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Phasing-out Coal, Reinventing European Regions

An Analysis of EU Structural Funding in four European Coal Regions

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1/ Introduction

1.1 Structural challenges for European coal regions

The European Union needs to decarbonise its energy system at an unprecedented pace in order to build a future-proof economy, and to deliver on commitments made internally, such as the Commission's Low Carbon Energy Roadmap, as well as globally through the adoption of the Paris Agreement.

The emissions reductions that the European Union has committed to are simply not feasible without an accelerated phase-out of coal-fired power plants (Climate Analytics 2017). At the same time, renewable energy technologies are on the rise, with high growth rates and rapidly falling prices. Emissions-free operation, distributed energy grids, benefits to human health, and a demonstrable share in keeping the earth's surface temperatures at manageable levels should make sunsetting coal a no-brainer. Yet it is not that easy.

A decarbonisation of the European energy system needs to bring very different and sometimes conflicting policy realms into harmony:

- Environmental concerns clearly point towards a fast-paced coal phase-out, especially in the case of most carbon intensive use of lignite / brown coal.
- Yet, economic realities necessarily limit the speed that these processes can achieve, as local and national economies need to adjust to new circumstances and have to internalise new structures for continued and sustainable economic development under changed economic and industrial parameters. It is increasingly acknowledged also by representatives from industry that ambitious mitigation actions may yield substantial business opportunities in many sectors (BCG and Prognos 2018). But even if a transformation of Europe's energy system may be economically beneficial for the Union as a whole, it still presents coal regions with a structural challenge that needs to be carefully planned and managed in order to not crash local, or even national, economies.
- Finally, social concerns are pivotal in the design of a coal phase-out process. Regions where coal is mined and used face some massive challenges for their citizens' continued livelihoods, as the coal industry is still a very important source of employment and income there. Again, a coal phase-out may in all likelihood have a positive employment effect for the EU as a whole, but for it to be acceptable, employment opportunities need to be present in Europe's coal regions as well if this process is not to lead to social disruption.

Coal regions have historically played a key role in many countries' economic and social development. Consequently, they have a strong political and societal influence, which makes structural change processes difficult. This is even more true in countries that are economically less strong and face economic and structural challenges anyways, as is the case in a number of Southern and Eastern European Member States. For these countries, coal regions are not only significant political powers in themselves, but also major economic assets, which they will not give up lightly.

In order to address such systemic resistance, the European Union therefore must respond to possible socio-economic impacts of the decarbonisation within its member states and particularly the affected regions. The process of decarbonisation needs to be supported by proactive processes for developing new visions and perspectives, to facilitate and cushion necessary structural transitions of the coal-mining sector in Europe.

In the past, structural policy has most often been applied in a reactive manner after the structural changes had already unfolded. The classic responses can be categorized in two groups: interventions to bail out the affected companies e.g. by providing generous subsidies or interventions to bail out the affected workers e.g. through compensation payments or early retirement.

In the light of the polluter pays principle, it is not desirable to pursue the former option. Mining companies bear a great responsibility not only for the re-cultivation of mining sites but also for their employees. Bailing out the workers should be seen as a last resort. While such measures may prevent the worst social disruptions, it is usually extremely costly and may not resolve the structural changes. Focussing on the individual workers also may risk disregarding the ripple effects in the labour market of the closure of mines. Even if the laid-off workers find new jobs with generous retraining and support, they may take away job opportunities of their sons and daughters (Caldecott, Sartor, and Spencer 2017).

The third and in our view the most desirable option is to pursue a preventive mode of structural policy that focusses on the affected regions. The basic idea is to establish effective innovation systems, develop alternative and more sustainable industries and to invest in labour market infrastructure, labour mobility and vocational (re)training.

The decarbonisation of the EU is a collective challenge - however, a challenge that will produce winners and losers. From what we know, it seems to be clear that European coal mining regions will be among the biggest losers. There are therefore at least two important reasons why the phase-out of coal mining and use should be supported from the European level. Normatively, because the principle of European solidarity would demand balancing out between winners and losers of the decarbonisation challenge. And pragmatically, because we will achieve a deep decarbonisation of the EU if and only if systemic change resistance is overcome and change resistance is particularly strong in the affected mining regions.

The European Union already has an instrument in place that is particularly well suited to provide the required support: the EU cohesion policy with its European Structural and Investment Funds (ESIF) and particularly the Cohesion Fund (CF), the European Social Fund (ESF), and the European Regional Development Fund (ERDF). While other instruments may be available at the European level (European Commission 2017d, 2016) the share scope and volume of these funds make them the first choice for this study.

Also, structural policy instruments and funding opportunities may be available on the national level. Though, many countries have aligned their own structural policies with the European level and may not currently have dedicated structural policy instruments implemented on their own. This is for example the case in Germany. In order to ensure maximum efficacy, it would of course be necessary to align and harmonise the structural policy instruments across the European, national and subnational governance levels in a consistent way.¹

¹ A systematic assessment of structural policy instruments and funding opportunities at the national and subnational level is beyond the scope of this study.

Phasing out coal is possible - the Limburg Case

In the beginning of the 1960s, Limburg, a region in the south-east of the Netherlands was due to become the first European region to successfully sunset its coal mining industry. This early example of a successful transition yields a number of insights for the necessary structural change processes in Europe's coal region's even if it is not without caveats.

In the early 1960s, gas, a cleaner, more flexible energy source than coal, was expected to deeply change the energy system - not dissimilar to what we now know renewable energy sources have accomplished. The Limburg region at that time was a major coal mining region in the Netherlands, and considered crucial to Dutch national energy security. After gas had been found in the north of the Netherlands (Groningen Province), the Dutch Minister of Economic Affairs, Den Uyl, presented a plan to close the 11 active Limburgian mines over the coming years, in favour of an uptake of a new industry based on gas.

Interestingly, this plan was not driven by short-term economic realities, but by a **long-term view** on anticipated market conditions in the future, **and associated forward-looking policies**. However, the plan would never have been successful were it not for a number of other crucial design factors.

First of all, the phase-out was designed to be a **collective process**. While the process was to be led by the **state**, the **mine management**, and importantly the **unions**, had a strong voice, and it was guaranteed that new job opportunities would be created equally to the job losses incurred from the closures. In fact, unions in communion with the mines' management were able to secure this strongly enough that **"no closure without new employment"** was subsequently taken up by the Dutch government as a pillar of the structural change process.

The process was further helped by a **common understanding** between the stakeholders that the new technology was a superior alternative to coal. There seems to have been broad agreement that early closures would be preferable because the company would still be able to guarantee good conditions, whereas a financial downturn would lead to much greater turmoil.

Finally, the transition process was **carefully managed** over a period of 25 years, despite a number of setbacks and periods of uncertainty in the 1970s, leading the region into a diversified and successful post- and neo-industrial economy that not only relies on industries, but to an increasing extent also on science and health, logistics and other, service-oriented sectors.

At the moment, the Netherlands are facing another need for a coal transition - the closure of the mines did not eliminate coal from electricity generation, and coal still constitutes nearly 13% of the national energy consumption. International climate commitments, strong environmental regulations nationally, and a vocal civil society are pushing the Dutch government forward to a renewed transition process. Its predecessors of the 1960s may provide helpful lessons learned in this regard.

(see Gales and Hölsgens 2017 for an in-depth analysis of the Limburg case)

1.2 Objective of the study

The EU can and should play a role in facilitating transformational change away from coal mining (especially lignite) and in particular in mitigating social and economic hardship that may occur in the course of these transitions. A thorough understanding of the utilisation of existing policy instruments and their relation to coal mining is a prerequisite for designing effective policy instruments that help regions to adjust to imminent changes, and to drive the transformation in a socially and economically just way.

To this end this study outlines specific transformation challenges in key European coal and lignite mining regions, namely of Aragon in Spain, Lusatia in Germany, Silesia in Poland and Western Macedonia in Greece. The study provides a brief summary of the regions' socio-economic structure, including the role of coal mining therein.

The core of the study is an assessment of how existing European structural instruments, specifically the European Structural and Investment Funds (the ESI Funds) are utilized in the region.

Content of the study

The study starts out with a brief overview on the European Structural and Investment Funds (the ESI Funds) including objectives, rules and allocation processes as well as monitoring requirements (see following section). Chapter two is dedicated to outlining our analytic design. Chapter three forms the core of this study. For the four cases presented here, we each give a brief overview over the main socio-economic factors, the role of coal in each region, and an analysis of the use of structural funding in the respective region. Chapter four synthesises our case study results to present some aggregate challenges and findings on the principal uses of EU structural funding resources. Chapter five concludes the study with some recommendations for future reforms of European structural funding vis-à-vis the coming coal phase-out challenges.

1.3 Background on EU structural funding

Regional policy is a strong instrument for structural change in European member states. It helps member states and regions adapt to new circumstances, be it economic or environmental, and transports policy priorities of the European level to the ground. European regional policy focuses strongly on the less developed regions of the Union, allowing them to develop and reach comparable levels of wealth and development faster in order to reduce social and economic inequalities between EU members.

Since 1988, the European Union has integrated its efforts in structural policies and funding under a common cohesion policy. Since then, the budget for developing Europe's regions in an integrated fashion, with common goals and specific regional foci, has increased to EUR 454 billion for the current budgeting period, 2014-2020, for the five European Structural and Investment Funds (the ESI Funds). For some European Member States, investments through the ESI Funds represent a significant share of their total public investment figures, at over 30% for twelve member states, and even beyond 70% for Croatia and Portugal in the current programming period. For the four case study countries the share is about 53% (Poland), 36% (Greece), 16% (Spain), and 4% (Germany) (European Commission 2017e).

While this report does not focus on climate protection and adaptation, it is clear that structural policies and programmes with a view to sunsetting coal mining and use, and to enabling regional pathways to a low-carbon economy, have significant impact potential on greenhouse gas emissions. The European climate policy goals therefore profit massively from a proactive regional policy. The Commission's report highlights that. Europe-wide, over 25% of ESI funding is planned for climate-related projects (ibid.).

Categorization of Regions

Each European region is assigned to one of three categories depending on its regional gross domestic product (GDP) per capita in relation to the EU average (European Union 2013):

Less developed regions with GDP per capita below 75% of EU27 average

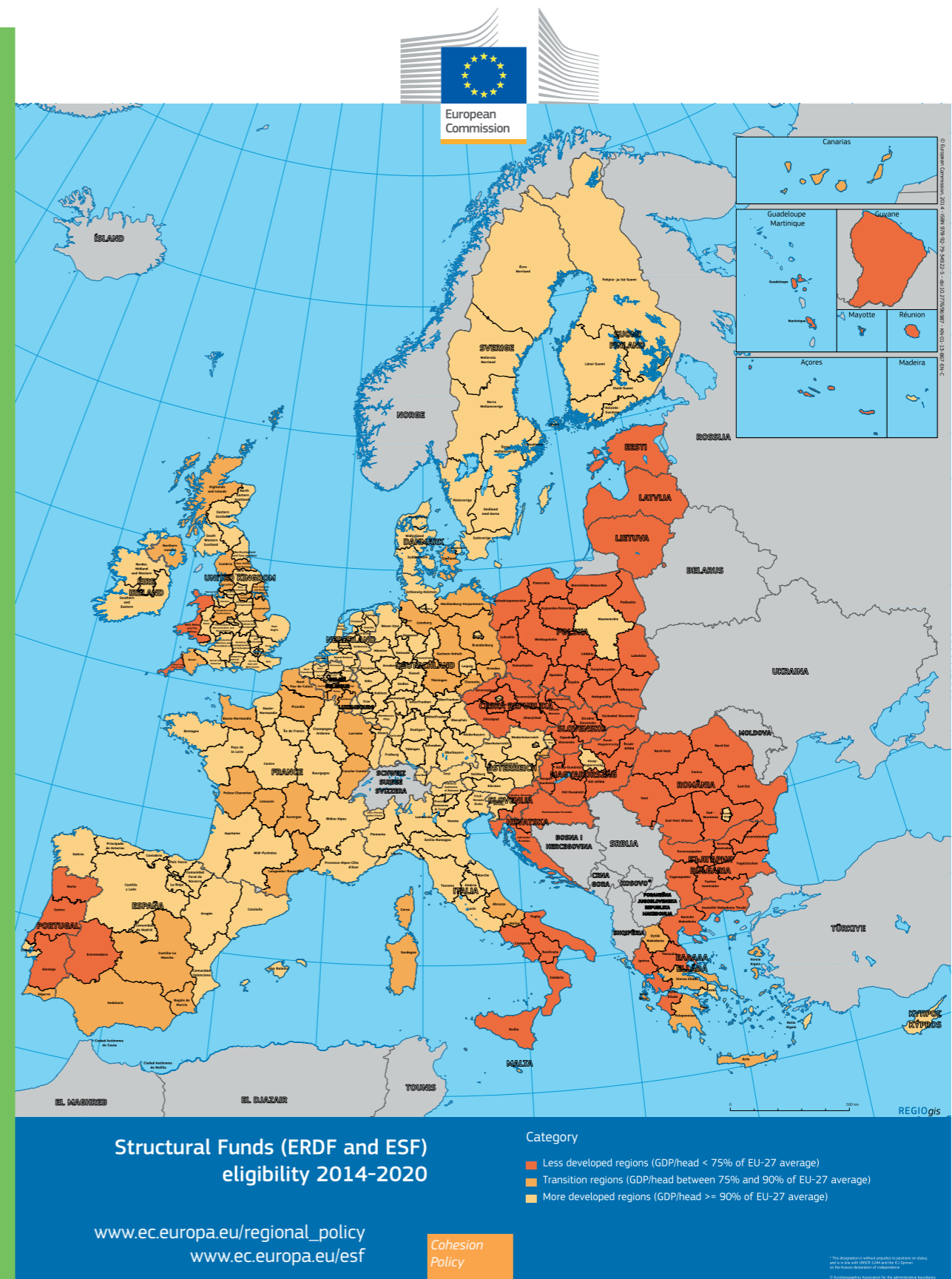
Transition regions with GDP per capita between 75% and 90% of EU27 average

More developed regions with GDP per capita above 90% of EU27 average

The EU has earmarked a fixed share of the overall budget to each of the respective regions so that lesser developed regions and transition regions can benefit from more generous financial support than their more developed counterparts. Moreover, the categorization determines the maximum co-financing rate that is provided and correspondingly the necessary share of own contribution.

The case study regions pertain to the following categories: Aragon, more developed region; Lusatia and Western Macedonia, transition regions; Silesia, less developed region.

Figure 1 Overview of the categorization of European regions for the 2014-2020 programming period. Source: (European Commission 2014a)



1.3.1 The European Union's ESI Funds

The European Union has established five major funding mechanisms as their so-called Structural and Investment Funds, or ESI Funds:

- the **European Regional Development Fund**, ERDF, designed to promote balanced development in different EU regions;
- the **European Social Fund**, ESF, in support of employment and human development;
- the **Cohesion Fund**, especially funding countries with a Gross National Income that is less than 90% of EU average;
- the **European Agricultural Fund for Rural Development**, EAFRD, which focuses on rural areas of the EU; and
- the **European Maritime and Fisheries Fund** (EMFF), aiding coastal communities to adapt, and to promote sustainable fishing.

Together, these funds have more than EUR 450 billion at their disposal, with the largest part of the funding (EUR 351.8 billion) available for use in European cohesion policy through ERDF, ESF, and Cohesion Fund, which are at the core of this analysis.

The ESI Funds follow a common three-pronged goal to support member states and regions in achieving smart, sustainable, inclusive growth in their current seven-year period (2014-2020). This links the ESI Funds to the EU's Europe 2020 strategy which has the same basic goalset.

1.3.2 Rules and Objectives

Generally all five ESI Funds follow a common rule set. The Common Provisions Regulation (CPR) (Regulation (EU) No 1303/2013) (European Union 2013) has defined a Common Strategic Framework that pertains to all ESI Funds, and common standards for all programmes. It further requires all European member states to develop a so-called Partnership Agreement that is used for access to all ESI Funds. In alignment with the Europe 2020 strategy, the CPR sets eleven thematic objectives as subsets to the three-pronged goal for growth that interventions financed through the ESI Funds may focus on:

- **Smart growth:**
 - Strengthening research, technological development and innovation;
 - Enhancing access to, and use and quality of, ICT;
 - Enhancing the competitiveness of small and medium enterprises (SMEs), of the agricultural sector (for the EAFRD) and of the fishery and aquaculture sector (for the EMFF).
- **Sustainable growth:**
 - Supporting the shift towards a low-carbon economy in all sectors;
 - Promoting climate change adaptation, risk prevention and management;
 - Preserving and protecting the environment and promoting resource efficiency;
 - Promoting sustainable transport and removing bottlenecks in key network infrastructures.
- **Inclusive growth:**
 - Promoting sustainable and quality employment and supporting labour mobility;
 - Promoting social inclusion, combating poverty and any discrimination;
 - Investing in education, training and vocational training for skills and lifelong learning;
 - Enhancing institutional capacity of public authorities and stakeholders and efficient public administration.

In order to ensure that in particular the objective of sustainable growth can be achieved, (EU) No 215/2014 includes a "coefficient for the calculation of support to climate change objectives". Each country shall indicate in its partnership agreement (see below) how the proposed activities align with the EU's objective to devote at least 20% of the budget to climate change objectives. For this purpose, each project type is assigned with a coefficient of either 0%, 40%, or 100% that helps to calculate that contribution. For example, activities related to renewable energy and energy efficiency, but also investments in cycle tracks and footpaths feature a climate coefficient of 100%. Whereas investments in re-training, labour mobility or ICT infrastructure, which are deemed particularly relevant for the structural challenges implied by the phase-out of coal mining and use, are not considered to contribute to the climate objectives and hence feature a climate coefficient of zero.

