Smart strategies for the transition in coal intensive regions

Project No: 836819

Best practice report:

Smart Specialisation Strategies and SET plan implementation actions

WP 2 – Task 2/ D.2.2

September 2019

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 836819. The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the INEA nor the European Commission are responsible for any use that may be made of the information contained therein.

TRACER website: www.tracer-h2020.eu

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Abbreviations

EDP	Entrepreneurial Discovery Process
ETC	European Territorial Cooperation
IP	Implementation Plan
IWG	Implementation Working Group
NGO	Non-governmental Organisation
NRW	North-Rhine Westphalia
PED	Positive Energy District
RES	Renewable Energy Source
S3	Smart Specialisation Strategy
SET	Strategic Energy Technology
SME	Small and Medium-sized Enterprise
SRIPs	Strategic Research & Innovation Partnership
SWOT	Strengths, Weaknesses, Opportunities, Threats

Executive Summary

This report describes how countries and regions are successfully putting into practice the principles of Smart Specialisation, drawing lessons for TRACER partner regions. Smart Specialisation suggests that the most effective way to deliver innovation, and ultimately regional or national economic development, is to concentrate public and private interventions and resources on a limited number of priorities, based on national/regional strengths. The approach draws on EU experimentation with regional innovation strategies since the early 1990s.

The **Smart Specialisation Strategy approach** (S3) is based on research that suggests that innovation depends on cooperation, which can allow underused knowledge and innovation capacities to be identified and used more effectively. The S3 approach is therefore based on an inclusive process of stakeholder involvement centred on an “entrepreneurial discovery” process (EDP). Examples of how a wide-ranging and inclusive process of stakeholder engagement can be carried out at national or regional level are found in Slovenia and the South Moravia region in the Czech Republic, where stakeholder engagement started early, took place over an extended period, and included extensive open discussion space where stakeholders could make their needs known. Ensuring an inclusive process of stakeholder engagement can be challenging, and Portugal illustrates the importance of building on existing networks of actors and pre-existing regional innovation dynamics. The stakeholder engagement process may lose momentum and need additional animation, as has been undertaken in the Pomorskie region in Poland. Widening the consultation and engagement process to include previously excluded actors is also important, as in Slovenia, where efforts have been made to include the civil society in the process, and in the Netherlands, where a programme has been set up to animate the universities.

Building on the entrepreneurial discovery process, the S3 approach then involves a **prioritisation exercise** which aims to help stakeholders to identify the domains, areas and economic activities where regions or countries have the potential to generate knowledge-driven growth, and to target investment and resources on these themes. The number and nature of these priorities will vary between regions. Different approaches can be taken to narrowing down the priorities on which the strategy should focus, such as commissioning a study to narrow down the themes as in Steiermark (Austria), or the three-stage hybrid approach comprising both entrepreneurial discovery and public tendering with expert input as in Pomorskie (Poland). Smart specialisation priority setting can also take place below the regional level and may require the alignment of priorities at different governance levels (local-regional, as in Bilbao) or between different types of area (rural-urban, as in Extremadura, Spain).

The implementation of the S3 approach requires ongoing **high levels of stakeholder involvement** but this can be challenging. We here identify examples of how this is being undertaken in Portugal, Warminsko-Mazurskie (Poland), Greece and Franche-Comte (France). In practical terms, the implementation of Smart Specialisation Strategies is being carried out in different ways, for example, using **calls for projects** in North-Rhine Westphalia (Germany), a **new dedicated funding instrument** in Flanders (Belgium) and **action plans/roadmaps** in Slovenia. It may be useful for strategies to **cross administrative boundaries**, and a good example of this can be found in Galicia-Norte (Spain and Portugal). Where capacity is lacking, various funding sources can potentially be used to support stakeholders, as in Czech Republic. An example of combining funding sources to pursue Smart Specialisation goals can be found in Wales (UK), where a project has combined funds in a “Stairway to Excellence” approach. In addition, retaining **continued stakeholder involvement** can be done by setting up bespoke structures (e.g. councils, platforms or working groups) with a role in strategy implementation, as in Portugal, Greece and Wielkopolskie (Poland). It is important to build trust among the participants in the process, e.g. through focus groups and project development labs as in Greece, or investment in collaborative projects which promote spill-overs (as in Franche-Comte).

