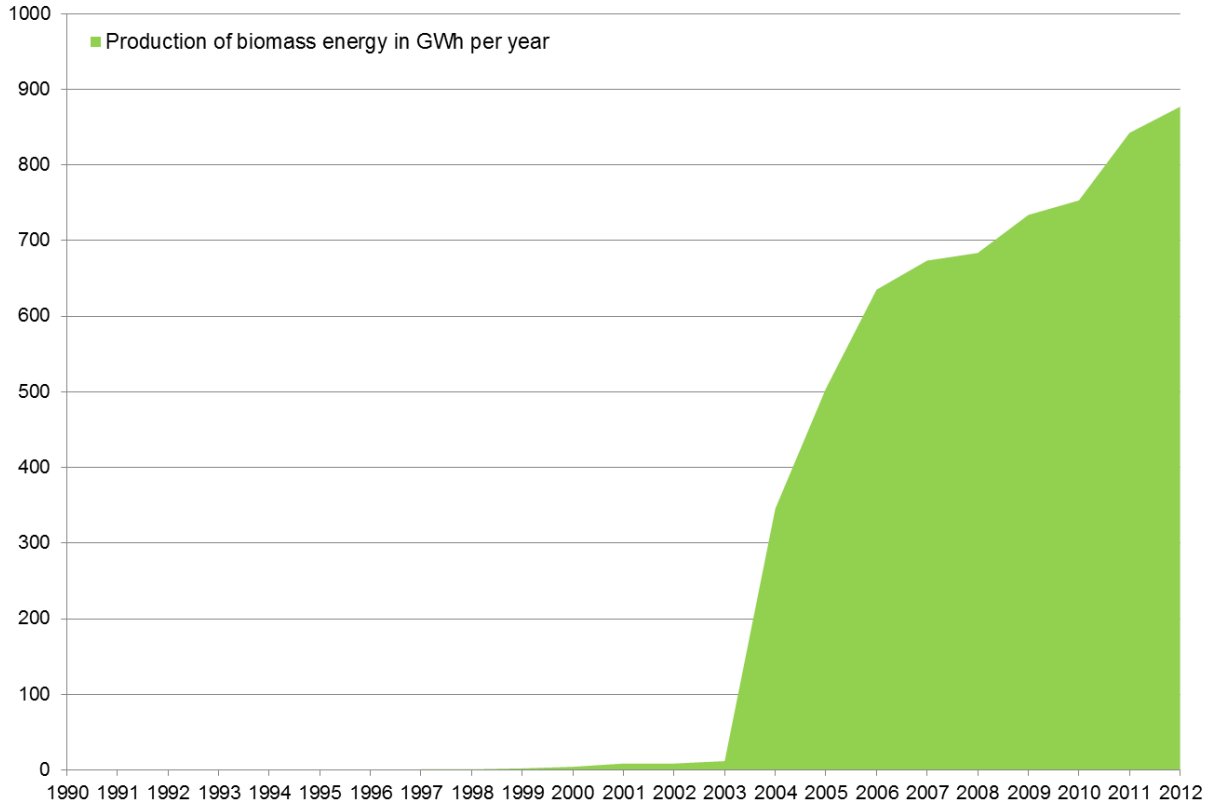


Figure 4.18: Electricity production from biomass in the Ruhr area, 1990-2012