1.3.3 Partnership Agreements

As a further link to the Europe 2020 strategy, member states have to relate their ESI Fund Partnership Agreements to achieving the Europe 2020 goals, and to also address country-specific recommendations arising from the European Semester, the EU's annual progress analysis towards achieving the Europe 2020 goals. If new relevant country recommendations are issued, the European Commission can ask member states to update their Partnership Agreements.

The content of the Partnership Agreement needs to address how ESI Fund interventions contribute to the EU priorities in the country, following a fairly detailed set of reporting elements, including among others the EU's climate change objectives, administrative capacities of implementing authorities, and the priority areas for cooperating under the ESI fund framework. The Partnership Agreement also includes the country's proposed list of programmes to be implemented through ESI Fund (co-)financing. The Partnership Agreement as well as every proposed programme is subject to negotiation between the Commission and the EU member state before a go-ahead decision is made, and funding is committed to implement the approved programmes. Civil society and other stakeholders may take part at these negotiations at the programming as well as the management stage. Overall management of programmes on the national level is organised by specialised management authorities appointed by the countries.

1.3.4 Monitoring and reporting

The Commission is responsible for monitoring the implementation of each approved programme, as well as the continued fit of the Partnership Agreements with overall EU policy objectives. Member states have to present annual implementation reports for each programme, again linking them to the achievement of the Europe 2020 strategy.

In 2017 and 2019, countries are also required to hand in progress reports on the goals they have set themselves at the Partnership Agreement level as well as those arising from the country-specific recommendations.

In 2017 and 2020 the Commission also publishes the Cohesion Report that draws on all information on European cohesion policy.





2/ Study Design

For each European coal mining region (Lusatia, Germany / Western Macedonia, Greece / Aragon, Spain / Silesia, Poland) analysed in this report, a case study was developed based on two empirical pillars:

- A general description of the region, including socio-economic facts, specifically highlighting the role of coal use and mining for the region, including historic developments, current trends and likely future challenges. This analysis is done based on scientific reports, statistical data and expert knowledge of the staff developing the case study.
- A detailed assessment of how European Structural and Investment Funds are currently being used in the region. This assessment is the core of this study and aims to answer the question, to which degree European funds for the region are currently being used specifically to support the necessary transition challenges, coal mining regions are facing.

Material used to assess ESI funds

For the sake of this study, we focus on current operational programmes (period 2014-2020), co-financed by European Structural and Investment Funds (ESI Funds). Pursuant to Regulation No. 1303/2013 Art. 115.2, member states are obliged to maintain detailed project lists including information on inter alia a project summary, location of the project, type of intervention, area of economic activity, project value and funding provided by the EU. These lists ought to be updated at least every six months (European Union 2013; European Commission 2014b). We will employ these project lists as a basis for our assessment.

The lists are maintained in national languages. Since the project team is not proficient in Greek nor Polish, the information was not easily accessible. While most of the data provided in the lists applies standardized codes, to access the most relevant parts – project name and summary – we had to revert to machine translation using “Google translate”. While the results are certainly not perfect, machine translation provides us with enough information to assess the relevance of a project and its potential structural effect.

The regulation (European Commission 2014b) specifies 123 numbered intervention categories for applicable projects under nine main headings:

- productive investment;
- infrastructure providing basic services and related investment;
- social, health and education infrastructure and related investment;

- development of endogenous potential;
- promoting sustainable and quality employment and supporting labour mobility; promoting social inclusion,
- combating poverty and any discrimination; investing in education, training and vocational training for skills and lifelong learning;
- enhancing institutional capacity of public authorities and stakeholders and efficient public administration; and
- technical assistance.

The desk-based analysis of project lists (see below for a more detailed description of the analytical steps) has been particularly suitable as it provides an accessible way of generating an overview about the spending of ESI funds in the respective regions. Another advantage is that, due to the standardized coding, it allows for some degree of comparability among the regions. Yet, the approach is also limited in important ways. First and foremost because the assessment is based on self reported aims/description of the projects. The data only allows for a generic assessment of the intended outputs of the relevant projects, not an evaluation of the actual outcomes let alone their longer-term impacts with respect to facilitating socio-economic adjustments in the regions (see also box on p44).

2.1 Appraisal of ESI Funds

Categories for ESI objectives

To assess how the projects co-funded with ESI funds relate to coal mining and structural challenges from decreasing coal mining and coal use we developed four categories:

- Direct effect on coal transition: Projects in this category are considered to directly respond to challenges from decreasing coal use and coal mining. This includes: retraining programmes for former employers of the coal sector, innovation and support which aims at a diversification of the industry base in the region, projects which create local employment opportunities outside the coal sector.
- Reinforcing coal: This category relates to all efforts which support the existing coal mining and coal use infrastructure. It includes innovation in technologies, which are primarily applied for coal mining and use as well as infrastructure investment directly related to coal.
- Ambiguous toward coal related structures: Some projects are in our view ambiguous in their probable effect - they combine aspects that support a transition away from coal with aspects that could increase structural dependencies. One example are coal-fired combined heat and power infrastructure investments. They help to increase the energy efficiency thus decrease the use of coal in the short term. However, they structurally support a mid- to long-term dependency on coal use, since a phase-out of coal would lead to stranded assets.
- General structural support: In this category we classify projects which generally support structural development in the region but are neither direct support for a coal related economy nor do they explicitly support alternatives. This very broad category includes e.g. investments in transport infrastructure and primary education - both of which are necessary for regions to develop opportunities beyond coal, but would equally support regions, which plan to rely on coal. Also included in this category are projects, which generally address social cohesion (e.g. gender balance, care for the elderly etc.) or cultural heritage. Generally, any project not classified in one of the top three categories was considered to be of general structural support.

■ **Unclassified:** For a minority of projects the given information was not sufficient to make any reliable assessment at all. This was only the case for the Lusatia case study. Here for some projects only titles were given, but no project summary. So it was not possible to assess to which of the four categories they would belong to.

Analytical steps

For each project region, the empirical data consists of lists with many thousand projects. Thus it was necessary to assess this data in a tiered approach:

Initially, a regional filter was applied to identify projects in the case study region. To this end, we identified a list of municipalities and/or counties in which coal mines are located for each case region. All projects located in one of the identified municipalities/counties were selected. Projects that list the entire region/province as location as well as national projects were also included in the initial selection. Owing to the regional focus of the research question, projects of national scope, however, were not included in the more detailed analysis.

In a second step all projects were assessed based on their *intervention code*. As described above EU reporting classifies all funds in 123 intervention codes. Most of these codes could be attributed to one of our assessment categories: 39 codes were considered to have a direct effect on coal transition (example: energy efficiency for housing both reduces energy dependence of coal and creates largely local employment opportunities). 62 codes were considered as general structural support (example: road transport infrastructure). 22 codes were considered to need individual checking on a project by project basis (example: innovation in large industries could both include development of new coal conveyor belts (thus be labelled as reinforcing coal) or research in a new IT company (thus be labelled as direct effect on coal transition). The categorisation based on intervention codes was done based on expert judgment of five researchers of the Wuppertal Institute with a broad background (climate policy, energy policy, regional development) employing a double blind process.

In a third step projects were assessed on a project by project basis. This (quite time consuming) effort was undertaken for all projects belonging to the 22 intervention codes that require individual checking. Additionally, the whole database (which includes project titles as well as short project summaries) was searched for key words relating to coal and coal mining. Finally, random control samples were taken from projects of all intervention codes e.g. the projects with highest individual budget were checked on a project by project basis, irrespective of the intervention code.

2.2 Complementary qualitative assessment

The tier 2 analysis of the structural effect required a thorough review of all relevant project summaries. This provided us with a good overview of how and for what kind of projects European funds are applied in the region. The review complements the quantitative analysis with qualitative findings, e.g. by highlighting exemplary projects that are particularly suited to cushioning imminent structural change and/or projects that, contrary to that, further lock in path dependencies and hence hinder the coal phase-out. Again it should be noted that we do not assess the effectiveness of the individual on-going projects within the regions at all. Our assessment exclusively builds on available project summaries and descriptions, and in the highlighted cases additional research.





3/ Regional Case Studies

In this chapter, we present four short case studies of selected coal-mining regions in Europe representing a variety of specific circumstances that we believe can paint a good picture of the challenges regions face in their efforts towards an economic diversification beyond the reliance on coal-based industries.

- **Aragon, Spain**, as an example of opencast brown coal mining in an economically-challenged member state.
- **Lusatia, Germany**, as the driving force of an otherwise structurally challenged region especially impacted by the fall of the Iron Curtain;
- **Silesia, Poland**, as an example for the strong influence of coal mining as a core asset of an Eastern European member state;
- **Western Macedonia, Greece**, as an example for the importance of a lignite mining region in an economically-challenged Southern member state, where coal is by large the main fuel source for electricity generation.

The proposed cases not only outline the high diversity of special circumstances that make structural change processes challenging, but also showcase a wide variety of options for support through European Union regional development.

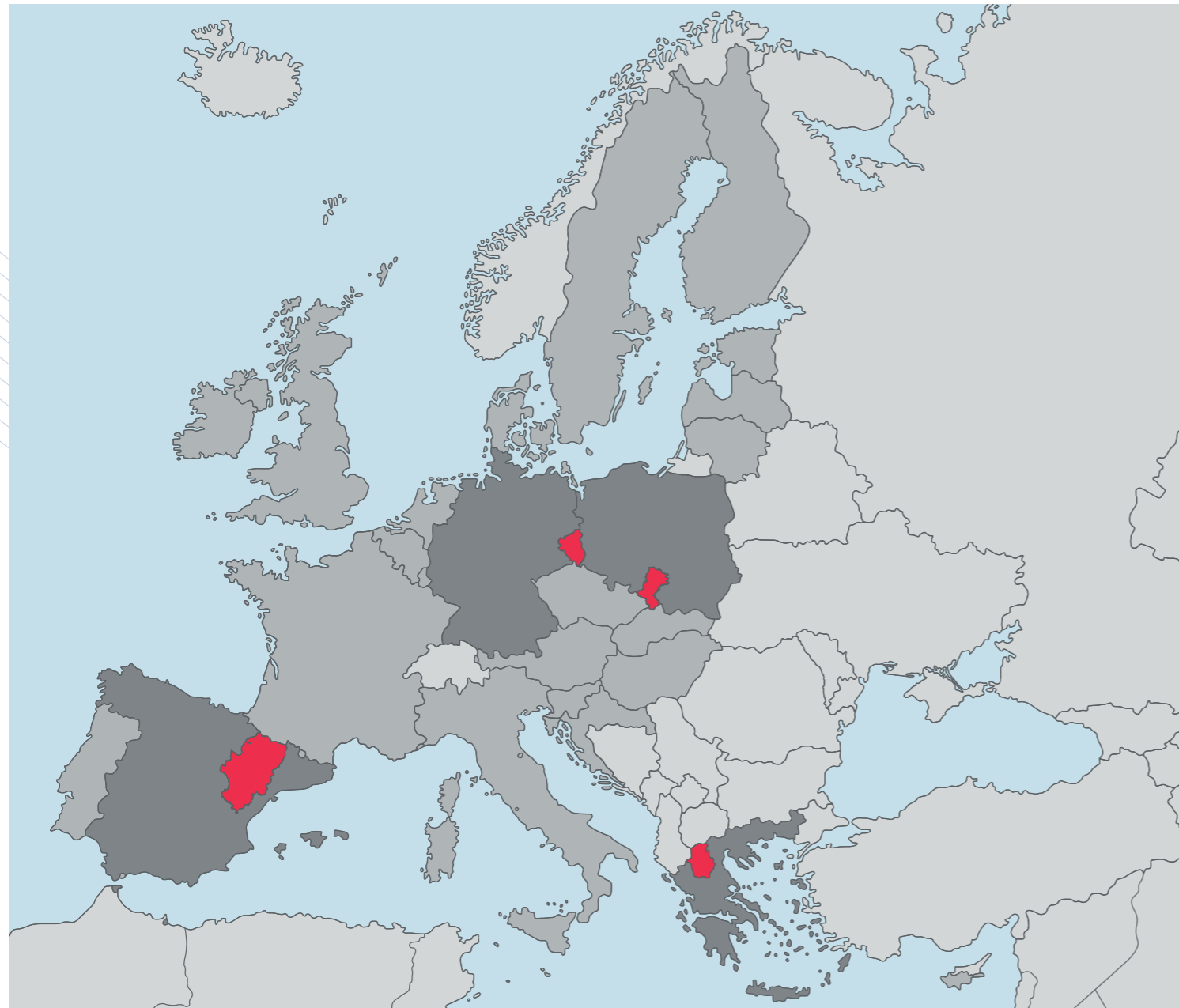


Figure 2 Overview of case study regions. Source: own illustration.

3.1 Poland: Silesia

Quick Facts Silesia		
General Information	regional	national
Population	4.536.000	38.006.000
GDP per Capita [EUR]	20.600	19.800
Share of industry on GDP(2014)	35%	26%
Unemployment Rate (2015)	7%	8%
Role of Coal in the Region		
Coal Output (2016)	59.2 million tonnes	
Coal Type	hard coal	
Employment in coal	80,000	
Main companies	Polska Grupa Górnicza, Jastrzębska Spółka Węglowa, Tauron Wydobycie, Przedsiębiorstwo Górnicze Silesia	
Power Plants Capacity	9,000 MW	
Electricity Generation (National)	2000	2015
Coal (share)	95%	81%
Renewable* (share)	3%	14%



3.1.1 Role of Coal in the Region

Mining and energy

Silesia is both Poland's and Europe's largest hard coal mining region, accounting for around 80% of total Polish hard coal resources at 46.9 billion tonnes, and spanning an area of around 5,600km² (Euracoal 2017b; Polish Geological Institute 2017a, 2017b). Whilst steam coal constitutes the predominant type of coal in the region, there is also a significant share of coking coal as well as a small amount of anthracite (Polish Geological Institute 2017b; Euracoal 2017b). In 2016, 59.2 million tonnes were mined in Silesia, which equates to 89% of Poland's hard coal production (Polish Geological Institute 2017b). Silesian hard coal is mainly used for electricity production, accounting for nearly 50% of all Polish power generation in 2015 (Euracoal 2017b). Moreover, Silesia accounts for 40% of Poland's emissions, both through coal-fired electricity and heat generation, but also Silesian industry (The Climate Group 2016).

Whilst hard coal is now only produced in the Upper Silesian Coal Basin, it is important to note that the Lower Silesian Coal Basin was also operative until 2000 (Polish Geological Institute 2017a). Mining ceased for economic reasons, in part due to difficult mining conditions. The remaining coal reserves in this area are estimated at around 424 million tonnes (Polish Geological Institute 2017a).

All operational hard coal mines in Poland bar one are located in Silesia. Four mining companies operate in the region: Polska Grupa Górnicza, Jastrzębska Spółka Węglowa, Tauron Wydobycie and Przedsiębiorstwo Górnicze Silesia. These control 19 active hard coal mines,² five hard coal power plants (Rybnik, Jaworzno, Łaziska, Bielsko-Biala, Tychy) and one lignite power plant (Belchatów) in Silesia, amounting to a total capacity of about 9 GW.

During the Communist era, all major mining companies were state-owned. Since the early 1990s, companies have gradually been opened up to private investors, but the state usually still has a stake in coal mining companies to a certain extent. The biggest company by far is the state-owned Polska Grupa Górnicza, which was responsible for 65% of total Polish hard coal production between 2007 and 2015. The second most significant player is Jastrzębska Spółka Węglowa, responsible for 17% of total Polish hard coal production between 2007 and 2015, with a 56% state share.

Mining has been a defining feature of Silesia since the 18th century, when the region transformed into a major mining and industry hub and, consequently, an urban centre. During the Communist era, coal grew to be a major pillar of both the economy and employment. Workers were offered stable jobs, various financial and other benefits. Mine operators also invested in social infrastructure, such as schools or hospitals (Szpor 2017). As of the 1990s, the Silesian mining sector has undergone significant modernization to improve productivity, whilst simultaneously cutting down on employment (Urząd Marszałkowski Województwa Śląskiego 2014a; Euracoal 2017b).

This has been due to difficult market conditions, with international competition offering coal at low prices. Polish companies needed to adapt to the new situation by modernising, increasing productivity and cutting costs. Hard coal production has decreased by around 60%, while employment has fallen by nearly 80% since the 1990s (Euracoal 2017b). At the end of 2016, about 80,000 people were employed in hard coal mining in Silesia (Wilczyński and Derski 2017). Nonetheless, the hard coal mining sector in Silesia still generates 10% of total industry revenues in the region (Wilczyński and Derski 2017).

Socio-economic characteristics

Silesia is located in the South of Poland, bordering on the Czech Republic. Around 4.6 million people live in the region, making it the second most populated region in Poland. Moreover, around 9 million people live within 100km of Silesia's capital, Katowice. The area not only has a high population density, but is also the most industrialised and urbanised area in Poland (Urząd Marszałkowski Województwa Śląskiego 2014b; The Climate Group 2016).

Silesia accounts for 12.4% of Polish GDP (The Climate Group 2016); however, there are significant disparities in GDP within Silesia. The sub-region GDP per capita ranges from €14,128 in 2013 in Katowice to €7,576 in 2013 in Bytomskie. Unemployment rates cover a similar range; average unemployment was around 8% in 2015, with a range from 4.7% in Tyski to 13% in Bytomskie (Urząd Marszałkowski Województwa Śląskiego 2014b, European Commission 2017). Unemployment is particularly high among the younger population – 39% of the unemployed are under the age of 34 (Urząd Marszałkowski Województwa Śląskiego 2014b).