An effective Smart Specialisation Strategy must also include a **sound monitoring and evaluation system** in order to ensure that good practice can be disseminated and any difficulties can be addressed. Examples of where strong efforts are made to monitor the implementation of Smart Specialisation are provided from Pomorskie (Poland) and Emilia-Romagna (Italy), while evaluation specific to Smart Specialisation has been carried out in the Czech Republic, and is planned in Galicia (Spain).

As TRACER focuses specifically on the experiences of coal intensive regions, this report also examines the design, implementation and monitoring of Smart Specialisation strategies in more depth in three European regions which have a history in coal mining. Smart Specialisation strategies have played a key role in the **innovation focus** of such regions and in their transition out of coal, partly using the competitive advantages they may have in the production and transportation of energy sources. For example, various European regions have identified clean coal technologies as a Smart Specialisation priority in their strategies. The regions are selected based on geographical diversity, phase of transition and sectors of specialisation:

- Mining in the small but coal-intensive region of **South Limburg** (the Netherlands) terminated in the 1970s. The region has faced several regional development challenges over the past decades, including high unemployment rates and structural reform. The case study describes the long-term national support for the region, different levels of stakeholder engagement, and new policy strategies in the areas of renewable energy production and distribution, knowledge economy and cross-border cooperation.
- A relatively rural region on the verge of phasing-out mining activity is the autonomous community of **Asturias**, Spain. Although heavily subsidised, the mining sector has been declining for decades until final closure this year. Current economic developments include renewable energy networks, (rural) tourism, transportation and SME innovation, which partly build on the industrial heritage and energy of the region.
- **North-Rhine Westphalia** (NRW) is a German region that includes active and closed lignite and hard coal mines. The region has been a target of federal support for various economic restructurings, for example in the Ruhr and Rhineland areas. Longstanding support has come from *Land* and national levels, and is continuing in the form of funding for completely phasing out coal production.

Besides their Smart Specialisation strategies, the mining history, wider transition policies, challenges and change-enabling conditions show how (former) coal regions have been handling economic diversification and structural adaptation. Together, the longitudinal historical processes and current innovation strategies that shape these regions may be an important resource for S3 and wider transition policies in coal-intensive regions elsewhere.

Finally, the **Strategic Energy Technology (SET) Plan** has been the research and innovation pillar of the EU's energy and climate policy since 2007, coordinating low-carbon research and innovation activities in EU Member States, Iceland, Norway, Switzerland and Turkey. The SET Plan helps structure European and national research programmes and triggers substantial investments on common priorities in low-carbon technologies. SET Plan Implementation Plans bring together SET Plan countries and industrial and research stakeholders to identify R&I activities to accelerate energy transition. The implementation of SET Plan Implementation Plans is currently not directly linked with existing R&I strategies for the transition in coal intensive regions. However, the coming years will produce opportunities and potential synergies for SET Plan Implementation Plans with activities in most TRACER target regions facilitating their transition towards a sustainable energy system. Further, TRACER target regions can potentially learn from the best practice projects linked to achieving SET Plan targets.

1 Introduction

Smart Specialisation suggests that the most effective way to deliver innovation, and ultimately regional or national economic development, is to support stakeholders to come together to reach agreement on concentrating public and private interventions and resources on a limited number of priorities, based on national/regional competitive advantage.

Smart Specialisation is a bottom-up approach, which is seen as:

- *Smart* - it aims to identify the region's specific strengths and assets;
- *Specialised* - it aims to target research and innovation investment on these strengths; and
- *Strategic* - it aims to support stakeholders to define a shared vision for regional innovation.

The approach draws on EU experimentation with regional innovation strategies since the early 1990s. In 2014-2020, every EU region or Member State has been required to develop and agree a Smart Specialisation Strategy (S3) – or a regional/national innovation strategy – as a condition for receiving EU Cohesion policy funding. Non-EU countries and regions are also using this approach to developing strategies for national and regional innovation.

The fundamental features of the Smart Specialisation approach include:

- extensive analysis of the regional (or national) socio-economic situation;
- an "entrepreneurial discovery process" where a wide range of stakeholders discuss and reach agreement on priorities and needs; and
- stakeholder agreement on a formal strategy and implementation roadmaps.