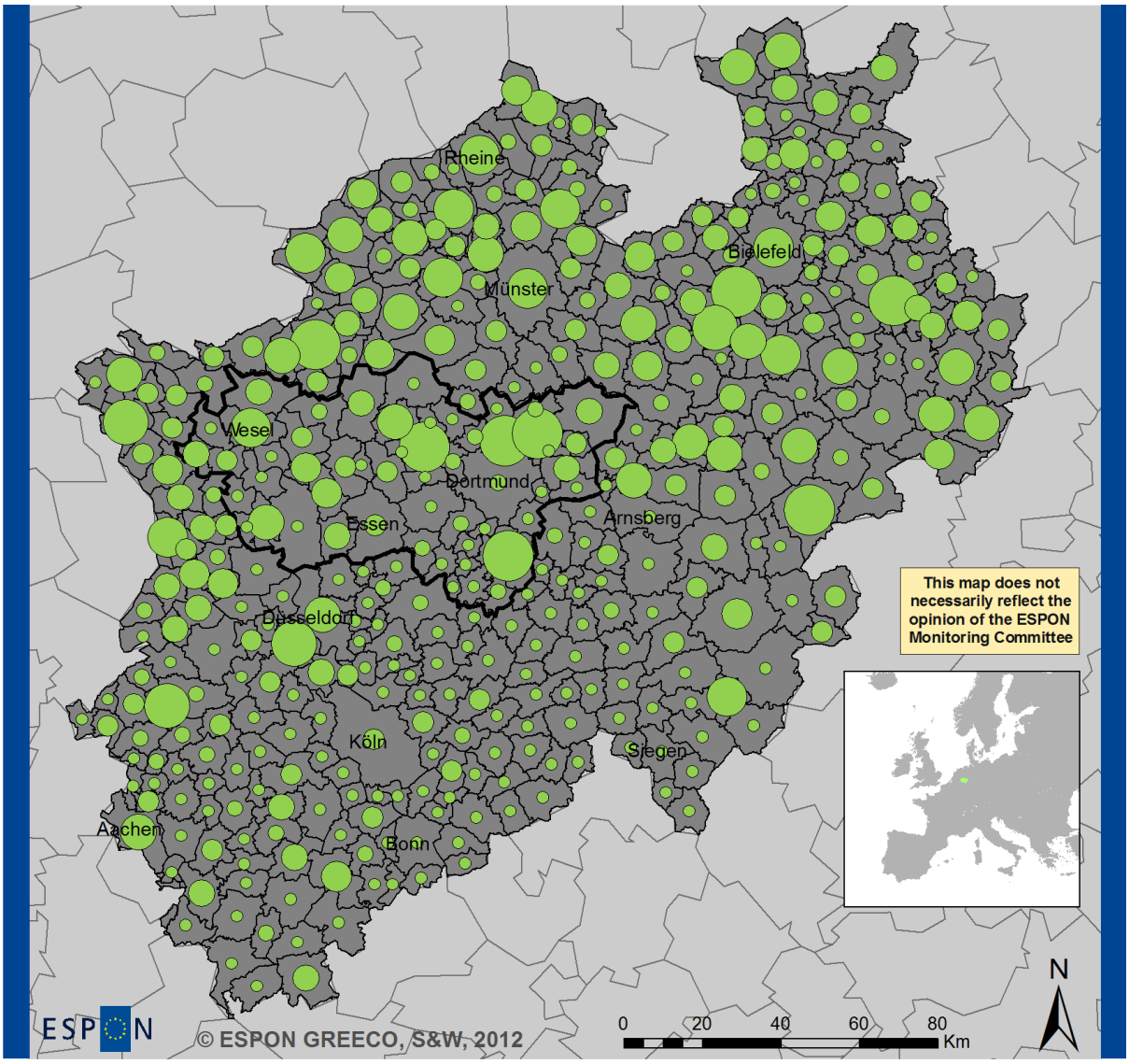


Figure 4.19: Electricity production from biomass 2012 (GWh)