In 2015, 62.5% of the region's population were in employment, with around two-thirds of employees aged between 25 and 44 (Urząd Marszałkowski Województwa Śląskiego 2014b). The proportion of employment in the services sector has increased correspondingly with the decrease of work in construction and mining (Urząd Marszałkowski Województwa Śląskiego 2014b).

In 2015, the two most important economic sectors in Silesia were services and industry. Services accounted for 52% of the Silesian economy, while industry – consisting of coal, iron and zinc mining as well as the automobile, building materials, chemical and machinery equipment industries – amounted to 37% (The Climate Group 2016). The Silesian industry sector is responsible for 35% of gross value added in the region (The Climate Group 2016). This is due to the fact that Silesia is home to numerous companies belonging to automobile (and related) industries – Silesia is now the largest automobile producer in Poland – as well as business process outsourcing, logistics and manufacturing sectors. Well-known companies are Fiat or Opel, but also mining technology companies such as FAMUR or mine operators such as Kompania Weglowa S.A (European Commission 2017b). Historically, mining as well as the iron and steel industries were the most significant contributors to the Silesian economy; however, with the decline in the role of hard coal, the energy, IT and machinery industries as well as the automobile and food sectors have grown in importance (Urząd Marszałkowski Województwa Śląskiego 2014b).

General research and development (R&D) expenditures in Silesia are lower than the Polish and EU average. R&D merely accounts for 0.62% of the country's GDP, whereas the Polish average is 0.87% and the EU average is 2.03%. Business R&D is especially low, standing at 0.32% of GDP, compared to the Polish average at 0.38% and the EU average at 1.29%. Just over 18% of investments in the manufacturing sector are allocated for R&D (European Commission 2017b).

Silesia is also home to higher education institutions such as the University of Silesia in Katowice, the Centre of Innovation, Technology Transfer and Development, the Silesian University of Technology or the Technical University of Częstochowa (ibid.).

Culture, challenges and future trends

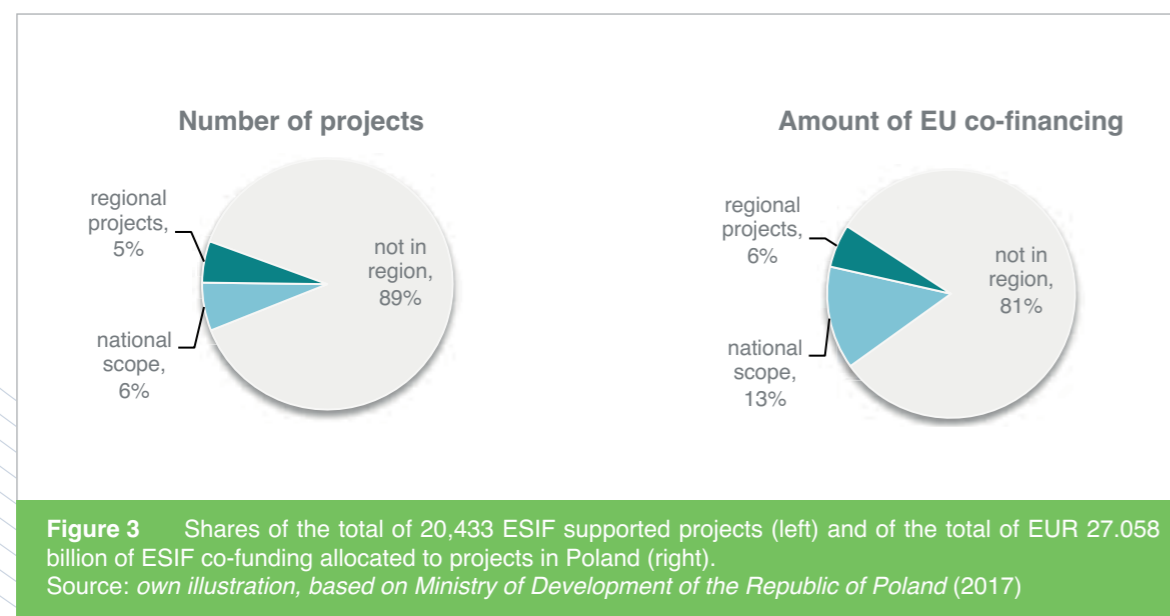
Due to its longstanding impact on the regional and national economy and people's lives in general, hard coal plays a large role in Silesian culture as well as Polish culture (Dzieciolowski and Hacaga 2015). Although its economic importance is decreasing, hard coal still constitutes a significant part of Silesia – not only in financial, but also in socio-cultural terms. Membership in trade unions is very high, and the major mining companies are fully or partially state-owned, bringing major revenues to the surrounding communities. Thus, there is strong entanglement between politics, the economy and the workforce in the coal sector (Szpor 2017). Previous attempts at re-structuring the hard coal sector have been met by heavy protests and strikes by the unions, which mobilise very quickly on issues that affect their livelihoods (Dzieciolowski and Hacaga 2015). As coal is regarded as a means of energy security whilst also boosting both the local and national economy, different stakeholders from companies, workers and communities to political parties generally strongly opposed to any reduction of coal use.

² Zespólna KWK ROW, Zespólna KWK Ruda, KWK Piast-Ziemowit, KWK Sońnica, KWK Bolesław Śmiały, KWK Wieczorek, KWK Wujek, KWK Mysłowice-Wesoła, KWK Murcki-Staszic, KWK Sońnica, KWK Borynia-Zofiówka-Jastrzębie, KWK Budryk, KWK Knurów-Szczygłowiec, KWK Pniówek, ZG Nowe Brzeszcze, ZG Janina, ZG Sobieski, KWK Silesia, Węglokoks, KWK Bobrek-Piekary

3.1.2 Use of Structural Funding in the Region

Poland is the single largest recipient country of funding from ESI Funds. Under current planning, Poland will receive a total of more than EUR 86 billion in the 2014-2020 period (European Commission n.d.). According to the project list provided by the Polish Government, a total of just over EUR 27 billion has been allocated so far (Ministry of Development of the Republic of Poland 2017). About 20 % of that money is related to the case study region. Our analysis identified a total of 2,498 projects in the region (regional and national) that collectively receive EUR 5.472 billion over the 2014-2020 period, though the lion's share of this budget is allocated to projects of national scope. In our analysis, we identified a total of 1,157 regional projects collectively receiving EUR 1.617 billion (6% of the national total). The share of projects and the amount of co-financing provided from ESIF is illustrated in **Figure 3**, below.

The money is channelled through a series of operational programmes. Of particular interest for this study are the national programmes “Digital Poland”, “Infrastructure and Environment”, “Knowledge Education Growth”, “Smart growth” as well as the regional operational programme for the Silesian Voivodeship.



By analysing the category of intervention of each listed project, we identified that the majority of EU co-financing is allocated to projects that are in a broad sense relevant to structural challenges with respect to coal phase-out (see **Figure 4**). This is true whether or not projects with national scope are included.

What is striking is the fact that a very small number of projects in the “general structural support” category (25 incl. and 12 excl. national projects) consume a disproportionate share of the ESIF contributions to the region. By far the largest individual position is the expansion of the A1 motorway that connects the Katowice area to Łódź and further to Warsaw. This project alone receives ESIF co-financing worth EUR 316.6 million. The other projects in this category are mostly projects in the area of sustainable urban transport, and for example entail the purchase of low-emission and/or electric buses. The projects were included in this category because they improve the economic structure, accessibility, attractiveness and competitiveness of the region and hence prepare the region for the structural challenges associated with a phase-out of coal mining and burning, but they do so on a very general level and irrespective of the future of coal.

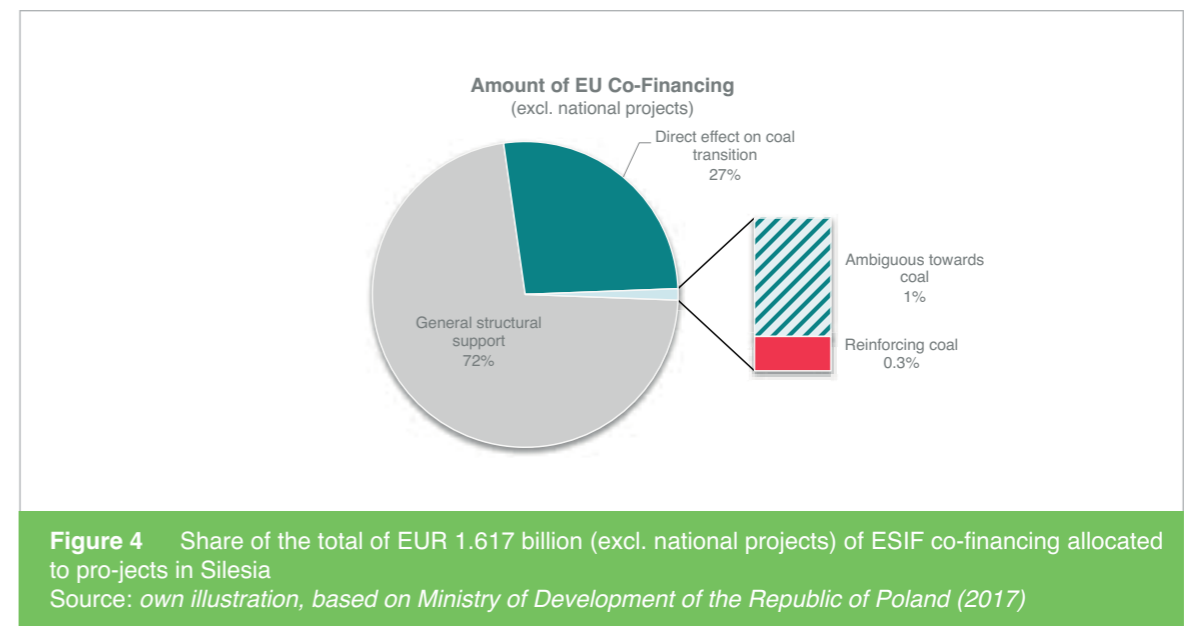
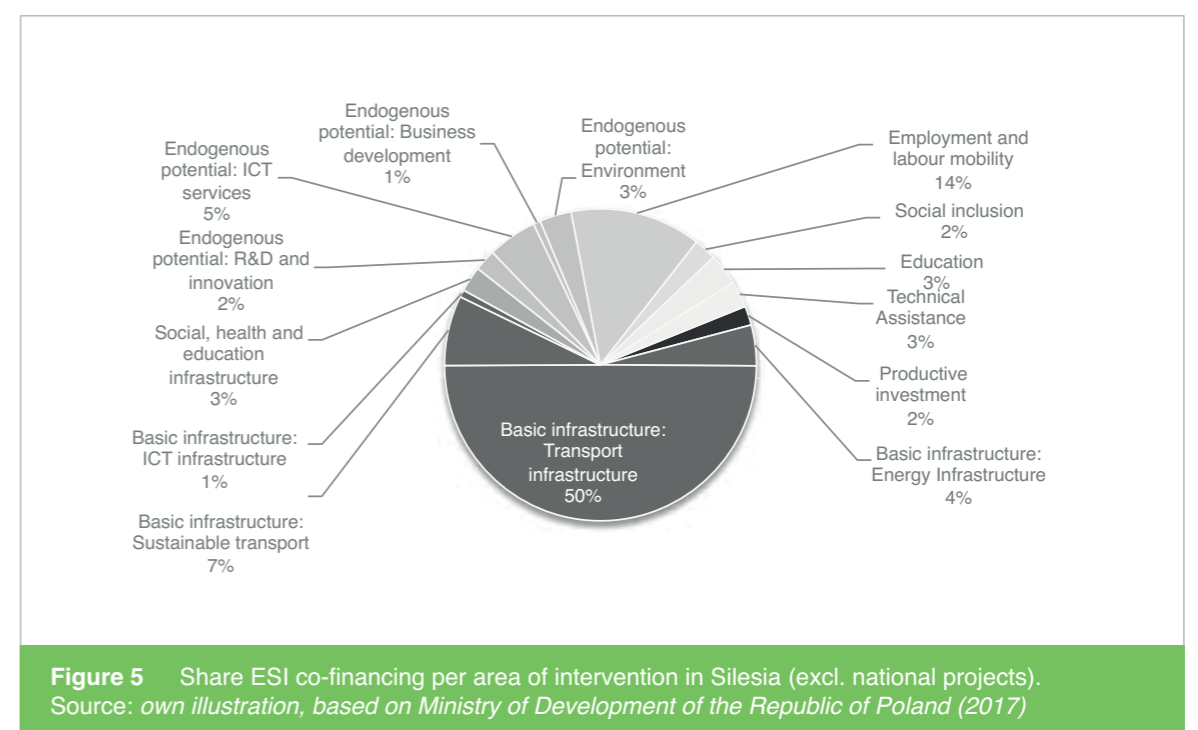


Figure 5 provides a breakdown of the allocation of ESIF co-financing with respect to the area of intervention. By far the largest share of the funding is dedicated to infrastructural projects, and in transport infrastructure in particular. Again the projects mentioned above (A1 motorway and sustainable urban transport) are dominating the portfolio. Projects promoting sustainable and quality employment and supporting labour mobility also take up a considerable share of the budget and are particularly relevant when it comes to cushioning adverse socio-economic effects of phasing out coal mining and burning.

Figure 6 indicates the assessment of the structural effect of the respective projects. It comes at no surprise that the vast majority of the projects identified as relevant to structural change in the first step of our analysis, are appraised to feature a potential to support structural change in the sense that it prepares the region to adequately adapt to the socio-economic changes induced by a phase-out of coal.



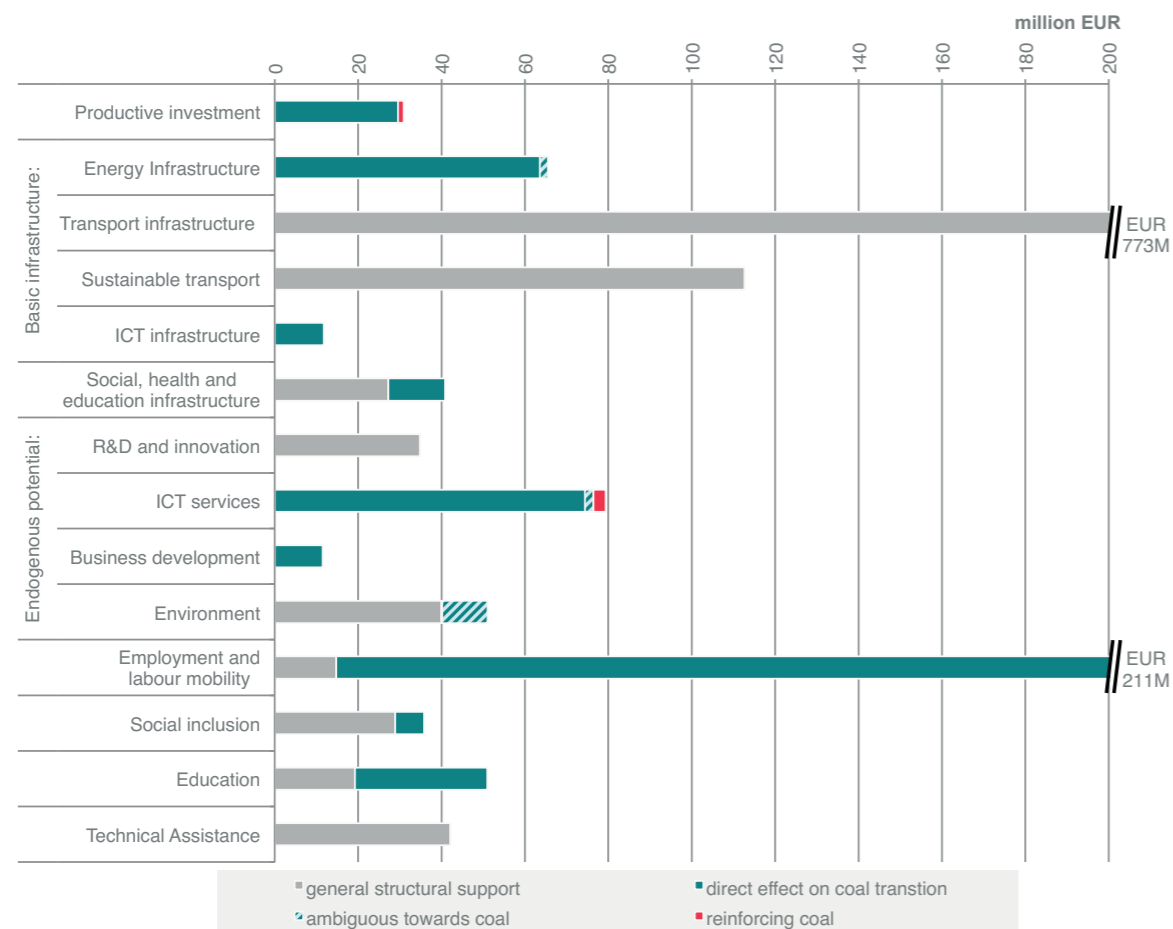


Figure 6 Overview structural effect of ESI Fund co-financing per area of intervention in Silesia (excl. national projects). Source: own illustration, based on Ministry of Development of the Republic of Poland (2017)

There are only 10 regional projects that were identified as actively reinforcing structural dependencies (12 including national projects, with the additional two together receiving less than EUR 0.5 million over the funding period). All of the projects involved private companies and where either direct productive investments or support for research and development activities for technologies directly associated with coal mining. The total amount of ESIF co-financing allocated to activities that reinforce structural dependencies is EUR 4.3 million (=0.3% of the relevant regional ESIF co-financing). This is the good news. “Beacon of coal” projects such as the Clean Coal Technology Centre that was co-financed with nearly EUR 35 million in the programming period 2007-2013 are not featured in the portfolio of the current programming period any longer (European Commission 2011).