This report describes how countries and regions are successfully putting into practice the principles of Smart Specialisation, drawing lessons for TRACER partner regions. Sections 2 - 5 draw on examples from both coal and non-coal regions. Sections 2 and 3 highlight examples of good practice in the process of designing Smart Specialisation Strategies, including in the drafting of strategies, involving stakeholders and in selecting regional strengths. Section 4 identifies examples of good practice in the practical implementation of Smart Specialisation, including supporting the ongoing involvement of stakeholders, delivering innovative projects, spanning administrative boundaries and combining funding sources. Section 5 describes good practices in the monitoring and evaluation of Smart Specialisation Strategies.

Three examples of coal regions where Smart Specialisation Strategies have been introduced and played an important role in the transition out of coal are outlined in Section 6. Section 7 describes the implementation of Strategic Energy Technology (SET) plans, including opportunities for TRACER regions and examples of best practice initiatives. Section 8 concludes the report, drawing lessons for the TRACER target regions.

2 Designing Smart Specialisation Strategies

The Smart Specialisation Strategy approach (S3) is based on research that suggests that innovation depends on cooperation, which can allow underused knowledge and innovation capacities to be identified and used more effectively. Smart Specialisation Strategies should therefore be designed based on an *inclusive process of stakeholder involvement*. This is centred on an "entrepreneurial discovery" process (EDP).[1] This generally involves meetings/workshops/interactions taking place within the region, where different stakeholders come together to build working relationships, share ideas/knowledge, and agree on a common vision and priorities rooted in the region's strengths (or "specialisation").

[1] https://s3platform.jrc.ec.europa.eu/what-is-smart-specialisation-

The following sub-sections describe how this has been put into practice in some countries and regions. Both Slovenia and South Moravia region in the Czech Republic provide examples of how a **wide-ranging and inclusive process of stakeholder engagement** can be carried out at either national or regional level. Ensuring an **inclusive process of stakeholder engagement** can be challenging, and the importance of existing networks of actors and pre-existing regional innovation dynamics is illustrated in an example from Portugal. The stakeholder engagement process may lose momentum and **need additional animation**, as has been undertaken in Pomorskie region in Poland. **Widening the consultation and engagement process** to include previously excluded actors is also important, as in Slovenia, where efforts have been made to include the civil society in the process, and Netherlands, where a programme has been set up to animate the universities.

2.1 Undertaking extensive EDP at national and regional levels

The process of drafting of **Slovenia's national Smart Specialisation Strategy** for 2014-2020 was led by central government. The government developed the initial draft of the strategy and then tested and refined it through discussions with stakeholders, mainly through large events with private businesses, research institutes and wider stakeholder groups. This work took a long time – it was carried out in several phases over a period of three years:

- in 2013, eight workshops were held involving c. 500 stakeholders;
- in 2014, alongside the commissioning of several studies and input from external experts, there was a further series of dedicated events and gathering of written proposals, resulting in the publication of a new draft version of the strategy;
- in 2015, there were further consultations and discussion rounds.

Several features of this **lengthy and extensive entrepreneurial discovery process** are considered to have worked well.[2] A large proportion of the time available during the events was allocated to open discussion. For example, three of the major events accounted for c.20 hours – of these, 18 were for discussion. This allowed stakeholders to make their needs known. For instance, for one theme, actors were able to clarify the stages of technological development where cooperation would be possible (i.e. the early stages, where cooperation could save time and money without impinging on individual firm's competitive advantage). The strategy document itself was kept relatively short (c. 40 pages) with supporting documents on analysis and governance. Stakeholder submissions to the process were submitted cooperatively by groups of actors, thus building in the need for actors to work together at an early stage. The different phases allowed stakeholders adequate opportunity to contribute and for their proposals to be given proper consideration.