Other alternative energy sources

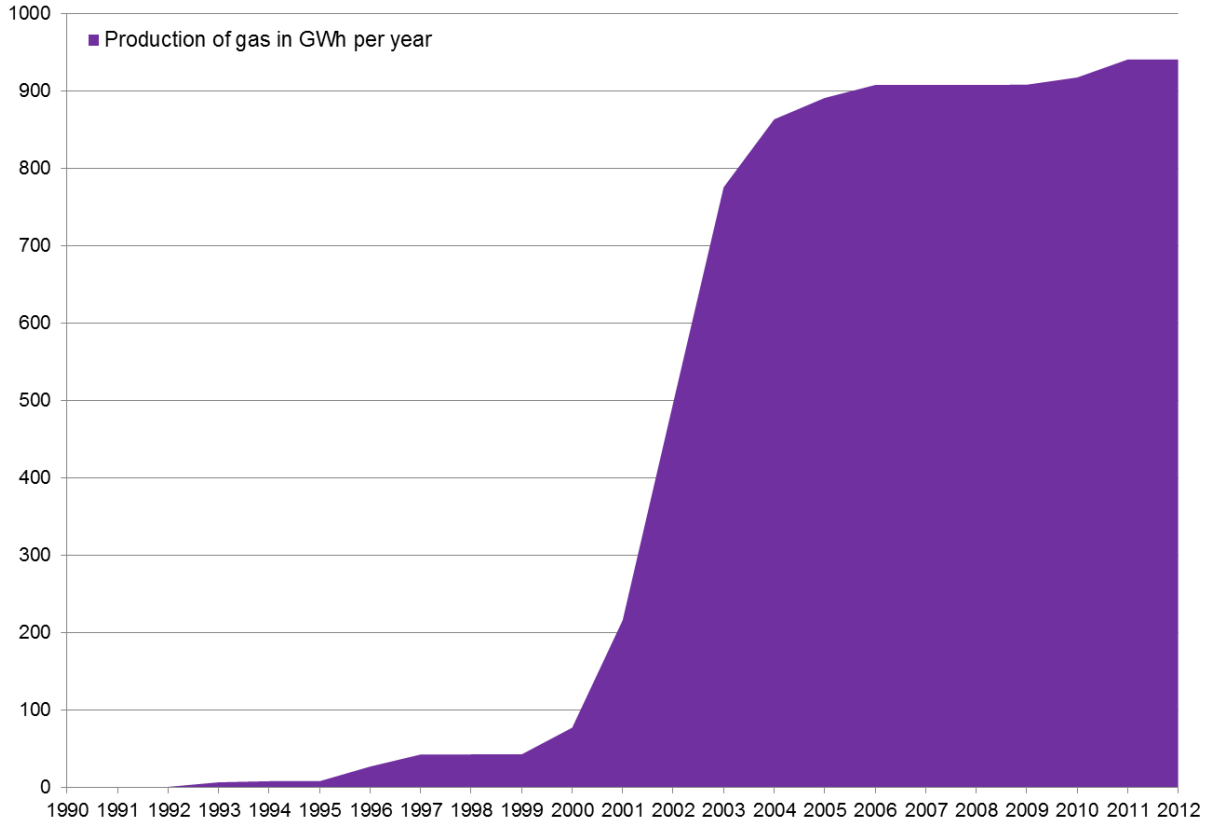
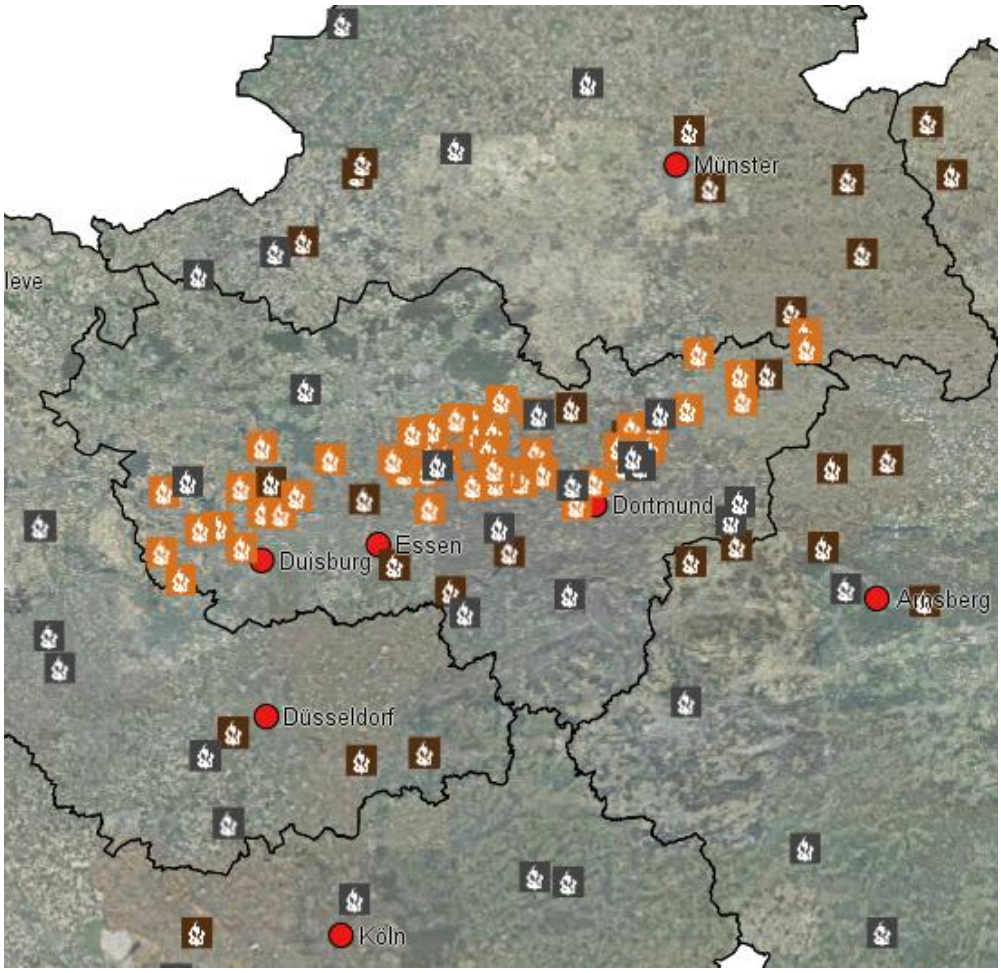