Two areas of investment are of particular interest when it comes to facilitating socially and economically viable structural change. (1) A strong economic base, i.e. competitive and innovative enterprises that can compensate eventual economic losses in the coal sector, and (2) a well functioning labour market in combination with an educational system of tertiary training and activation measures to offer re-training for laid off coal workers and to helps them find new employment.

Unfortunately, the data in the project list does not provide enough granularity to further assess how ESIF funds are spent to support enterprises through productive investments and support for R&D and business development. More than half of the projects in the respective intervention categories list “other unspecified manufacturing industries” or “other unspecified services” as their area of economic activity.

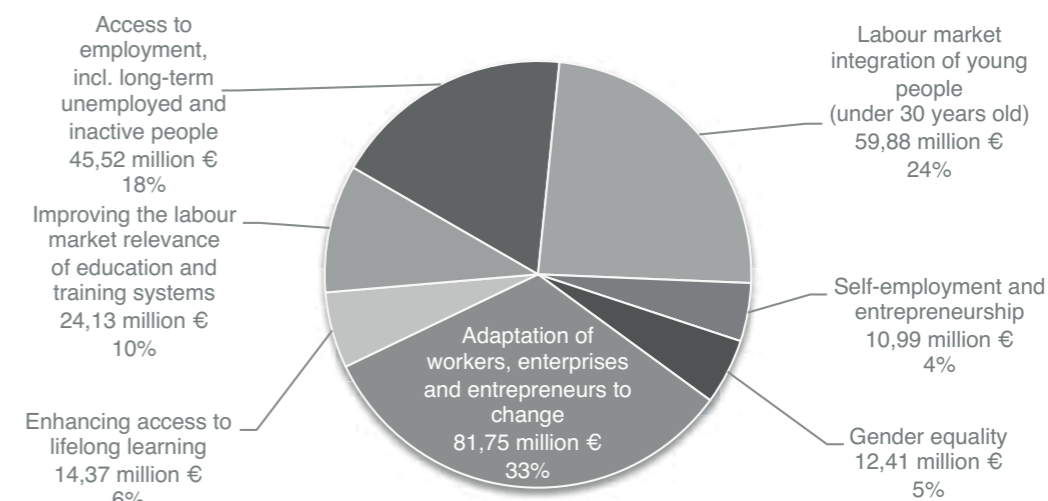


Figure 7 Breakdown of ESI co-financing for projects in the main categories ‘promoting sustainable and quality employment and supporting labour mobility’ and ‘education, training and vocational training for skills and lifelong learning’ in the Silesian coal mining region (excl. national projects). Source: own illustration, based on Ministry of Development of the Republic of Poland (2017)

Projects dedicated to employment, the performance of the labour market and tertiary education including vocational training make up for a surprisingly large share of the overall budget. A total of EUR 236.66 million has been allocated to a total of 386 mostly small-sized projects.

While projects in the categories of ‘access to employment, incl. long-term unemployed and inactive people’, ‘labour market integration of young people’, ‘Supporting self-employment and entrepreneurship’, ‘improving the labour market relevance of education and training systems’, and ‘enhancing access to lifelong learning’ can lay important foundations for the region to adjust swiftly to imminent structural changes, the most relevant category is also the largest in terms of the volume of ESIF co-financing received: ‘adaptation of workers, enterprises and entrepreneurs to change’. In fact, there are a total of 16 projects (among 38 in the entire category) that explicitly focus on employees of companies undergoing restructuring and/or suffering the negative effects of economic change with a priority treatment to (former) employees of mining companies.

However, these kinds of projects are all relatively small and appear to be piecemeal. The largest project covers retraining for only 108 persons. 14 out of 16 projects list the number of beneficiaries and the total count of persons benefitting is a mere 737 people. Also in terms of budget allocation, these kind of interventions receive only marginal support relative to the overall portfolio. Collectively the 16 projects have been allocated a total of EUR 3.9 million. This is still less than the EUR 4.3 million that have been identified as funding that directly reinforces structural dependencies with respect to coal in the region.

3.2 Greece: Western Macedonia

Quick Facts Western Macedonia

General Information	regional	national
Population (2015)	276.000	10.858.000
GDP per Capita [EUR]	18,200	19,600
Share of industry on GDP (2014)	47%	13%
Unemployment Rate (2015)	31%	25%

Role of Coal in the Region

Coal Output (2015)	35.7 million tonnes	
Coal Type	brown coal (lignite)	
Employment in coal	6.000	
Main companies	PCC (mostly state owned)	
Power Plants Capacity	3,060 MW	
Electricity Generation (National)	2000	2015
Coal (share)	64%	43%
Renewable* (share)	9%	29%

*wind, PV, solar thermal, geothermal, hydro, waste, biofuels



3.2.1 Role of Coal in the Region

Mining and Energy

The Western Macedonian Region is Greece's main area for lignite production. With an amount of 35.7 million tonnes (2015) the region contributes around 80% to the country's lignite production (Euracoal 2017a). The region holds 4 remaining power plants, all operated by the mostly state-owned company Public Power Corporation (PPC). Together the power plants Agios Dimitrios (1114 MW), Meliti (289 MW), Amyntaio (546 MW) and Kardias (1110 MW) (WWF Greece 2016) produce 70% of the total lignite-fired energy capacity in Greece (Public Power Corporation 2016). In total, lignite has a share of 31.6% in Greek electricity generation (2016) (OECD and IEA 2017a). Furthermore, coal combustion emits 37% (2015) (OECD and IEA 2017a) of the total CO₂ emitted by Greece.

Up until 1938, lignite in Western Macedonia was mainly used as a substitute for wood in heating. Western Macedonia started to exploit its lignite resources at an industrial scale in 1939. With a total lignite deposit of 1.8 billion tonnes the Kozani, Ptolemaida, Amyntaio and Florina mining areas cover more than one-eighth of the region's total area (Chatzitheodoridis, Kolokontes, and Vasiliadis 2010). The first lignite-fired power station LIPTOL was planned in 1956 in Ptolemaida, initiating the rise of lignite-fired electrical power in Greece. Over time, six power stations (Agioas Dimitrios, Amyntaio, Meliti, Kardias, Ptolemaida and Liptol) with a capacity of ca. 4 GW were built by PPC. The company is now the largest employer in the region, providing 6.3 % of all jobs and 45.9 % of the direct job opportunities in the secondary sector (WWF Greece 2016).

However, the share of lignite in electric power production in Greece has decreased from 69.8% in 2002 to 38% in 2015, which not only lead to shutting down two power stations, but also promoted an increase in the share of RES, natural gas and hydro power (WWF Greece 2016). Although there is a positive development towards a renewable energy system, PPC still plans to build two more lignite-fired power plants in Western Macedonia (Ptolemaida V and Meliti II) (Public Power Corporation 2016). The onset of a transformation in energy production also affected the region's employment. First lay-offs have taken place among mining contractors and an estimated 1,000 jobs are under threat with PPC (WWF Greece 2016).

Socio Economic Characteristics

The Western Macedonia Region, one of the less populated areas in the country, is located in the north-western part of Greece, boarding Albania and the Former Yugoslav Republic of Macedonia. It consists of the regional units Kozani, Grevena, Kastoria and Florina. The capital is Kozani with 71,000 inhabitants (Hellenic Statistical Authority 2011). The closest city is Thessaloniki, located 130 km east of Kozani.

Over the past 50 years the population of Western Macedonia has decreased by 11.5% from 1961 to 2014. The remaining population is increasingly ageing with a majority of people over 65 years. About 49% of the production and 23.9 % of employees of Western Macedonia are located in the secondary sector, which is dominated by lignite mining and electricity production. Most of the jobs in this sector are in the PPC, so the region largely depends on that company. In terms of unemployment, Western Macedonia is rated 9th among all European Regions with an unemployment rate of 27.6% in 2014 (WWF Greece 2016). Still, Western Macedonia fares relatively well with per capita GDP higher than in many other Greek regions (see [Figure 1](#) above).

3.2.2 Use of Structural Funding in the Region

Under the current planning, Greece will implement 7,345 projects under the European Structural and Investment Funds (ESIF). The funding accounts to EUR 6.7 billion with a total budget of EUR 8.4 billion in the 2014-2020 period (European Commission n.d.). Our analysis identified 500 projects in the region of Western Macedonia with a funding of EUR 215 million and a total budget of EUR 265 million.

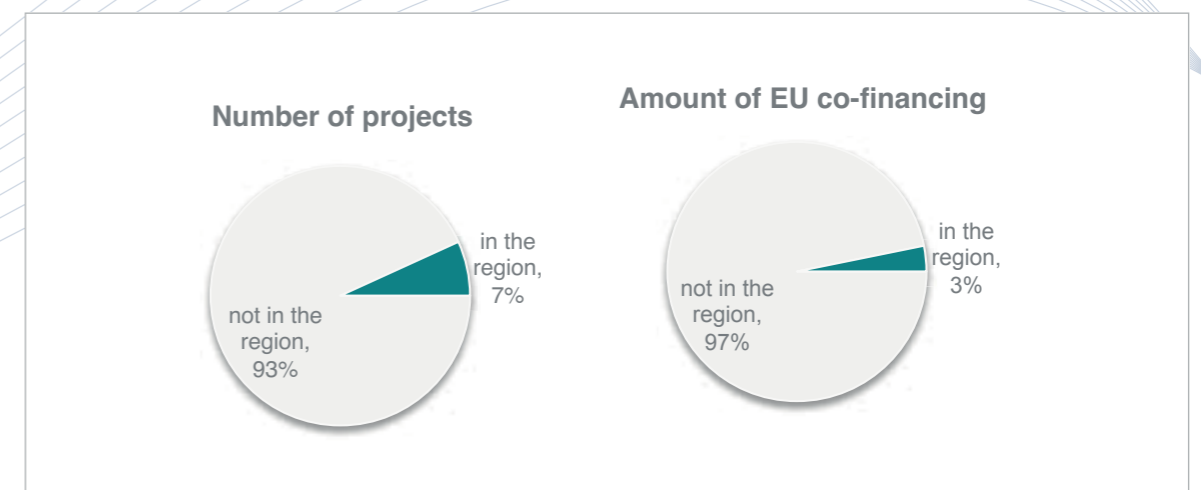


Figure 8 Shares of the total of 7,345 ESIF supported projects (left) and of the total of EUR 6.7 billion of ESIF co-funding allocated to projects in Greece (right).

Source: own illustration, based on (Ministry of Economy and Development 2017)

The projects in the region show a strong focus on social aspects such as trainings for the unemployed, lifelong learning, etc. Overall there are 101 projects in the operational programme "Human Resources Development, Education and Lifelong Learning" out of which 41 were identified as projects with a direct effect on the coal transition in the region. Another focus is the development of social and public infrastructure within the operational programmes "Reforming Public Domain" and "Technical Support". The first contains organisational and administrative projects in the public sector and the latter mainly comprises equipment, material, software, and other technical support for offices that were classified as having a rather indirect effect with regard to structural change in the region.

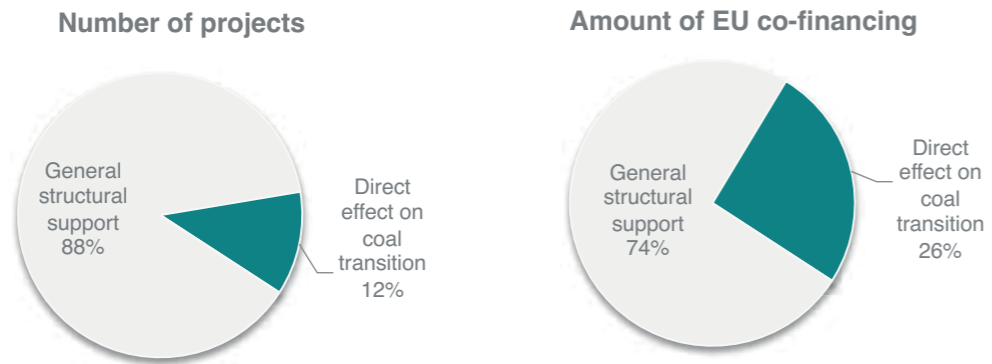


Figure 9 Shares the total of 500 ESI Fund supported projects (left) and of the total of EUR 265 million of ESIF co-funding allocated to projects in Greece with direct effects on the coal transition in the region and rather general structural support and indirect effects (right).
Source: own illustration, based on (Ministry of Economy and Development 2017)

Of special interest are the operational programmes “Competitiveness and Business Innovation” with 51 projects and “Western Macedonia” with 68 projects. They aim at economic development and job creation in the region, and support “SMEs to become more competitive and innovation-driven” (European Commission 2017c). The projects comprise technical and social infrastructure projects as well as funding for SMEs and industry that were classified as having a direct effect on the coal transition on the region. Others have a more indirect effect but are important nevertheless, such as the improvement of water infrastructure in several municipalities.

The operational programme “Infrastructure Transport, Environment and Sustainable Development” comprises only 14 projects. Nevertheless, these projects account for almost EUR 52 million and EUR 44 million of EU co-financing. Only the programme “Western Macedonia” has a higher share of eligible costs in the region with EUR 123 million and EUR 98 million co-financing.

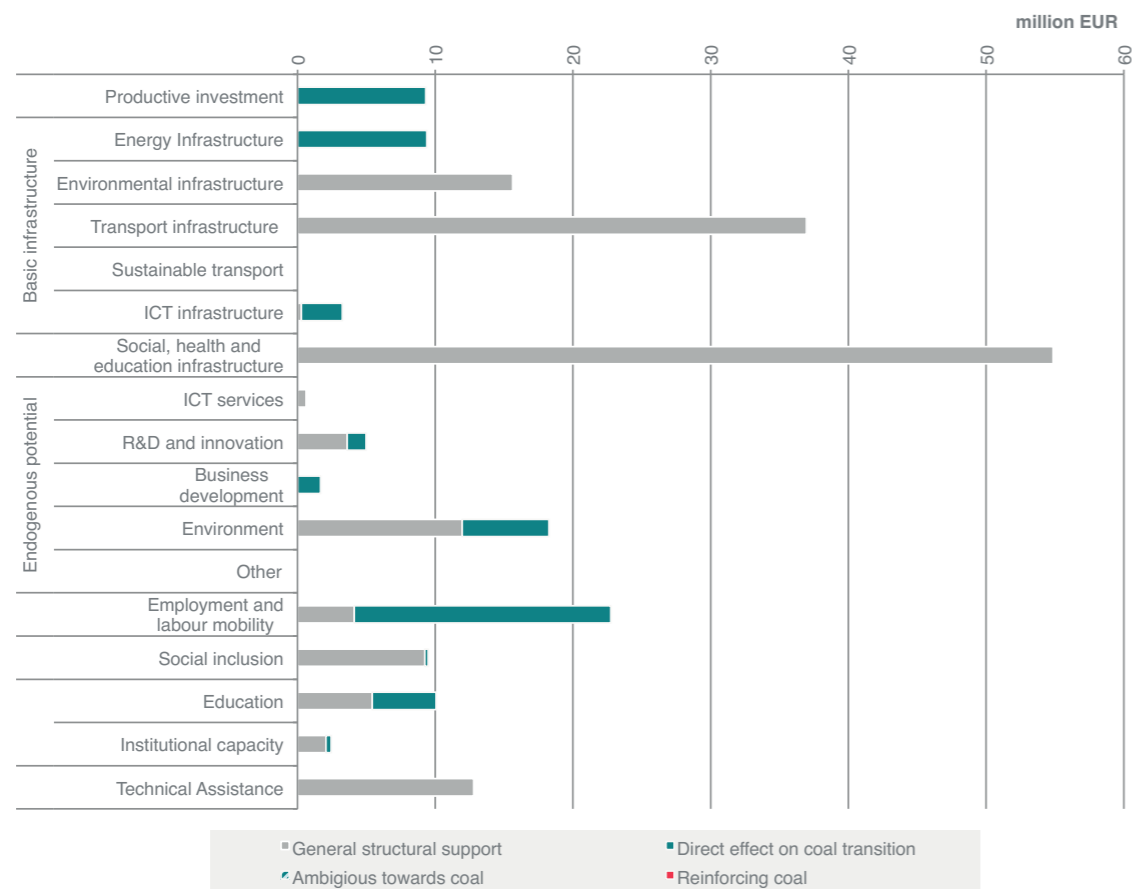


Figure 10 Overview structural effect of ESI Fund co-financing per area of intervention in Silesia (excl. national projects).
Source: own illustration, based on (Ministry of Economy and Development 2017).



3.3 Germany: Lusatia

Quick Facts Lusatia

General Information	regional	national
Population	1.100.000	81.198.000
GDP per Capita [EUR]	n/a	35,800
Share of industry on GDP(2014)	30%	26%
Unemployment Rate (2015)	10%	5%
Role of Coal in the Region		
Coal Output (2016)	62.3 million tonnes	
Coal Type	brown coal (lignite)	
Employment in coal	8,300 mining only: 5,600	
Main companies	LEAG	
Power Plants Capacity	7,200 MW	
Electricity Generation (National)		
Coal (share)	2000	2015
Coal (share)	53%	44%
Renewable* (share)	8%	31%



3.3.1 Role of Coal in the Region

Mining and energy

Lusatia is Germany's second largest lignite mining region. In 2016 62.3 million tonnes were mined here, corresponding to 35 % of Germany's lignite production. In Lusatia 94% of the lignite produced is being used for the generation of electricity and heat (in CHP plants). There are three lignite-fired power plants in the region (Jänschwalde: 3 GW; Schwarze Pumpe: 1.6 GW; Boxberg: 2,6 GW), 49,3 TWh in 2016 (Lausitz Energie Bergbau AG 2017).