In the Czech Republic, the national Smart Specialisation Strategy for 2014-2020 included 14 "regional supplements", corresponding to regional innovation and Smart Specialisation Strategies for each self-governing region and the city of Prague. Among these, the **innovation strategy of South Moravia Region is considered to be a leading example**.[3] The current regional strategy is the fourth generation of such a strategy and was developed by the South Moravian Innovation Centre. The process started in 2012 with initial discussions involving c.35 key stakeholders from the regional innovation ecosystem (i.e. businesses, research centres, local and regional government and intermediary institutions). There were three discussion days (altogether c.18 hours) with discussions supported by a professional facilitator. The outcome was the development of a strategic framework for the future regional innovation strategy. Working groups (involving over 150 people) were then set up for each key "area of change". The working groups each met three times to address the SWOT analysis, identify objectives and develop a list of indicative projects to be funded. Participants were asked to prepare their own inputs for the discussion and give feedback on drafting team's inputs. Subsequent drafts

[2] Polverari L (2016) 'Implementing Smart Specialisation in 2014-2020 ESIF programmes', IQ-Net Thematic Paper 39(2), European Policies Research Centre, University of Strathclyde, Glasgow.
[3] Polverari L (2016).

were reviewed on an ongoing basis, including through the European Commission's Peer Review process.

2.2 Benefitting from existing networks and dynamics

Participation by regional actors in the strategy development process was greatly enhanced in Portugal in the 2014-2020 period. However, the degree of stakeholder involvement varied across regions.[4] In Algarve, the design process was estimated to have involved around 80 percent of the region's enterprises, all research centres as well as other entities and actors. Along with Algarve, the regions of Norte, Madeira and the Açores were considered "leaders" in the process, having successfully launched participatory and structured processes, thanks to the **availability of existing networks of actors and pre-existing regional innovation dynamics**. In other regions, the process was constrained by a number of challenges and there was more limited regional participation. Alentejo, for example, was found to lack the critical mass necessary to create a dynamic regional innovation eco-system.

2.3 Animating the EDP

Keeping the EDP process going can be challenging. Pomorskie region in Poland recognised the **need for continued animation of the entrepreneurial discovery process.** The frequency of interaction with regional entities had started to decline, requiring additional efforts to maintain the involvement of the participants. The regional government signed a contract with the consultancy Deloittes for an advisory service which included the development of recommendations for the management of the EDP. The regional government also launched the "Smart Progress" project, to be supported through the Structural Funds Regional Operational Programme and to be implemented in 2019-2021. The project will provide various animation activities to support the EDP, internationalise strategy areas, develop staff, and monitor and manage the process of identifying further design concepts and joint initiatives.[5]

2.4 Ensuring an inclusive EDP

Particular efforts were made to **involve representatives from civil society** in the development of Slovenia's Smart Specialisation Strategy. Civil society actors contributed to the draft proposals, especially where they related to the themes of human resources development and education. Civil society representatives were also included in the National Innovation Platform set up to deliver the strategy. Their involvement is expected to be particularly relevant for the horizontal social innovation theme.

In Limburg (Netherlands), there has also been an effort to include actors previously not strongly involved in policy development processes.[6] The Brightlands programme was launched to increase involvement of and support for universities, facilitating the creation of science and industry clusters.

3 Defining priorities for Smart Specialisation

The Smart Specialisation process brings stakeholders together to agree to prioritise the domains, areas and economic activities where regions or countries have a competitive advantage or have the potential to generate knowledge-driven growth.[7] The aim is to support

[4] Polverari L (2016).
[5] Polverari L and Dozhdeva V (2018) From Smart Growth to Smarter Europe: Learning from Smart Specialisation Delivery, IQ-Net Thematic Paper 43(2), European Policies Research Centre Delft.
[6] European Commission (2016) Implementing Smart Specialisation Strategies. A Handbook, Luxembourg, https://s3platform.jrc.ec.europa.eu/documents/20182/154972/Implementing+Smart+Specialisation+Strategies+A+Handbook/2a0c4f81-3d67-4ef7-97e1-dcbad00e1cc9
[7] https://s3platform.jrc.ec.europa.eu/what-is-smart-specialisation-

stakeholders to reach agreement to target investment and interventions on a limited number of priorities. The number and nature of these priorities will vary between regions.

Different approaches can be taken to narrowing down the priorities on which the strategy should focus, as shown in Steiermark (Austria) and Pomorskie regions (Poland). Smart specialisation priority setting can also take place below regional level. This may introduce complex dynamics and require priorities to be aligned at different levels within a multi-level governance setting (as in Bilbao and Extremadura in Spain).