Figure 4.20: Electricity production from mine gas, landfill gas and sewage gas in the Ruhr area, 1990-2012



Grubengas – orange / hellbraun

Deponiegas – grau

Klärgas – dunkelbraun

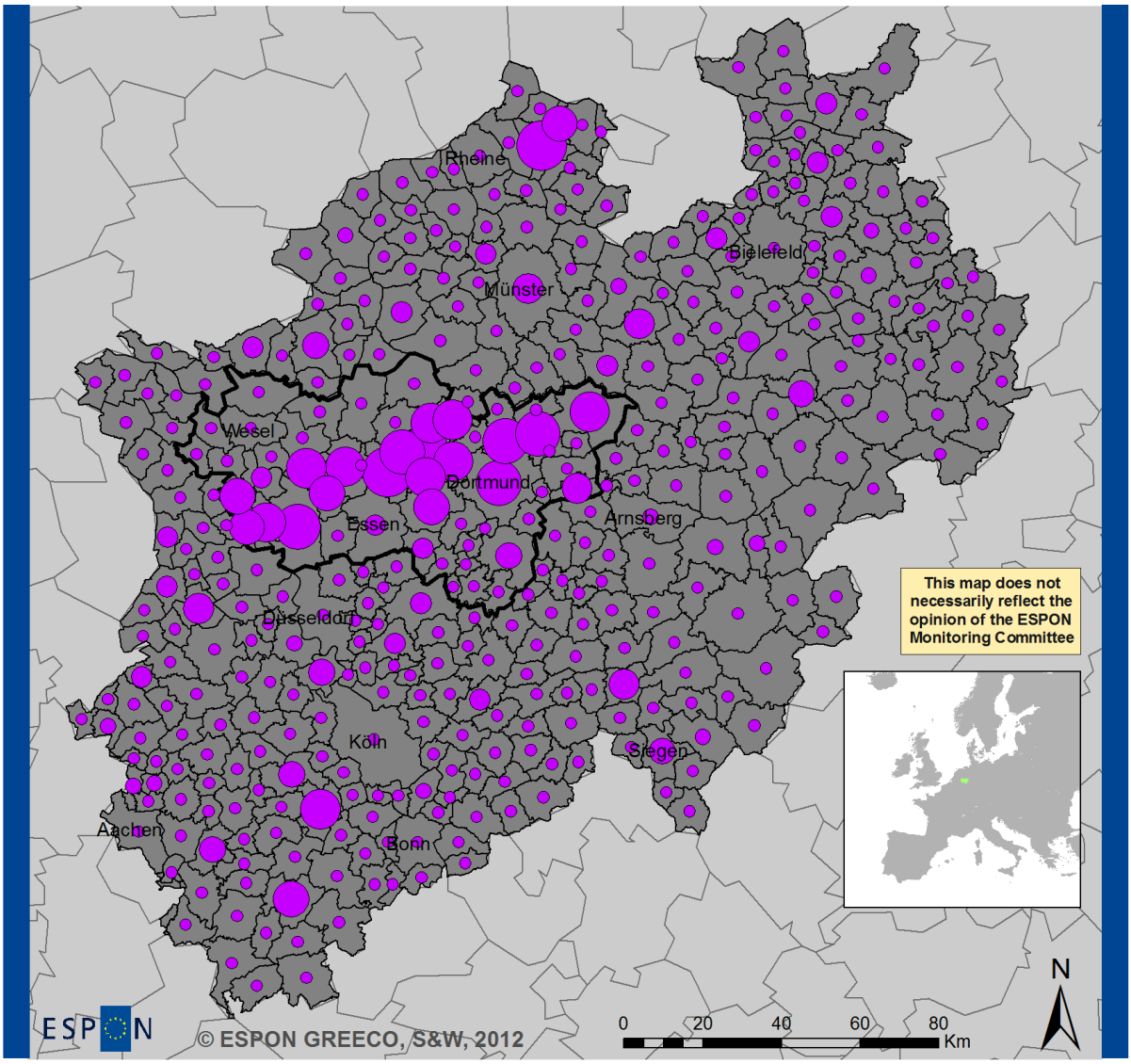


Figure 4.22: Electricity production from mine gas, landfill gas and sewage gas 2012 (GWh)

Water power

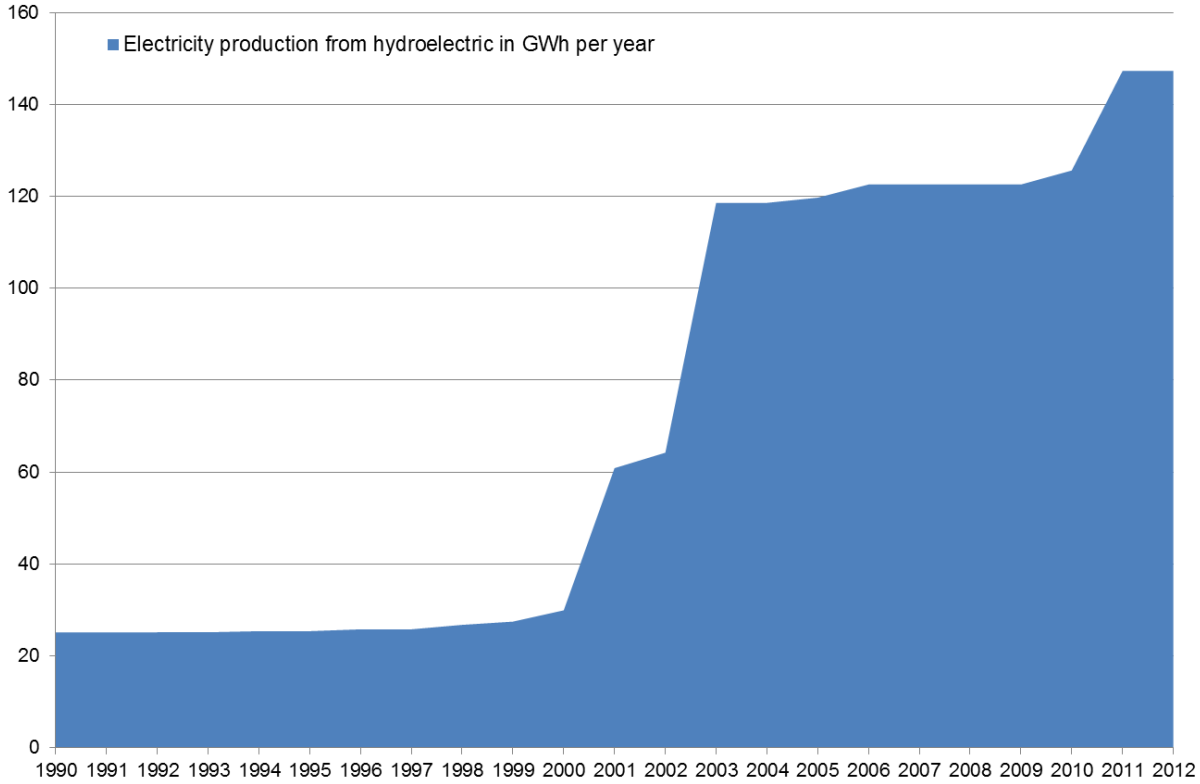


Figure 4.23: Electricity production from hydroelectric in the Ruhr area, 1990-2012