Mining is done exclusively in open pit mining in four sites (Nochten, Reichwalde, Welzow-Süd and Jänschwalde) covering a mining area of 87,000 hectares. Mining activities date back to 1815. Industrialised mining has strongly increased in the early 20th century, when lignite was used for electricity generation, coal briquette production (as a heating fuel), and as a basic raw material for the chemical industry in the region. From the 1950s on, mining production was further increased as lignite was the only major domestic energy source for East Germany. In 1988 almost 80,000 miners were employed in the region, producing 200 million tonnes of lignite. After the reunification of Germany production plummeted: in 1998 only 50,000 tonnes were produced by only 8,000 miners (see also [Figure 11](#)). Lignite was less and less used for heating purposes, and large parts of the chemical industry in the region were shut down. The remaining industry used oil as a basis. Finally the power plants were modernised, thus using less lignite for the same amount of electricity generated. Many mines were shut down. An area more than 55,000 hectares was recultivated - thus transformed into farmland, forests and lakes.

Jobs in lignite mining, Lusatia

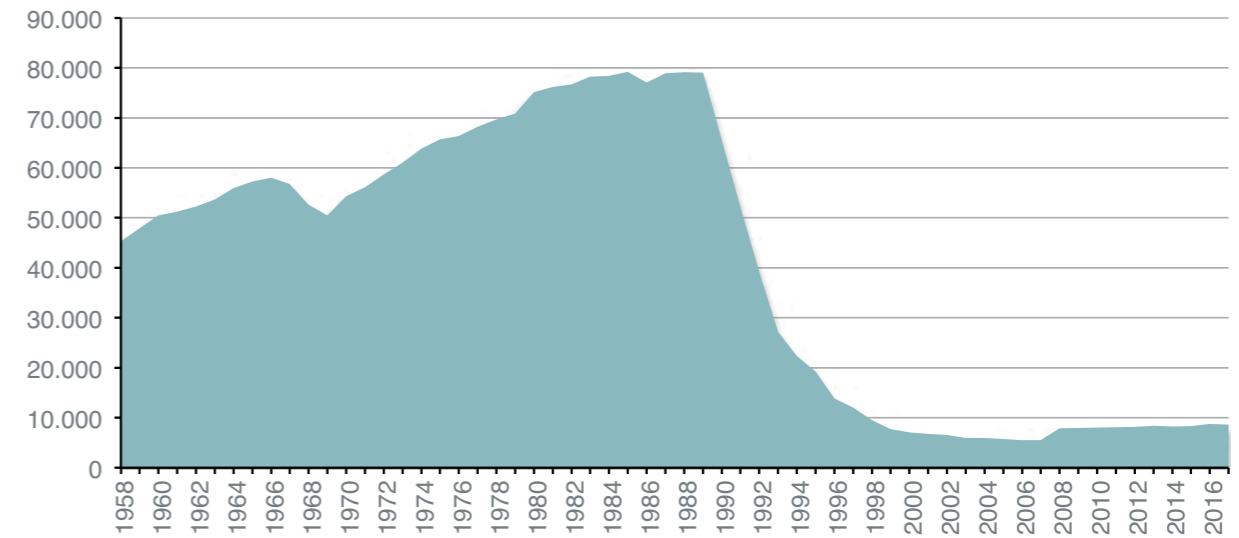


Figure 11 Jobs in lignite mining in Lusatia – historic development. Between 1990 and 1999 direct jobs in lignite mining in Lusatia decreased from 80,000 to 8,000. As of 2008, data includes employees in lignite fired power plants. Source: own illustration, based on (Statistik der Kohlenwirtschaft e.V. 2016).

In the 1990s and early 2000s a massive modernisation effort was undertaken in both mining and power plants. Furthermore the region tried to position itself in developing efficient and clean coal technologies, including setting up corresponding research capacities. The largest German CCS test site in Ketzin is located in the region. However, public acceptance for CCS is too low in Germany to be pursued further. Against this background and Germany's climate targets, today, the question of a lignite phase-out is heavily debated both at the national level and in the region. In any case, all energy scenarios point to a further decrease both in lignite mining and use within the next decades.

Mining and power plants are both run by LEAG, which combines the companies Lausitz Energie Bergbau AG (mining) and Lausitz Energie Kraftwerke AG (generation). They are owned by the Czech energy company Energetický a Průmyslový Holding (EPH) and PPF Investments. The former owner Vattenfall had paid EUR 1.7 billion when selling its lignite assets in Lusatia in 2016 in order to cover for future liabilities of post-mining recultivation needs. In 2017 LEAG announced not to pursue plans for new power plants in the region anymore, and also reduced its plans for extending the mining areas due to the energy policy debate in Germany (Agora Energiewende 2017).

Socio-economic characteristics

Lusatia is located in the east of Germany, close to the Polish border. Factually, the region stretches across the border, but for this report only the German part of Lusatia is considered. The region extends to two German states: the larger, northern part of Lusatia is located in Brandenburg, while the smaller, southern part is located in Saxony. Lusatia is a rural area with 1.1 million inhabitants. The largest city is Cottbus (100,000 inhabitants). The closest urban agglomerations are Dresden (to the south), Leipzig (to the west) and Berlin (north of Lusatia).

Lusatia shows many features of a structurally weak region in Germany. This has been the case for more than 25 years, and is projected to remain thus in the foreseeable future. Due to the economic decline after reunification in 1990, many people have moved out of the region, resulting in a net population loss of 18% between 1995 and 2015 (Markwardt and Zundel 2017). In some of the counties (Landkreise) with formerly high mining activities, population even decreased by 30% (Ragnitz, Markwardt, and Schwarzkopf forthcoming). Population projections predict a further decline (25% between 2015 and 2040) which would correspond to a steeper decline compared to neighbouring regions (Agora Energiewende 2017), Markwardt et al. 2016). Since especially young people left the region in the search for new jobs, the average age is above German average. Unemployment is at 10%, again higher than the German average, but comparable to other structurally weak regions of East Germany or the Ruhr area (s. [Figure 12](#)) (Agora Energiewende 2017), Albrech, Fink, and Tiemann 2016). However, Lusatia also shows signs of economic recovery after the breakdown in the 1990s when unemployment rates in the mining areas were at 20% - twice as high as today.

In comparison to other rural areas in Germany, Lusatia's degree of industrialisation is high (almost 30% of GDP). The mining, energy and water sector strongly contributes to both jobs and economic wealth creation. However, the region is on a pathway towards diversification. The four industry sectors food (and food processing), chemicals, metal and mechanical engineering contribute to roughly 50% of the more than 80.000 jobs in industry in Lusatia (Kluge et al. 2014).

Culture, challenges and future trends

Culturally, mining and energy is deeply rooted in Lusatia. The region defines itself as an “energy region”, and activities to develop both CCS and renewables in the region can be seen as an effort to keep a historical continuity despite economic upheavals. The shift towards renewables provides opportunities for the region in production, installation, operation and maintenance of wind, PV and biomass. However, it will not be possible to fully substitute future losses in jobs or GDP due to the foreseeable reduction of coal mining and use (IÖW 2017).

Assessments of the innovation system of Lusatia conclude that the region is rather weak in terms of developing innovations (Markwardt et al. 2016). This is also due to the fact that coal mining and energy industries are large-scale industries, and consequently employees perceive themselves as workers and not entrepreneurs. The non-mining companies in the region are generally quite small companies with little possibilities and ambition for aggressive growth. Thus it is difficult for the region to compensate job losses in the coal sector.

Nevertheless, many efforts have been made in the past to strengthen the region and to diversify it economically. To support this process several institutions have been set up locally (Markwardt et al. 2016). One example is the “Innovationsregion Lausitz - iRL”, a local agency which aims at supporting regional economic development (iRL 2018). Shareholders are the regional chambers of industry and commerce, the University of Cottbus and various other regional trade associations. The iRL was founded in 2016 as a response to the challenges that climate policy and the foreseeable closure of coal fired power plants and mines pose to the region. This regional development corresponds to an important aspect of a possibly accelerated coal phase-out in Germany on the national level: here the economic situation in the mining regions is increasingly discussed as part of the energy policy discourse, and various proposals have been made on how miners or mining regions could be supported in the coming transition process (Agora Energiewende 2017; enervis 2016). The focus so far however was on proposals for national support programmes and less on European approaches.

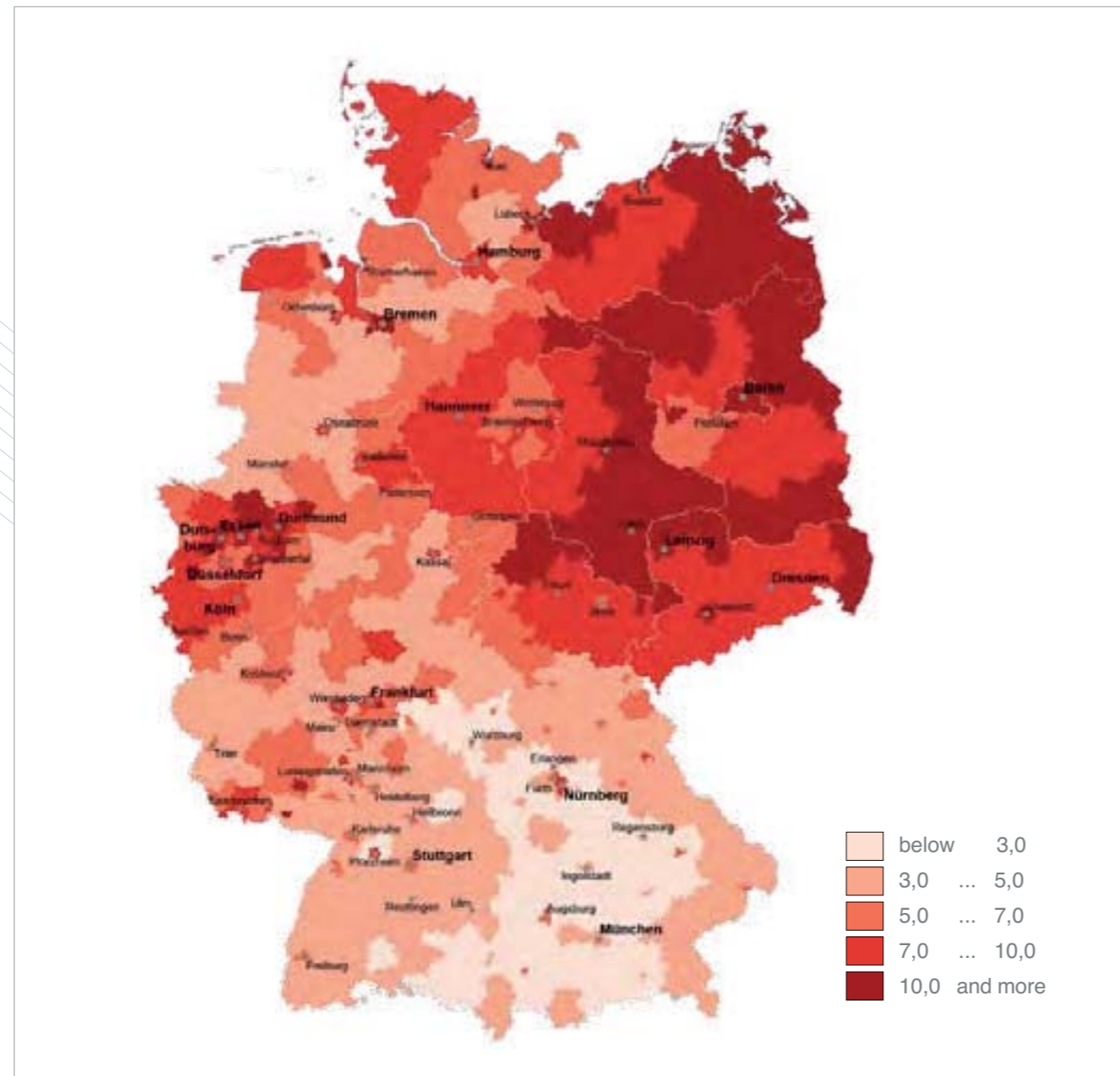


Figure 8 Regional distribution of unemployment in Germany (in percentage of workforce). Source: (Albrech, Fink, and Tiemann 2016).

3.3.2 Use of Structural Funding in the Region

Operational Programmes in Brandenburg and Saxony

ESI funds are governed and distributed on the level federal states (Länder) in Germany. Since the German part of Lusatia coal mining region is located partially in the state of Brandenburg and partially in the state of Saxony it is necessary to analyse operational programmes and use of funds of both states.

- The Operational Programme of Brandenburg (Brandenburg 2014) concentrates on four priority areas:
- Strengthening applied research, development and innovation
- Strengthening SMEs
- Reducing CO₂ emissions in all tranches of the economy
- Integrated development of urban and rural spaces

The Operational Programme mentions lignite mining as an important part of the region's economy and heritage, but also acknowledges the problem lignite poses as a source of emissions. Climate mitigation is not only a priority in supporting energy efficiency and renewables, but is generally mainstreamed by a climate proofing policy for all investments. As an example, the regulations on project selection explicitly state that it is not allowed to fund projects which would contravene sustainable development ("Die beantragten Maßnahmen dürfen nicht gegen eine ökologisch nachhaltige Entwicklung (...) verstoßen") (Brandenburg 2017a). However, a stringent operationalization of this objective (e.g. through a black list of unwanted actions) is not given in the regulations.

Total budget of the Operational Programme for Brandenburg is at EUR 1,057,054,036, with an EU contribution of EUR 845,643,228. The share of northern Lusatia is not specified in the Operational Programme.

Saxony, the German federal state where the southern part of Lusatia is located, does not mention lignite mining in its Operational Programme at all, other than as a part of the region's heritage (Sachsen 2015). Lusatia as a region is also not mentioned at all. This may be due to the fact that Lusatia is only a small part of Saxony, with relatively small contributions in terms of inhabitants and economic relevance.

Use of ESI funding

Under the current planning, a total of 18,603 projects have been granted under the European Regional Development Fund (ERDF) and the European Social Fund (ESF) combined in the two German states Brandenburg and Saxony (ESI funding share: EUR 1.39 billion, funding rate 80%) (Brandenburg 2017c, 2017b; Sachsen 2017). Of these, 2,658 projects can be attributed to the Lusatia region with a cumulated co-financing volume of EUR 131.5 million. Additionally 808 projects are implemented on state level (ESI funding share: 142 million €). It is not possible to assess to what extent these state-level projects may or may not impact on Lusatia.

Of the ESI funding for projects implemented directly in Lusatia, slightly more than half can be considered to directly support the challenges of a transition away from coal mining and use (see Figure 13, top chart). In contrast, not a single project was identified which would support the existing coal sector and only 0.1 % of the budget go to projects which we considered "ambiguous". However, for projects covering 5% of the regional budget it was not possible to make any assessment at all ("unclassifiable" in Figure 13). The reason is that despite the requirements of Regulation 1303/2013 Art. 115 for many projects in the state of Brandenburg no summary of the project scope was given in the data provided by the state government. Especially in the field of technology innovation it was often not possible to clearly identify the specific application. Thus, it can not be ruled out that some of these projects may have some linkages to coal mining and coal use.

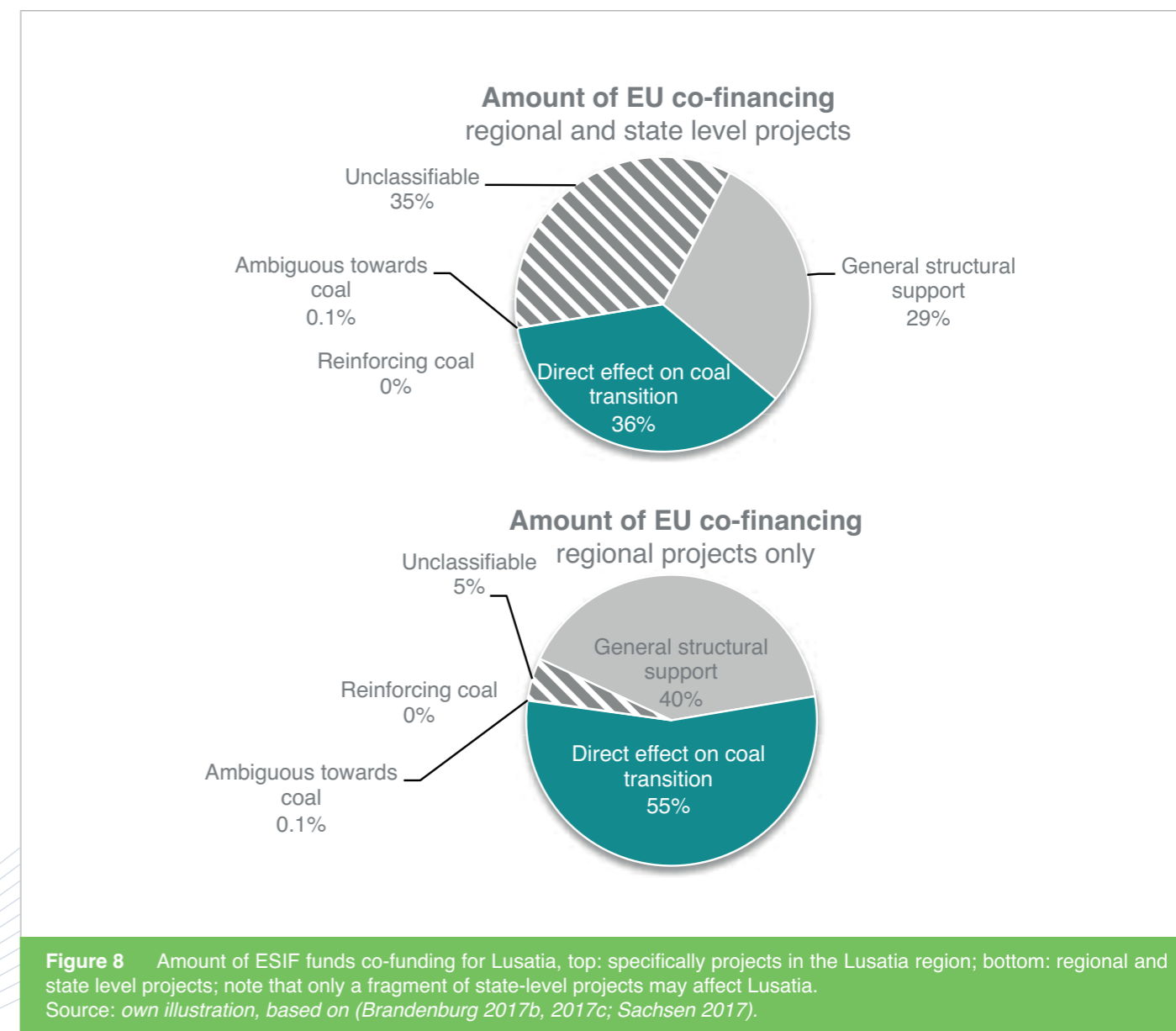


Figure 8 Amount of ESIF funds co-funding for Lusatia, top: specifically projects in the Lusatia region; bottom: regional and state level projects; note that only a fragment of state-level projects may affect Lusatia. Source: own illustration, based on (Brandenburg 2017b, 2017c; Sachsen 2017).