3.1 Selecting regional strengths

When developing the Economic Strategy Steiermark 2020,[8] a **study** was conducted to narrow down the number of themes (*Stärkefelder*) identified in the previous Technology Policy Concept.[9] The study assessed the degree of proximity and overlaps between the different themes, allowing them to be reduced from eleven to three thematic foci (*Leitthemen*).

The selection of areas of specialisation in Pomorskie was undertaken through a "**hybrid"approach,** comprising both entrepreneurial discovery and public tendering with expert input.[10] The work allowed 28 potential specialisation areas to be identified and subsequently narrowed down to seven and then four. The process involved three phases:

1. *Analysis of the economic profile of the region* based on existing strategic documents, including the Regional Development Strategy for the Pomorskie Region until 2020 and the Regional Strategic Programme "Pomeranian Creativity Port". These documents include a general assessment of the potentials, barriers and economic development opportunities in the region, and identify traditional industries as well as industries with the highest potential for growth. The documentation served as a SWOT analysis and analysed the development potential of 12 industries of significant importance to the region. In addition, analytical work was carried out with the participation of a number of regional stakeholders (representatives of enterprises, science sector and NGOs).
2. A *call for proposals was launched inviting proposals for areas of smart specialisation* from representative partnerships of stakeholders, mainly from the business and science sector. Proposals were assessed by a Selection Board comprising experts (from outside the region, including three foreign experts) with international business and scientific experience. During the first stage of the call, 28 partnerships submitted proposals. During the second stage, a final number of seven proposals were submitted and assessed by the Selection Board.
3. The *selection of Smart Specialisation areas* was made by the Board of the Pomorskie Region, based on the assessment presented by the Selection Board and its own analysis. The Board selected four Smart Specialisation areas and negotiated agreements with the Partnerships representing those areas.

3.2 Aligning priorities at local, regional and national levels

Bilbao (Spain) is considered to represent good practice for how **city-led efforts developed links between local Smart Specialisation Strategies and the wider regional Smart Specialisation Strategy**.[11] The local development agency (Bilbao Ekintza) organised a cluster prioritisation exercise at city level. Bilbao city worked to explore connections and promote in-depth interaction with the Basque Smart Specialisation themes at regional level, focusing on three of the six locally-identified themes. In practical terms, the aim was to promote and facilitate a pipeline of city-level projects under these themes, closely aligned with the regional

[8] Wirtschaftsstrategie Steiermark 2020 (WiSt 2020).
[9] Charles D, Gross F and Bachtler J (2012) 'Smart Specialisation' and Cohesion Policy – A Strategy for All Regions? IQ-Net Thematic Paper 30(2), European Policies Research Centre, University of Strathclyde, Glasgow.
[10] Polverari L (2016).
[11] Polverari L and Dozhdeva V (2018).

level. Bilbao Ekintza set up a new collaborative platform bringing together the public sector, research centres and think tanks, private sector and cluster organisations and public and private universities. In addition, the "Innovanet" network had been set up previously to help promote vertical collaboration across regional, provincial and local governments and with other actors in business and innovation promotion with the aim to share ideas, experience and knowledge regarding innovation.[12]

Requiring EDP flexibility to enable participation at different territorial levels was also important in Extremadura (Spain), where the territory of Tajo-Salor-Almonte developed its own sub-regional EDP, building on experience with the LEADER programme.[13] The rural EDP allowed local actors to address local strengths and weaknesses.

4 Implementing Smart Specialisation Strategies

A **high level of continued stakeholder involvement** is necessary, not only during strategy design but also during implementation, in order to continue to build cooperation and maximise potential for innovation. However, retaining active stakeholder participation can be challenging, and there are examples of how this is being undertaken in Portugal, Warminsko-Mazurskie (Poland), Greece and Franche-Comte (France).

In practical terms, the concrete implementation of Smart Specialisation Strategies is being carried out in different ways, for example, using **calls for projects** in North-Rhine Westphalia (Germany), a **new dedicated funding instrument** in Flanders (Belgium) and **action plans/roadmaps** in Slovenia.

It may be useful for strategies to **cross administrative boundaries**, and an example of this can be found in Galicia-Norte (Spain/Portugal).

Where capacity is lacking, various **funding sources** can potentially be used to support stakeholders, as in Czech Republic. An example of combining funding sources to pursue Smart Specialisation goals can be found in Wales (UK).