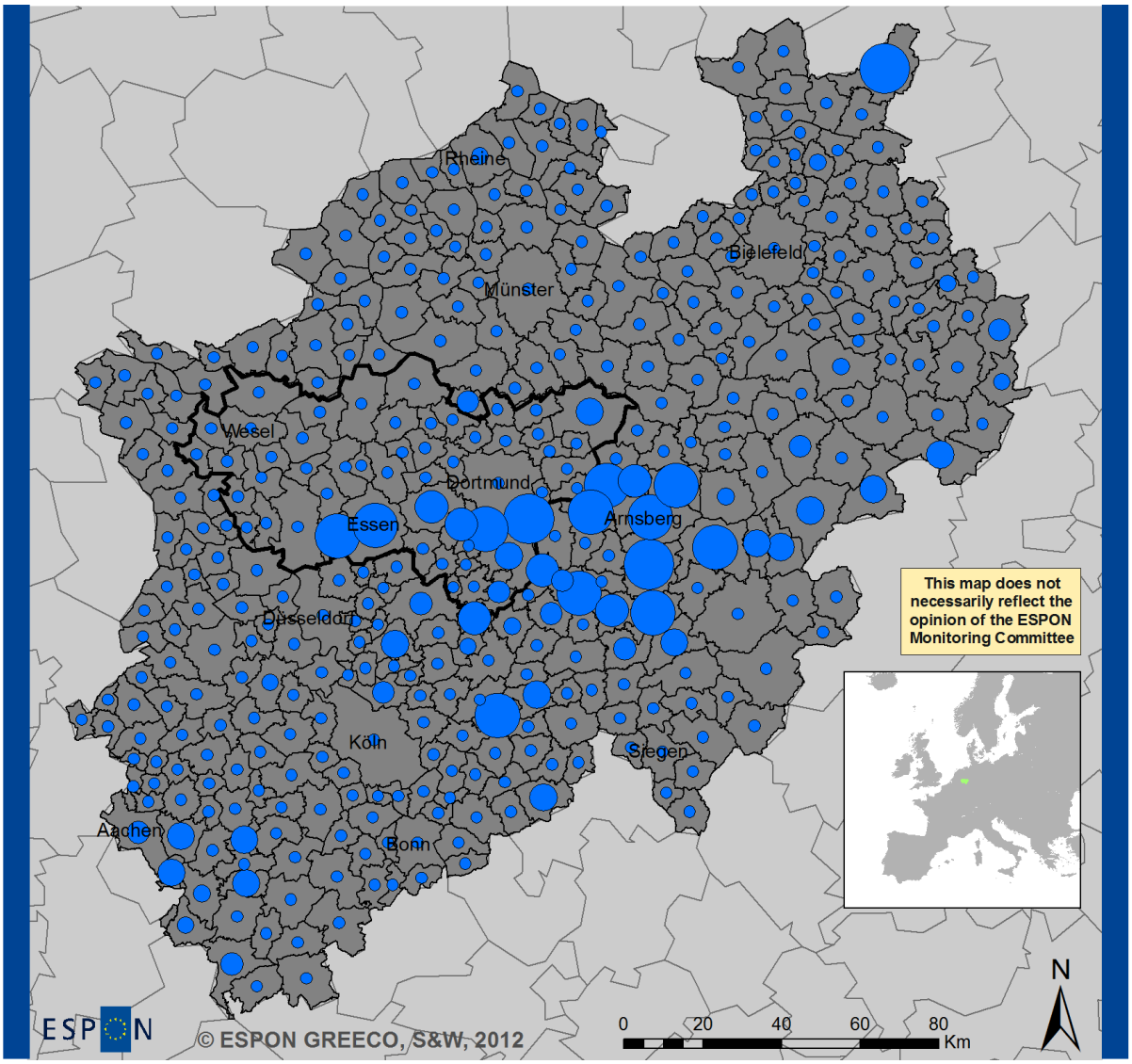


Figure 4.24: Electricity production from hydroelectric 2012 (GWh)