The bottom chart in Figure 13 illustrates use of funds combined for purely regional projects and projects on state level. In Brandenburg EUR 90 million are allocated to the business promotion bank of the federal state of Brandenburg (Investitionsbank des Landes Brandenburg) to support medium and small sized enterprises with financial services like venture capital, equity etc.³ If these funds were equally distributed among sectors, the vast majority would go into developing economic alternatives beyond coal. However, since no more detailed information was available to us, we can not assess which share of these funds (if any at all) supports companies of the coal sector. Consequently we had to label 35% of the ESI Funds as unclassifiable.

³ Note that in various cases we identified obviously false implementation codes. We have adjusted the classification according to available information on the funds (see <https://www.ilb.de/de/wirtschaft/eigenkapitalfinanzierung/>)

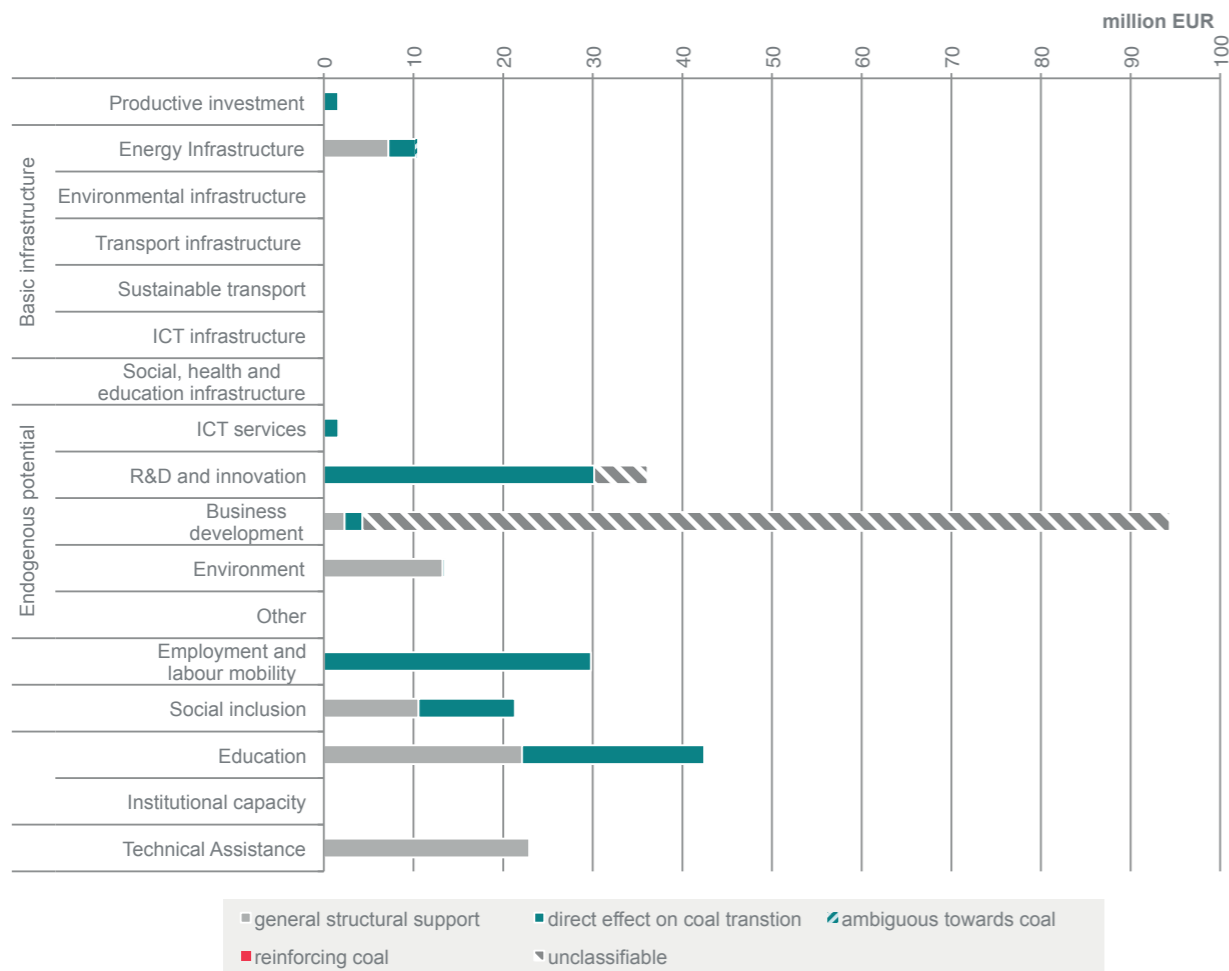


Figure 14 Overview structural effect of ESIF co-financing per area of intervention in Lusatia (incl. state level projects). Source: own illustration, based on (Brandenburg 2017b, 2017c; Sachsen 2017).

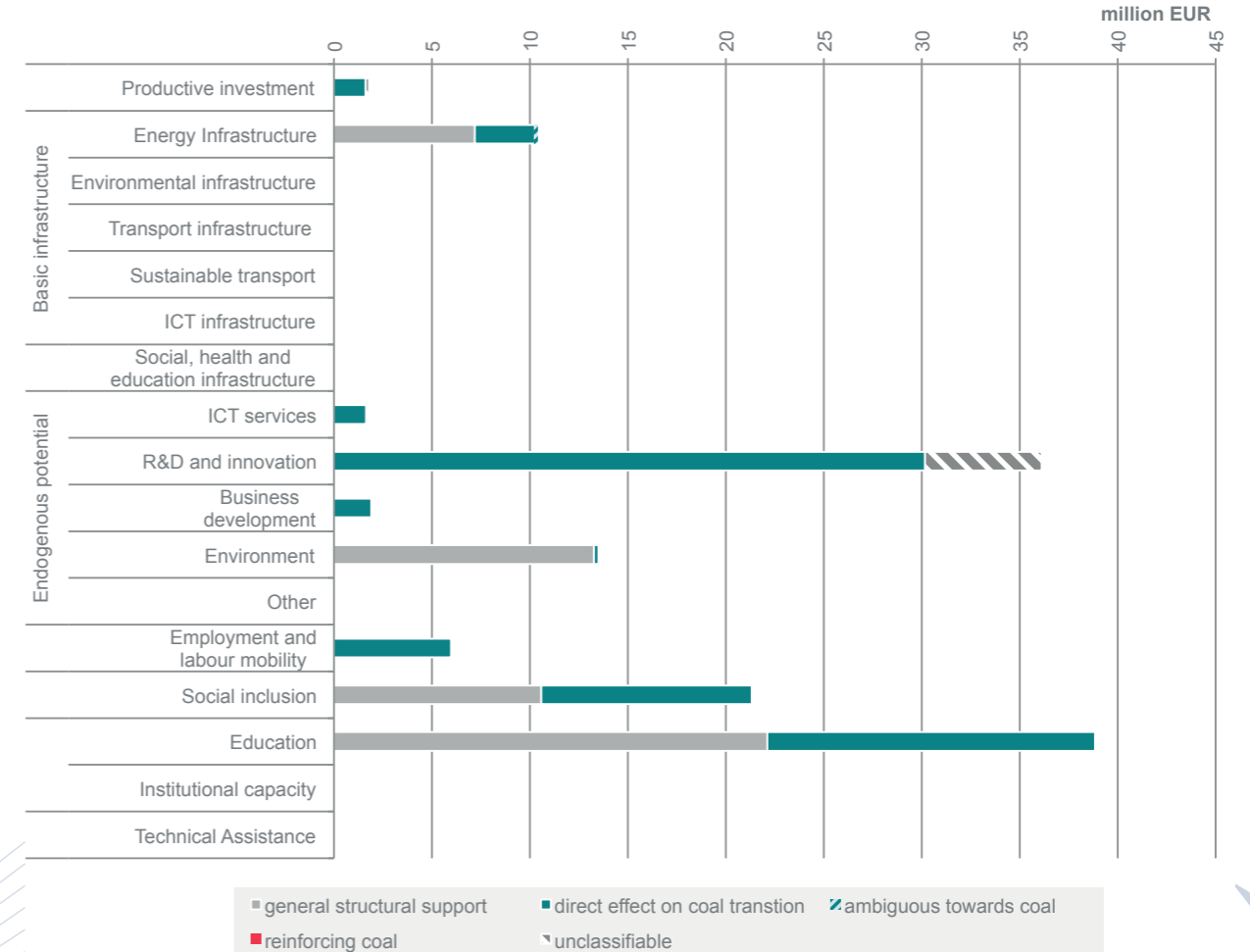


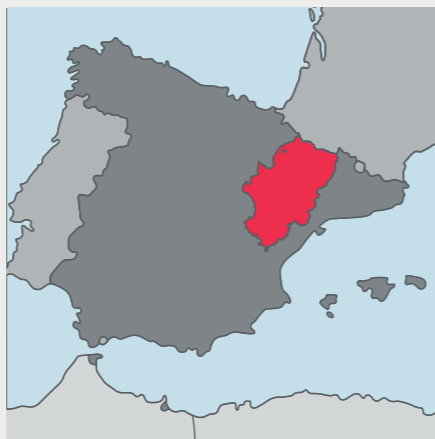
Figure 15 Overview structural effect of ESIF co-financing per area of intervention in Lusatia (regional projects only). Source: own illustration, based on (Brandenburg 2017b, 2017c; Sachsen 2017).

A more detailed breakdown of ESI Funds across implementation fields are given in **Figure 14** (combined regional and state level projects) and **Figure 15** (specifically regional projects). The general picture for Lusatia is that hardly any funds are used for infrastructure (mainly energy efficiency and renewables). The core of funding goes into business development, R&D and innovation. However, it has to be noted that especially funds for business development are available for the entire state of Brandenburg and only a share will reach companies in Lusatia (to compare: the Brandenburg part of Lusatia holds roughly one third of the inhabitants of the whole state). Furthermore, a focus lies on employment and labour mobility, social inclusion and education projects. Here it needs to be noted that a large share of the employment and labour mobility projects are governed on state-level and consequently are only partially available for employees in Lusatia. In several implementation areas reporting in Brandenburg is done on the level of individual actions. Consequently Lusatia has many small scale projects (training for individual people, support for companies to attend trade fairs) with budgets often between EUR 1,000 and EUR 5,000.

Zooming in on projects specifically and exclusively in Lusatia (**Figure 14**) it becomes visible that the majority of funds go into education, R&D and innovation. Most of these projects are considered to have a direct positive impact towards a transition away from coal use and mining. However, for EUR 5 million of funds a classification is not possible due to insufficient information (see above).

3.4 Spain: Aragon

Quick Facts Aragon		
General Information	regional	national
Population	1.326.000	46.450.000
GDP per Capita [EUR]	28,500	25,900
Share of industry on GDP(2014)	25%	18%
Unemployment Rate (2015)	16%	22%
Role of Coal in the Region		
Coal Output (2015)	1.3 million tonnes	
Coal Type	brown coal (sub-bituminous)	
Employment in coal	500	
Main companies	Compañía General Minera de Teruel, S.A., SAMCA, Endesa-Enel	
Power Plants Capacity	1,100 MW	
Electricity Generation (National)		
Coal (share)	2000	2015
Renewable* (share)	19%	19%
	36%	36%



*wind, PV, solar thermal, geothermal, hydro, waste, biofuels

3.4.1 Role of Coal in the Region

Mining and Energy

With 1.3 million tonnes in 2015, the autonomous community Aragon in the north of Spain is home to nearly half of the Spain's coal production (Euracoal 2017c). Three thermal power plants within the region (owned by ENEL-Endesa) cover about 10% of the nation's coal-fired electric energy capacity: Andorra GI (368 MW), Andorra GII (368 MW), Andorra GIII (366 MW) (Greenpeace Spain 2016b). Compared to other countries, the share of coal in the electrical power generation in Spain is relatively small at 19% (2015)(OECD and IEA 2017b). The CO₂ emissions of the electrical power production amount to 60.5 million tonnes per year (2014), 70% of which were emitted for coal-fuelled electricity generation. The Andorra power plants just emit about 1% of the overall coal power production (Greenpeace Spain 2016b).

The main coal mining and power production region in Aragon is Teruel with its municipality Andorra. The reserves there contain about 200 million tonnes of sub-bituminous brown coal in open cast mining, but the high sulphur content makes the usage in power plants less attractive (Euracoal 2017c). Only after the power plants had been fitted with flue gas desulphurisation in 1992, domestic coal was utilised (Belen and Lopez 2016). The Spanish domestic coal production decreased by 24.5% in 2015 (Greenpeace Spain 2016a), but the coal usage in electricity rose from 14% (2014) to 19% (2015) (OECD and IEA 2017b). The Spanish government has been offering continued financial aid to coal mines only if they present a plan for a final shutdown of operations until 2018, through the "Plan de Cierre de la minera des carbon 2011-2018", This strategy is a continuation of Spain's coal mine policy which has already led to a reduction of coal mining personnel by more than 90% nation-wide since the beginning of the millennium.

On the other hand domestic coal consumption has now mostly shifted from domestic to imported coal. With 80% of the coal used for electricity generation imported, the "Plan de Cierre" has not led to a turn-around in Spain's energy system, even if domestic mines are progressively being closed down. (Greenpeace Spain 2016a).

Socio Economic

Aragon is an autonomous community in Spain, originated from the former medieval Kingdom of Aragon. It is located in the north-eastern part of Spain, with the French border to the north, Catalonia to the east and the Valencian Community to the south. With its three provinces Huesca, Zaragoza and Teruel it holds a population of 1,326,403 inhabitants (Eurostat 2017), almost half of which is living in Zaragoza. Zaragoza is also the name of the capital of Aragon. The coal region analysed in this report is called Andorra, a municipality of Teruel, with 7,875 inhabitants (2016) (Instituto aragones de estadística 2017). The closest cities to Andorra are Zaragoza (100 km), Barcelona (250 km) and Valencia (250 km).

The core mining region in Aragon has seen a substantial decrease in population of -14.4% over the last 30 years. Particularly small villages were affected by this loss of population. This development is however not a specific one, but one that can be observed in many rural areas of Aragon and across Spain. Even more relevant in the context for the imminent phase-out of coal mining is for example the huge educational gap in the region, with 76% of the population at compulsory schooling levels only. Also, employment of women is particularly low in the region – 65.3% in Andorra vs. 77.1 in Aragon. What is more, employment is highly concentrated in the core mining area with 45% of the jobs located in the municipality of Aragon.

In the recent past, the labour market has begun to transform towards more diversity. While the extractive and energy agencies constituted 23.9% of all employment and 77.5% of Gross Value Added (GVA) 2000, their share has decreased to 17.9% employment and 47.3% GVA in 2015. That transformation benefits almost all other sectors, like Public Services (Employment: +14.6%; GVA: +21.3%), Manufacturing Industry (Employment: +6.3%; GVA: +8.0%) and Other Sector (Employment: +5.9%; GVA: +30.3%). Only Agriculture and Construction remained the same in GVA and even decreased in terms of employment (Agriculture -4.7%, Construction -10.2%) (Greenpeace Spain 2016a).

3.4.2 Use of Structural Funding in the Region

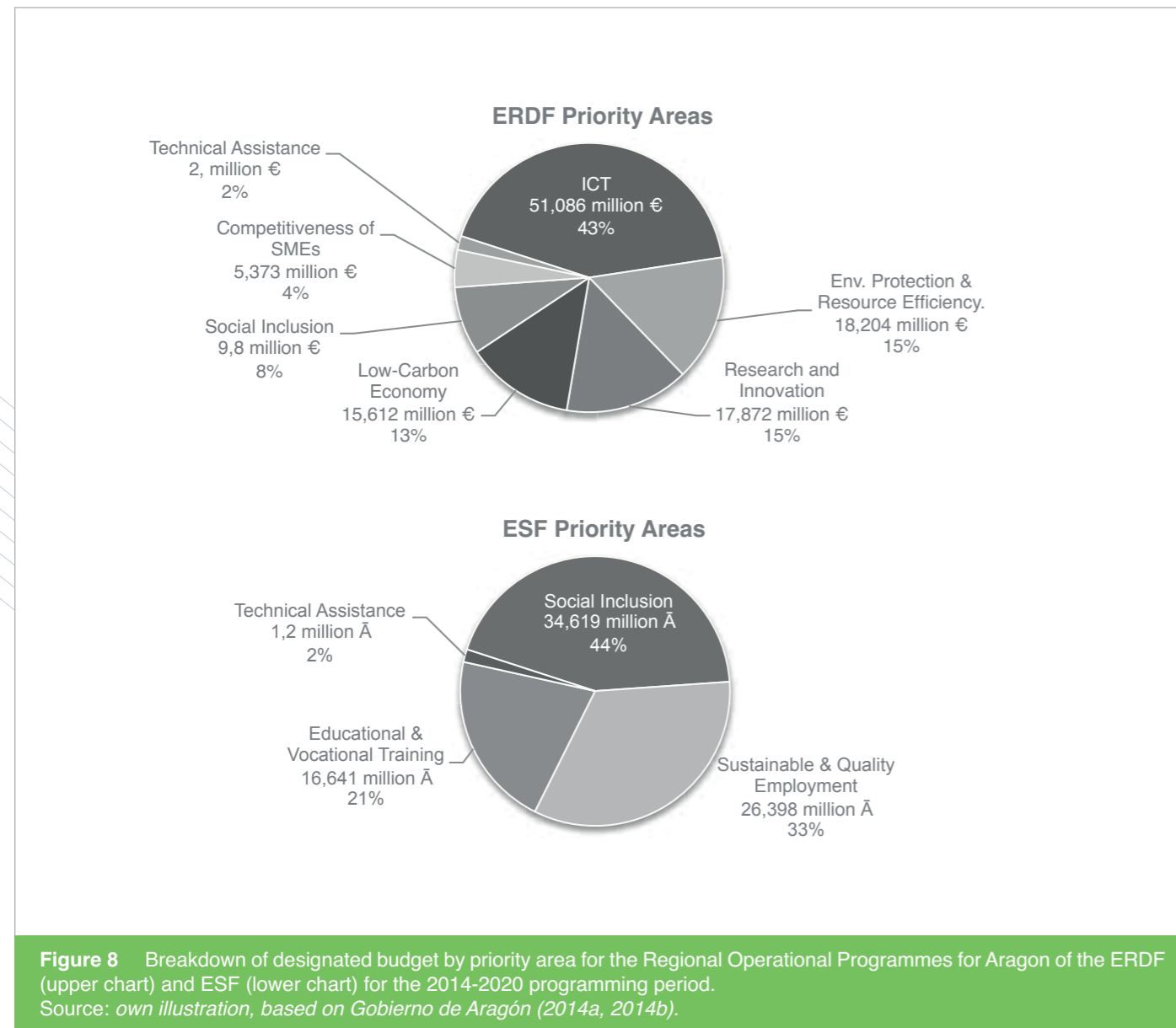
Aragon is a very peculiar case, the reason being that as of November 2017 there has not been one project approved by the managing authorities, neither in the regional operational programme of the ESF nor of the ERDF.⁴ With more than half of the programming period already past, this lack of approved projects signifies a lack of implementing capacities in the region. However, it is beyond the scope of this study to investigate the details of this situation. At this point we cannot gauge what specific circumstances caused the delay in selecting and approving projects to implement the two regional operational programmes.

For lack of projects, the methodology applied for the other regions could not be adopted for Aragon. One alternative would have been to assess data from the 2007-2013 programming period. However, given the different rules, principles and priorities of the earlier programming period, this would also not be comparable with the other regions. Most importantly, though, arguably the data simply is too old to provide a meaningful answer to the overarching research questions, which are imminently forward-looking: we are asking what EU funds can contribute to facilitate and support the imminent structural change associated with phase-out of coal. However the operational programmes of the 2007-2013 period were drafted and the corresponding priorities set when coal phase-out had not been widely accepted as a core challenge. Consequently, assessing the previous programming period would neither be fair nor would it provide any meaningful answers for the upcoming challenges.

⁴ confirmed by personal communication with the responsible officers in the Dirección General de Fondos Europeos within the Ministry of Finance and Public Administration (Managing Authority for the ERDF) and in the Unidad Administradora del Fondo Social Europeo within the Ministry of Employment and Social Security.

Consequently, the only way forward is to describe and synthesise the operational programmes themselves, i.e. to describe what Aragon has planned to do rather than what it is actually doing. The remainder of this section briefly outlines the priorities and spending categories as outlined in the regional operational programmes of the ESF and ERDF in Aragon.

In total, the two regional programmes indicate a budget of EUR 199 million in ESI Funding co-finance to be allocated to Aragon (EUR 120 million for ERDF and EUR 79 million ESF). The ERDF regional programme comprises six priority areas. By far the largest share is designated to supporting the utilization and improving the access to and quality of information and communication technologies in the region. In the ESF, the largest share of the budget is designated to activities in the priority area of “social inclusion” (see **Figure 16** below).



Activities to be co-financed through ESI funding include

- EUR 22.98 million in the category “Access to employment for job-seekers and inactive people, including the long-term unemployed and people far from the labour market, also through local employment initiatives and support for labour mobility”
- EUR 16.5 million for “ICT: High-speed broadband network (access/local loop)”
- EUR 9.66 million for “Rehabilitation of industrial sites and contaminated land”
- For research and innovation it contains EUR 7.25 million for public R&I infrastructure as well as EUR 9.45 million for R&I processes in small and medium enterprises.
- and a total of EUR 19.1 million for community-led development initiatives (ERDF) and community-led local development strategies (ESF).

As indicated above, none of the ESI Funds’ co-funding designated in the operational programmes has actually been allocated to specific projects. If implemented, the majority of the co-finance will be spent in ways that have a high potential of supporting structural change. In particular the relatively large sums designated towards improvements in the labour market are promising. However, whether or not these investments will actually fully materialize in the three last years of the programming period remains to be seen.





4/ Synthesis of regional study results

4.1 Challenges in coal mining regions

Our analysis of the four mining regions Silesia, Western Macedonia, Aragon and Lusatia captures the diversity of circumstances and regional specificities, but also a number of commonalities European mining regions face in the process of phasing out coal and diversifying their economic base.

One clear distinction to be made is between hard coal and lignite regions. Silesia, where hard coal is predominant, is strongly industrialised, with a high level of urbanisation. While coal mining and coal use plays an important role, other industries as well as a larger diversity of other sectors also have high shares in regional value creation. Typically, hard coal regions such as Silesia established steel industries relatively early, which by itself led to a more diverse value chain in the region. As a result, coal mining is an important cultural factor, but is not necessarily as pivotal in today's economic circumstances of the region. Silesia's per capita GDP is above national average, and the decline of employment in coal mining and use is compensated by strong growth in other sectors. Often, hard coal regions are able to adjust their industrial and economic structures through their own efforts to a higher extent due to their relatively high economic powers.

Brown coal regions, on the other hand, typically are much weaker, often rural areas with low population densities, where employment in mining and the energy sector are the predominant employment factor. Especially Western Macedonia, and to a slightly lesser degree Lusatia and Aragon, are examples of this. Aragon as a region is a bit of an outlier in this collection of cases, as the coal mining (sub-)region of Andorra is very small population-wise, and thus the situation of the region is much more strongly determined by Aragon's capital Zaragoza. With a large city at the centre which brings in a more varied set of demands and opportunities, Aragon's dependence on the coal industry has already started to wane. For the other two brown coal regions, the picture is bleaker. Western Macedonia strongly depends on one, mostly state-owned company that holds the majority of both the lignite mines and lignite-firing power plants. Similarly, one private company is the exclusive owner of both the mines and the power plants in Lusatia. After the fall of the Iron Curtain, the mining and energy industries in Lusatia almost collapsed, rendering a formerly relatively successful region in economic trouble. More recently, Western Macedonia has started to experience job losses due to a modernisation of Greece's energy system. High levels of unemployment, especially of the younger generation, as well as a low level of economic diversity add to the importance to support structural change processes within these regions in order to allow sustainable levels of jobs and wealth creation.

A common observation of all coal regions is the fact that mining plays a role as a creator of identity, although to varying degrees of importance. As coal was the most important driver of all countries' industrialisation, coal mining regions have been pivotal in these processes. As a result, mining is often idolised in pictures and hero stories that give a region and its inhabitants a positive image. But with the advent of strong climate protection, these images tend to break down, as coal, and especially lignite, have been identified as the main source of carbon dioxide pollution. In narrative terms coal went from a source of prosperity to a source of harm.

And miners who used to be the heroes are now at best involuntary accomplices of polluting corporations. Such a turning from "good" to "bad" may not be accepted easily. It is perceived as a loss of a positive identification and an abasement of past efforts. This again may lead to clashes between coal workers and environmentalists, because of a different perception of heritage: whereas coal miners often protect the region's mining heritage, and therefore will strongly protest against closures of mines, environmentalists will typically applaud any closure because it will mean less pollution, and, in the case of open pit mines, less destruction of villages and local environments.

Nevertheless, the regions we have analysed are acutely aware of the challenges they face due to the structural change that will inevitably ensue. Consequently, we see increasing efforts in policies and institutions to diversify and strengthen importance of other industries and sectors in the regions, or even direct support to sunset mining activities. Examples for the shifting politics of coal are Spain's "Plan de Cierre de la minera des carbon 2011-2018", which rules that mines that want to keep receiving financial aid from the national budget need to present plans to shut down their activities, or the "Innovationsregion Lausitz", which offers support to local economic development through bringing together stakeholders from industry, trade and science to foster the regional innovation system. The European Union could significantly add value to these developments by financing the required socio-economic adjustments in response to structural changes. ESI funding could in this sense "help the regions help themselves".

4.2 Use of ESI funding in mining regions

The comparative analysis of the use of European Structural and Investment Funds (ESI Funds) in the four coal mining regions yields the following key results:

Only marginal funds for coal related activities

In Western Macedonia and Lusatia no EU funds are used in ways that actively reinforce structural path dependencies with regard to coal use or mining. For Aragon, based on the limited information that is available for the region, it can be said that no plans exist to fund coal sector activities with ESI funds. Only in Silesia a very small share of projects support innovation and investments in companies of the coal sector (with a cumulated ESI co-funding of EUR 4.3 million, which corresponds to 0.3% of the allocated regional ESI funds).

This in itself is a quite remarkable finding in our view. Given the EU's explicit focus on sustainable growth it may not look surprising. However, in the corresponding regulation there are no provisions that explicitly rule out specific technologies (so more efficient coal use or carbon capture and storage technologies could be framed to be sustainable). Furthermore, our conceptualization did not only include direct investments into coal and coal infrastructure but also R&D and productive investments in associated sectors. Thus, the extremely low shares of coal related fund use do come as a surprise, especially in comparison to historic structural policy priorities. In previous ESI funding periods innovation in coal technologies and clean coal had still been strong priorities in some countries. And in the German Ruhr area, for example, billions of Euros were invested in the 1960s up to the 1990s in order to keep uncompetitive coal mining alive.

Unique profile for each region

The use of ESI funds in the regions differ quite strongly. We can discern some regional specificities:

- Western Macedonia uses ESI funding primarily to support local infrastructures (social, health, education, transport) as well as for labour mobility and social inclusion activities. Thus ESI funds help to keep local basic infrastructures and services alive against a severe economic background (> 30% unemployment) of the region.
- Silesia puts a heavy focus on provision of road transport. However, this picture may be a little deferred as very few very large projects already consume the lion's share of the budget (which may be unique and partly due to specific priorities just at the time of our assessment). A second priority is employment and labour mobility activities, thus compensating for social upheavals due to the economic transition of the last decades. Remaining funds are almost equally spread in all other funding areas.
- Lusatia puts a clear emphasis on research, innovation, business development and education as well as labour mobility activities through ESI funding. There is a clear focus on strengthening the endogenous economic potential. In contrast there is hardly any funding for basic infrastructure anymore (which has been an important factor in previous years.) The little there is, is limited to the support of energy efficiency and renewables. More than 50% of all funds allocated can be considered to directly support a transition away from coal mining and coal use.
- Aragon is peculiar since no funds have been allocated so far. Thus it was only possible to analyse targets stated in the operational programmes (but not budgets of actually allocated projects). These programs show clear priorities towards innovation and training, information and communication technologies (ICT) and low carbon economy on the one hand and activities towards social inclusion and quality employment on the other.



Interpretation and validity of ESI funding analysis

In order to interpret the results of our ESI funding assessment correctly it is important to note the following aspects:

- Analysed were allocated funds (granted projects) as communicated by the regions (status September 2017). As the funding period runs from 2014 to 2020 it is likely that funding priorities may change in coming years. In some regions, individual projects exist with very large budgets (e.g. road infrastructure in Silesia), which were allocated early in the funding period and which may thus distort the picture of funding priorities across implementation areas.
- ESI funds of previous periods were not analysed comprehensively. The reason being that we assume previous funding periods would not have mirrored the current energy and climate policy trends and objectives adequately. However, differences in regions may be explained by previous activities (e.g. limited need for infrastructure investment, if this was already financed a decade ago).
- Basis of the assessment are fields of action as described in titles and abstracts of granted projects. Thus we assess projects based on their self-declared targets. We explicitly do not evaluate the outcome of projects nor the longer term impacts with respect to coal related socio-economic structures.
- In addition to ESI funds, regions may draw on many other sources of funding (other EU funding, national funds, taxes etc.). The different abilities of the regions to draw onto these funds may partially explain their priorities in ESI support. However, an assessment of all funds available to the regions is beyond the scope of this study. It thus needs to be noted that other funds may show quite different patterns of either supporting the coal sector or a transition away from coal use and mining.

EU reporting helpful to assess ESI funds impact - but could be improved

On an aggregated level we find that the reporting requirements by the EU on the use of ESI funds are indeed very helpful to ensure good governance. All Member States are obliged to publish standardised and comparable data on ESI funding use on a timely basis (updates every 6 months). This data was the basis for our analysis - without this reporting requirement, such an analysis would have been impossible. However, we still see some room for improvement:

- Part of the data for Lusatia was incomplete, preventing comprehensive assessments. It could be that this is an outlying case, but it may still be helpful if the Commission would thoroughly countercheck the project data provided by the Managing Entities for completeness and compliance with reporting requirements.
- On a related note, it might be helpful for comparative purposes if the data provided would all have a common language. While the intervention codes are the same for all countries, the reliance on national languages complicates comparative analysis. This was certainly true for our study, but it may also ease the work of the Commission in preparing biennial reports, the Cohesion report and others. Also note that comparability of the data is explicitly mentioned in Regulation 1303/2013 Art. 115.
- Furthermore, we see a need for not only transparency on ESI budget spending but also impact assessments of the effects achieved through ESI funded projects in particular in view of the impending challenges of the coal phase-out. Regulation 1303/2013 Art. 55-57 specify evaluation requirements of ESI funds. Yet, the evaluation is supposed to address on the general level the mission of each ESI Fund and the targets of the EU's strategy for smart, sustainable and inclusive growth. Further research would be needed to look into the specific effect in relation to the phase-out of coal.



5/ Conclusions

The economic importance of coal mining has already decreased in Europe over the last decades - due to purely technological and economic reasons. Consequently, many coal mining regions in Europe have been losing an important part of their economic base and are facing structural changes. The need to bring down Europe's CO₂ emissions quickly and dramatically will inter alia increase the economic strain on these regions – despite the fact that the decarbonisation of Europe's energy system also brings along many opportunities for Europe's economic and innovation system as a whole. Coal mining regions will have to undergo a structural transition process and have to define a future for themselves – a future beyond coal. Given that climate mitigation is a collective effort in Europe, it seems fair that coal mining regions should receive support to master the challenges of this transition.

This study analysed how European Structural and Investment Funds (ESI Funds) are currently being used in four coal mining regions: Aragon (Spain), Lusatia (Germany), Silesia (Poland) and Western Macedonia (Greece). Key findings of this analysis and subsequent conclusions on how to better support coal mining regions are:

- The use of ESI funds differs from region to region – which corresponds to different conditions, needs and development perspectives in the regions. This flexibility in tuning priorities to regional circumstances is something, which seems to be an essential basis for adequate and effective use of ESI funds in general but in particular when they are used to facilitate socio-economic adjustments in the face of impending coal phase-out.
- Regions may already today use ESI funds to support their transition towards a time beyond coal mining and coal use. And in fact only marginal shares of ESI funds are currently used to strengthen existing coal infrastructures and companies. However, in most regions only a minority of funds is directly used to help to prepare the region for its future beyond coal. This is partly due to urgent needs to compensate regional structural weaknesses and partly due to regional and national development and energy priorities.
- Climate mitigation (and adaptation) is already one priority in ESI funding. However, so far this objective is mainly underpinned with support for renewables and energy efficiency. It is not yet generally mainstreamed in the sense of supporting the transition towards a carbon neutral economy – which would include support to phase-out high carbon technologies. For example, some of the interventions that this study found to be particularly relevant feature a climate coefficient⁵ of zero and cannot be counted towards the climate change objectives. This holds for example for most measures aiming at strengthening ICT infrastructure as well as education and vocational training. In particular the latter may be essential for a sustained and sustainable change process in the region and ultimately the long-term success of the phase-out of coal which in itself is a necessary condition for successful climate change mitigation.
- Some regional institutions have started to integrate a wider perspective by requiring that all ESI funded projects (including projects supporting endogenous potentials of the regions like support for SMEs) should not contradict sustainable development goals. This approach could still be intensified (e.g. operationalized more strictly).

In summary, coal regions may already today use ESI funds to support the necessary transition ahead of them. However, against the background that decarbonising Europe's energy system is one of the key challenge for the European Union in this century, and phasing-out coal within the next decades is a fundamental step on this path, the EU may want to explore options more directly targeted in their support for coal regions in their efforts for a future beyond coal. Based on the results of this study, we see two general options:

- An explicit funding priority or intervention category “support to phasing out high carbon infrastructure” (or similar) could be integrated into the ESI funding schemes explicitly the European Regional Development Fund, ERDF. An own category for coal transition in the next funding phase would be very helpful to make efforts in the regions more explicit, and to incentivise local and national decision makers to explicitly consider this option. This approach is however a fairly low-level intervention, since the responsible regional entities may still choose to address – or not address – this issue when using ESI funding.
- A more targeted option could be a specific programme under the ERDF, ring-fencing a certain percentage of funds to offer explicit support for a transition of the economy of a region towards an alternative, sustainable, energy system. There are many possible ways how to operationalise such a programme, including by an EU-level definition of such regions and through a combination with ESI funding streams.