Combined effects

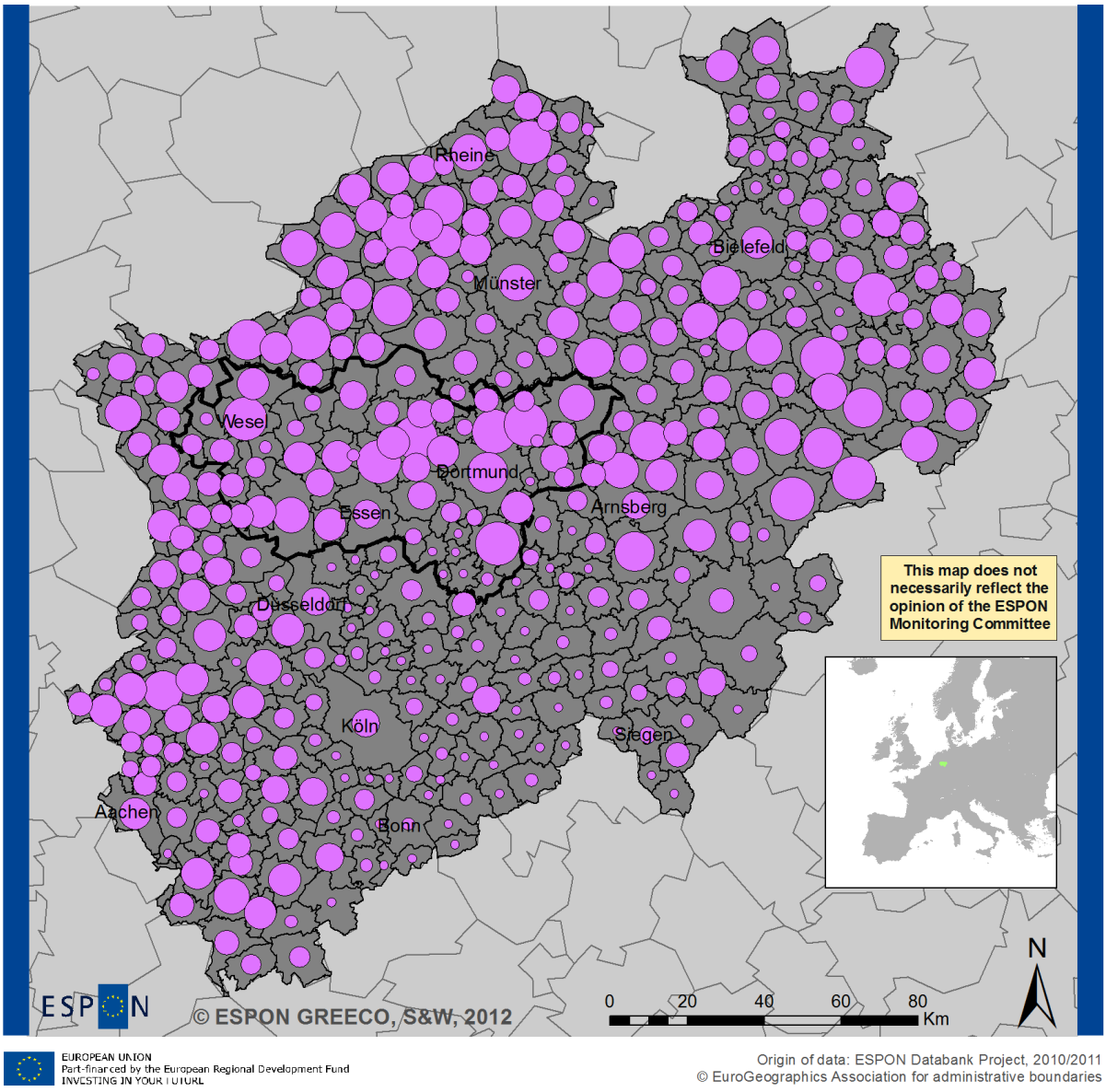


Figure 4.25: Electricity production from renewable energy 2012 (GWh)

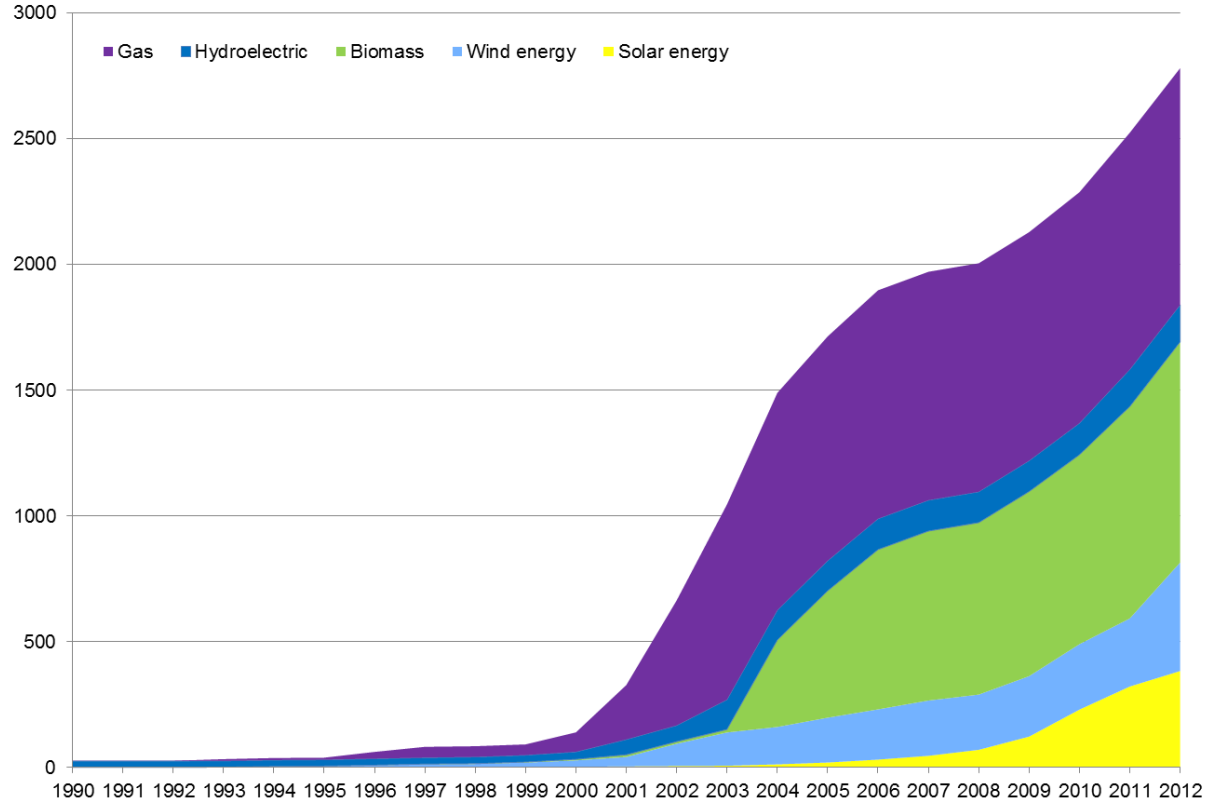


Figure 4.26: Electricity production from renewable energy in the Ruhr area, 1990-2012