Whichever specific approach would be chosen, we consider it to be very important to include regional stakeholders of coal mining regions in the design process of such a support programme. The EU “Coal regions in transition platform” which was launched in December 2017 could be a suitable forum to inform such a debate (European Commission 2017a).

Finally, we would like to note that both of the above support options would not have to be restricted to coal mining regions, but could be extended to carbon-intensive regions in general: most obvious are other regions, which rely economically on the supply of high carbon energy sources, like oil shale mining in the north-east of Estonia. Even beyond energy supply, one could discuss to include regions into such a low-carbon support scheme, which are both structurally weak and heavily rely on high-carbon energy use. Regions with high shares of chemical or metal industry also face massive challenges in the path towards a carbon neutral economy, however a different one. It is not about phasing-out production altogether but supporting the companies to develop and deploy climate-neutral production of their goods and services.

All things considered, the EU structural policy with its ESI funds provides a comprehensive toolbox and extremely valuable resource on which European coal regions can draw in order to reinvent themselves, to shape their own future beyond coal. Currently, however, the tools are not put to use in a systematic manner. The recommended adjustments, we hope, can help to hone these tools so that they can be most effectively put to use.

⁵ All intervention codes were assigned with a specific “coefficient for the calculation of support to climate change objectives” of either 0%, 40% or 100% (See also section 1.3.2 above).



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7/ Annex

List of intervention categories including appraisal

* Coefficient for the calculation of support to climate change objectives

No.	INTERVENTION FIELD	Coefficient*	Main Category	Subcategory (if applicable)					
					support	check	minor	ambiguous	reinforce
001	Generic productive investment in small and medium – sized enterprises ('SMEs')	0 %	I. Productive investment		X				
002	Research and innovation processes in large enterprises	0 %	I. Productive investment		X				
003	Productive investment in large enterprises linked to the low-carbon economy	40 %	I. Productive investment		X				
004	Productive investment linked to the cooperation between large enterprises and SMEs for developing information and communication technology ('ICT') products and services, e-commerce and enhancing demand for ICT	0 %	I. Productive investment		X				
005	Electricity (storage and transmission)	0 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure		X			
006	Electricity (TEN-E storage and transmission)	0 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure			X		
007	Natural gas	0 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure			X		
008	Natural gas (TEN-E)	0 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure			X		

009	Renewable energy: wind	100 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure	X				
010	Renewable energy: solar	100 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure	X				
011	Renewable energy: biomass	100 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure	X				
012	Other renewable energy (including hydroelectric, geothermal and marine energy) and renewable energy integration (including storage, power to gas and renewable hydrogen infrastructure)	100 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure	X				
013	Energy efficiency renovation of public infrastructure, demonstration projects and supporting measures	100 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure	X				
014	Energy efficiency renovation of existing housing stock, demonstration projects and supporting measures	100 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure	X				
015	Intelligent Energy Distribution Systems at medium and low voltage levels (including smart grids and ICT systems)	100 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure	X				
016	High efficiency co-generation and district heating	100 %	II. Infrastructure providing basic services and related investment	Energy Infrastructure		X			
017	Household waste management (including minimisation, sorting, recycling measures)	0 %	II. Infrastructure providing basic services and related investment	Environmental infrastructure			X		
018	Household waste management (including mechanical biological treatment, thermal treatment, incineration and landfill measures)	0 %	II. Infrastructure providing basic services and related investment	Environmental infrastructure		X			
019	Commercial, industrial or hazardous waste management	0 %	II. Infrastructure providing basic services and related investment	Environmental infrastructure			X		
020	Provision of water for human consumption (extraction, treatment, storage and distribution infrastructure)	0 %	II. Infrastructure providing basic services and related investment	Environmental infrastructure			X		

021	Water management and drinking water conservation (including river basin management, water supply, specific climate change adaptation measures, district and consumer metering, charging systems and leak reduction)	40 %	II. Infrastructure providing basic services and related investment	Environmental infrastructure			X		
022	Waste water treatment	0 %	II. Infrastructure providing basic services and related investment	Environmental infrastructure			X		
023	Environmental measures aimed at reducing and / or avoiding greenhouse gas emissions (including treatment and storage of methane gas and composting)	100 %	II. Infrastructure providing basic services and related investment	Environmental infrastructure			X		
024	Railways (TEN-T Core)	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
025	Railways (TEN-T comprehensive)	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
026	Other Railways	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
027	Mobile rail assets	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
028	TEN-T motorways and roads — core network (new build)	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
029	TEN-T motorways and roads — comprehensive network (new build)	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
030	Secondary road links to TEN-T road network and nodes (new build)	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
031	Other national and regional roads (new build)	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
032	Local access roads (new build)	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		

033	TEN-T reconstructed or improved road	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
034	Other reconstructed or improved road (motorway, national, regional or local)	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
035	Multimodal transport (TEN-T)	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
036	Multimodal transport	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
037	Airports (TEN-T) (2)	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
038	Other airports (2)	0 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
039	Seaports (TEN-T)	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
040	Other seaports	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
041	Inland waterways and ports (TEN-T)	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
042	Inland waterways and ports (regional and local)	40 %	II. Infrastructure providing basic services and related investment	Transport infrastructure			X		
043	Clean urban transport infrastructure and promotion (including equipment and rolling stock)	40 %	II. Infrastructure providing basic services and related investment	Sustainable transport			X		
044	Intelligent transport systems (including the introduction of demand management, tolling systems, IT monitoring, control and information systems)	40 %	II. Infrastructure providing basic services and related investment	Sustainable transport			X		

045	ICT: Backbone/backhaul network	0 %	II. Infrastructure providing basic services and related investment	Information and communication technology (ICT) infrastructure	X				
046	ICT: High-speed broadband network (access/local loop; >= 30 Mbps)	0 %	II. Infrastructure providing basic services and related investment	Information and communication technology (ICT) infrastructure	X				
047	ICT: Very high-speed broadband network (access/local loop; >= 100 Mbps)	0 %	II. Infrastructure providing basic services and related investment	Information and communication technology (ICT) infrastructure	X				
048	ICT: Other types of ICT infrastructure/ large-scale computer resources/equipment (including e-infrastructure, data centres and sensors; also where embedded in other infrastructure such as research facilities, environmental and social infrastructure)	0 %	II. Infrastructure providing basic services and related investment	Information and communication technology (ICT) infrastructure				X	
049	Education infrastructure for tertiary education	0 %	III. Social, health and education infrastructure and related investment				X		
050	Education infrastructure for vocational education and training and adult learning	0 %	III. Social, health and education infrastructure and related investment		X				
051	Education infrastructure for school education (primary and general secondary education)	0 %	III. Social, health and education infrastructure and related investment				X		
052	Infrastructure for early childhood education and care	0 %	III. Social, health and education infrastructure and related investment				X		
053	Health infrastructure	0 %	III. Social, health and education infrastructure and related investment				X		
054	Housing infrastructure	0 %	III. Social, health and education infrastructure and related investment				X		
055	Other social infrastructure contributing to regional and local development	0 %	III. Social, health and education infrastructure and related investment		X				

056	Investment in infrastructure, capacities and equipment in SMEs directly linked to research and innovation activities	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
057	Investment in infrastructure, capacities and equipment in large companies directly linked to research and innovation activities	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
058	Research and innovation infrastructure (public)	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
059	Research and innovation infrastructure (private, including science parks)	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
060	Research and innovation activities in public research centres and centres of competence including networking	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
061	Research and innovation activities in private research centres including networking	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
062	Technology transfer and university-enterprise cooperation primarily benefiting SMEs	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
063	Cluster support and business networks primarily benefiting SMEs	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
064	Research and innovation processes in SMEs (including voucher schemes, process, design, service and social innovation)	0 %	IV. Development of endogenous potential	Research and development and innovation				X	
065	Research and innovation infrastructure, processes, technology transfer and cooperation in enterprises focusing on the low carbon economy and on resilience to climate change	100 %	IV. Development of endogenous potential	Research and development and innovation				X	
066	Advanced support services for SMEs and groups of SMEs (including management, marketing and design services)	0 %	IV. Development of endogenous potential	Business development					X
067	SME business development, support to entrepreneurship and incubation (including support to spin offs and spin outs)	0 %	IV. Development of endogenous potential	Business development	X				
068	Energy efficiency and demonstration projects in SMEs and supporting measures	100 %	IV. Development of endogenous potential	Business development	X				
069	Support to environmentally-friendly production processes and resource efficiency in SMEs	40 %	IV. Development of endogenous potential	Business development	X				

070	Promotion of energy efficiency in large enterprises	100 %	IV. Development of endogenous potential	Business development	X				
071	Development and promotion of enterprises specialised in providing services contributing to the low carbon economy and to resilience to climate change (including support to such services)	100 %	IV. Development of endogenous potential	Business development	X				
072	Business infrastructure for SMEs (including industrial parks and sites)	0 %	IV. Development of endogenous potential	Business development		X			
073	Support to social enterprises (SMEs)	0 %	IV. Development of endogenous potential	Business development	X				
074	Development and promotion of commercial tourism assets in SMEs	0 %	IV. Development of endogenous potential	Business development	X				
075	Development and promotion of commercial tourism services in or for SMEs	0 %	IV. Development of endogenous potential	Business development	X				
076	Development and promotion of cultural and creative assets in SMEs	0 %	IV. Development of endogenous potential	Business development	X				
077	Development and promotion of cultural and creative services in or for SMEs	0 %	IV. Development of endogenous potential	Business development	X				
078	e-Government services and applications (including e-Procurement, ICT measures supporting the reform of public administration, cyber-security, trust and privacy measures, e-Justice and e-Democracy)	0 %	IV. Development of endogenous potential	Information and communication technology (ICT) — demand stimulation, applications and services			X		
079	Access to public sector information (including open data e-Culture, digital libraries, e-Content and e-Tourism)	0 %	IV. Development of endogenous potential	Information and communication technology (ICT) — demand stimulation, applications and services			X		
080	e-Inclusion, e-Accessibility, e-Learning and e-Education services and applications, digital literacy	0 %	IV. Development of endogenous potential	Information and communication technology (ICT) — demand stimulation, applications and services			X		

081	ICT solutions addressing the healthy active ageing challenge and e-Health services and applications (including e-Care and ambient assisted living)	0 %	IV. Development of endogenous potential	Information and communication technology (ICT) — demand stimulation, applications and services				X	
082	ICT Services and applications for SMEs (including e-Commerce, e-Business and networked business processes), living labs, web entrepreneurs and ICT start-ups)	0 %	IV. Development of endogenous potential	Information and communication technology (ICT) — demand stimulation, applications and services	X				
083	Air quality measures	40 %	IV. Development of endogenous potential	Environment			X		
084	Integrated pollution prevention and control (IPPC)	40 %	IV. Development of endogenous potential	Environment			X		
085	Protection and enhancement of biodiversity, nature protection and green infrastructure	40 %	IV. Development of endogenous potential	Environment				X	
086	Protection, restoration and sustainable use of Natura 2000 sites	40 %	IV. Development of endogenous potential	Environment				X	
087	Adaptation to climate change measures and prevention and management of climate related risks e.g. erosion, fires, flooding, storms and drought, including awareness raising, civil protection and disaster management systems and infrastructures	100 %	IV. Development of endogenous potential	Environment				X	
088	Risk prevention and management of non-climate related natural risks (i.e. earthquakes) and risks linked to human activities (e.g. technological accidents), including awareness raising, civil protection and disaster management systems and infrastructures	0 %	IV. Development of endogenous potential	Environment				X	
089	Rehabilitation of industrial sites and contaminated land	0 %	IV. Development of endogenous potential	Environment	X				
090	Cycle tracks and footpaths	100 %	IV. Development of endogenous potential	Environment				X	
091	Development and promotion of the tourism potential of natural areas	0 %	IV. Development of endogenous potential	Environment	X				
092	Protection, development and promotion of public tourism assets	0 %	IV. Development of endogenous potential	Environment	X				

093	Development and promotion of public tourism services	0 %	IV. Development of endogenous potential	Environment	X				
094	Protection, development and promotion of public cultural and heritage assets	0 %	IV. Development of endogenous potential	Environment	X				
095	Development and promotion of public cultural and heritage services	0 %	IV. Development of endogenous potential	Environment	X				
094	Protection, development and promotion of public cultural and heritage assets	0 %	IV. Development of endogenous potential	Environment	X				
095	Development and promotion of public cultural and heritage services	0 %	IV. Development of endogenous potential	Environment	X				
096	Institutional capacity of public administrations and public services related to implementation of the ERDF or actions supporting ESF institutional capacity initiatives	0 %	IV. Development of endogenous potential	Other			X		
097	Community-led local development initiatives in urban and rural areas	0 %	IV. Development of endogenous potential	Other		X			
098	Outermost regions: compensation of any additional costs due to accessibility deficit and territorial fragmentation	0 %	IV. Development of endogenous potential	Other			X		
099	Outermost regions: specific action to compensate additional costs due to size market factors	0 %	IV. Development of endogenous potential	Other			X		
100	Outermost regions: support to compensate additional costs due to climate conditions and relief difficulties	40 %	IV. Development of endogenous potential	Other			X		
101	Cross-financing under the ERDF (support to ESF-type actions necessary for the satisfactory implementation of the ERDF part of the operation and directly linked to it)	0 %	IV. Development of endogenous potential	Other			X		
102	Access to employment for job-seekers and inactive people, including the long-term unemployed and people far from the labour market, also through local employment initiatives and support for labour mobility	0 %	V. Promoting sustainable and quality employment and supporting labour mobility		X				
103	Sustainable integration into the labour market of young people, in particular those not in employment, education or training, including young people at risk of social exclusion and young people from marginalised communities, including through the implementation of the Youth Guarantee	0 %	V. Promoting sustainable and quality employment and supporting labour mobility		X				

104	Self-employment, entrepreneurship and business creation including innovative micro, small and medium sized enterprises	0 %	V. Promoting sustainable and quality employment and supporting labour mobility			X			
105	Equality between men and women in all areas, including in access to employment, career progression, reconciliation of work and private life and promotion of equal pay for equal work	0 %	V. Promoting sustainable and quality employment and supporting labour mobility					X	
106	Adaptation of workers, enterprises and entrepreneurs to change	0 %	V. Promoting sustainable and quality employment and supporting labour mobility			X			
107	Active and healthy ageing	0 %	V. Promoting sustainable and quality employment and supporting labour mobility					X	
108	Modernisation of labour market institutions, such as public and private employment services, and improving the matching of labour market needs, including through actions that enhance transnational labour mobility as well as through mobility schemes and better cooperation between institutions and relevant stakeholders	0 %	V. Promoting sustainable and quality employment and supporting labour mobility			X			
109	Active inclusion, including with a view to promoting equal opportunities and active participation, and improving employability	0 %	VI. Promoting social inclusion, combating poverty and any discrimination					X	
110	Socio-economic integration of marginalised communities such as the Roma	0 %	VI. Promoting social inclusion, combating poverty and any discrimination					X	
111	Combating all forms of discrimination and promoting equal opportunities	0 %	VI. Promoting social inclusion, combating poverty and any discrimination					X	
112	Enhancing access to affordable, sustainable and high-quality services, including health care and social services of general interest	0 %	VI. Promoting social inclusion, combating poverty and any discrimination					X	
113	Promoting social entrepreneurship and vocational integration in social enterprises and the social and solidarity economy in order to facilitate access to employment	0 %	VI. Promoting social inclusion, combating poverty and any discrimination			X			
114	Community-led local development strategies	0 %	VI. Promoting social inclusion, combating poverty and any discrimination				X		

115	Reducing and preventing early school-leaving and promoting equal access to good quality early-childhood, primary and secondary education including formal, non-formal and informal learning pathways for reintegrating into education and training	0 %	VII. Investing in education, training and vocational training for skills and lifelong learning				X		
116	Improving the quality and efficiency of, and access to, tertiary and equivalent education with a view to increasing participation and attainment levels, especially for disadvantaged groups	0 %	VII. Investing in education, training and vocational training for skills and lifelong learning				X		
117	Enhancing equal access to lifelong learning for all age groups in formal, non-formal and informal settings, upgrading the knowledge, skills and competences of the workforce, and promoting flexible learning pathways including through career guidance and validation of acquired competences	0 %	VII. Investing in education, training and vocational training for skills and lifelong learning		X				
118	Improving the labour market relevance of education and training systems, facilitating the transition from education to work, and strengthening vocational education and training systems and their quality, including through mechanisms for skills anticipation, adaptation of curricula and the establishment and development of work-based learning systems, including dual learning systems and apprenticeship schemes	0 %	VII. Investing in education, training and vocational training for skills and lifelong learning		X				
119	Investment in institutional capacity and in the efficiency of public administrations and public services at the national, regional and local levels with a view to reforms, better regulation and good governance	0 %	VIII. Enhancing institutional capacity of public authorities and stakeholders and efficient public administration				X		
120	Capacity building for all stakeholders delivering education, lifelong learning, training and employment and social policies, including through sectoral and territorial pacts to mobilise for reform at the national, regional and local levels	0 %	VIII. Enhancing institutional capacity of public authorities and stakeholders and efficient public administration		X				
121	Preparation, implementation, monitoring and inspection	0 %	Technical Assistance				X		
122	Evaluation and studies	0 %	Technical Assistance				X		
123	Information and communication	0 %	Technical Assistance				X		
TOTAL				39	22	62	0	0	

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