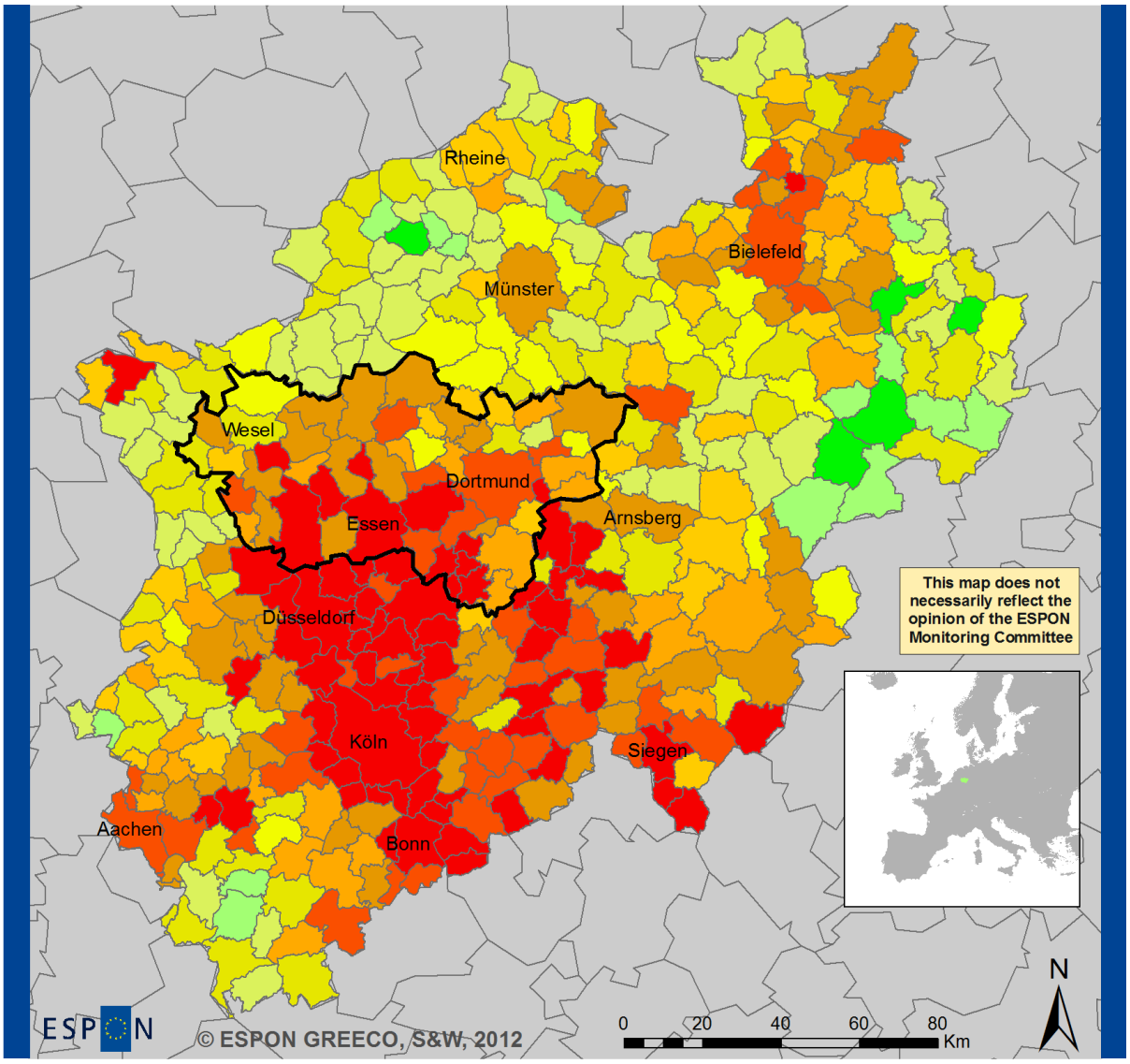


Figure 4.27: Electricity production from renewable energy of electricity consumption 2011 (%)

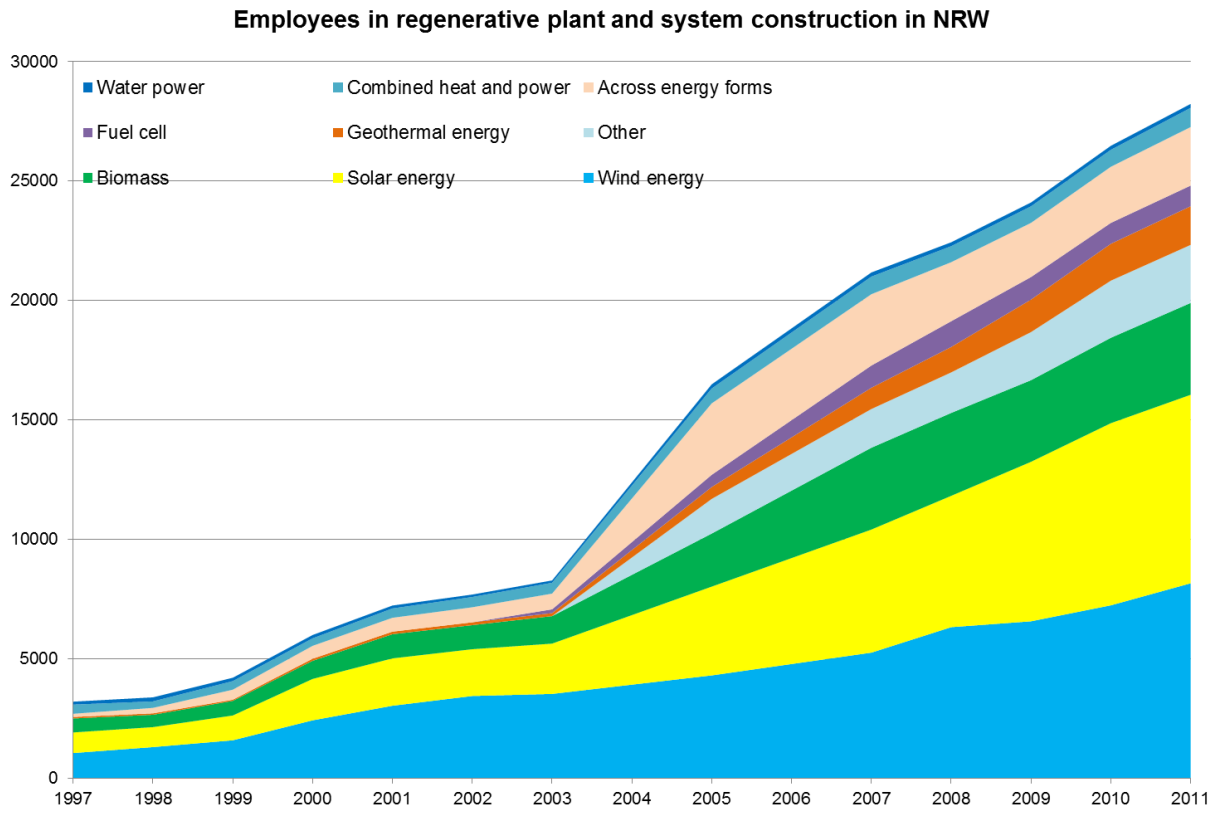
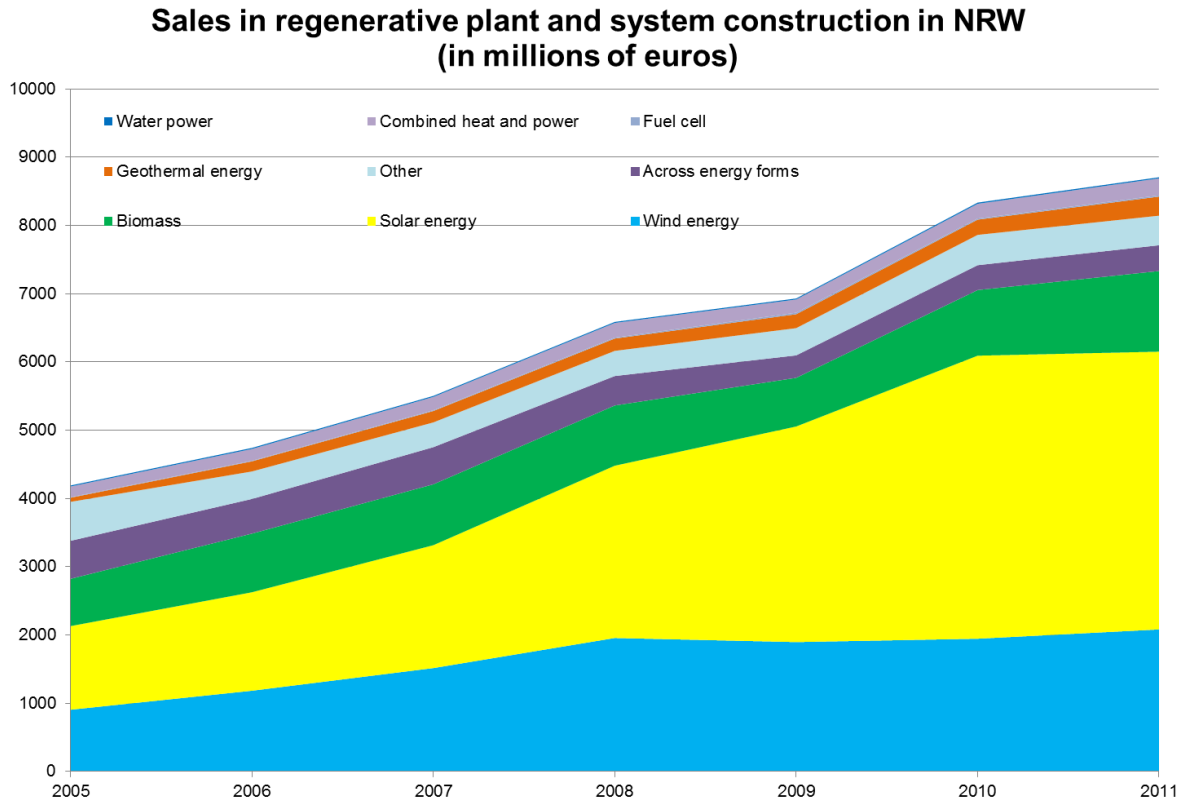


Figure 4.28: Employees in regenerative plant and system construction in NRW



Source: Lage der regenerativen Energiewirtschaft in NRW

Figure 4.29: Sales in regenerative plant and system construction in NRW

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