4.1 Facilitating ongoing stakeholder involvement during implementation

Ongoing entrepreneurial discovery at regional level is being supported in Portugal through the creation and operationalisation of Regional Innovation Councils and Innovation Platforms.[14] The Councils are expected to have an important role in helping to adjust project calls to demand. The Platforms are intended to provide "spaces of continuous entrepreneurial discovery", ensuring a multi-institutional and multi-sectoral regional response. The model has functioned particularly successfully in Centro region. The Centro Region Coordination Commission launched a public consultation in November 2016 aimed at "stimulating an increased citizen participation in the process of strategy design as well as at inviting specialists to become involved in the working groups on the four Innovation Platforms". Wider stakeholder engagement has continued into the implementation phase, including through processes supported by the University of Aveiro, the inter-municipal communities and other actors.

In Greece, the continuation of the EDP has also been enabled by national-level **innovation platforms, and by meetings, workshops and round tables in the regions**. At national level, innovation platforms bring together relevant actors in an ongoing consultation process which results in calls for projects. Within the regions, the managing authorities for the Structural Funds programmes coordinate the dialogue with businesses, research centres, universities and other stakeholders.

The EDP is also ongoing in Warminsko-Mazurskie (Poland), where **workshops** have been held in cooperation with the Commission's Joint Research Centre, targeting entrepreneurs, the

[12] Charles D, Gross F and Bachtler J (2012).
[13] European Commission (2016).
[14] Polverari L and Dozhdeva V (2018).

science sector and business environment institutions. This has resulted in cooperation on the development of an **Action Plan**. In Wielkopolska (Poland), six working groups (with 182 participants, of which 10 are companies) are closely involved in the implementation of the strategy. This encourages the actors' trust and commitment, and links the EDP with the actual implementation of the strategy.[15]

Trust-building has also been a feature of the EDP in Eastern Macedonia and Thrace (Greece). This has been particularly important given that participatory dialogue was being introduced into RTDI policy-making for the first time.[16] Two types of event were used to build trust and involvement – EDP Focus Groups (sectoral events aimed at generating innovative ideas through interaction between businesses, public and research sectors) and Project Development Labs. These consisted of two sets of events moving EDP ideas towards implementation, identifying funding opportunities and developing action plans. Draft calls for proposals developed with input from the focus groups were presented at the second Lab for feedback from stakeholders and the opportunity to develop ideas further with the support of R&D funding experts.

Supporting ongoing involvement of stakeholders has also been a priority in Franche-Comté region (France).[17] To encourage ongoing stakeholder mobilisation within the selected S3 priority areas, the regional government undertook **targeted investment in collaborative projects** with the potential to involve more than one priority area, encouraging the potential for synergies and spillovers. Three large scale projects were selected following a call for proposals and evaluation by a panel of external experts.

4.2 Delivering innovative projects

To deliver on Smart Specialisation in practical terms, **new ways to deliver innovation projects** have been found in North-Rhine Westphalia (Germany). The *Land* introduced a new approach to selecting projects using the Competitive Calls for Future Markets (*Leitmärkte*).[18] The competitive call approach was originally developed by the *Land* in the run-up to the 2007-2013 Structural Funds period, drawing on previous experience with regional innovation support. The competitive call approach was considered to have been highly successful in 2007-2013, and to have generated many high quality projects. Funding was reprogrammed away from other instruments/themes towards the competitive calls focused on innovation support, where absorption capacity proved to be higher. This approach was therefore continued with minor adjustments in the 2014-2020 period.[19] Key elements of the approach are:

- There is clear communication of each competitive call via the websites of the ERDF Operational Programme (OP) for the *Land* and the intermediate body, and information events targeted at potential applicants.
- There is a structured approach across all calls, with eight overarching calls in 2014-2017 (compared to 54 in 2007-2013) but with repeated project submission dates, announced in advance, aimed at improving planning for applicants.
- Each call text sets out eligibility criteria and selection/implementation procedures, as well as a description of the project selection criteria (including weighting). There is a selection jury of external experts for each call; the names of the jury members are published on the OP website.

[15] European Commission (2016).
[16] European Commission (2016).
[17] European Commission (2016).
[18] Polverari L (2016); Polverari L and Dozhdeva V (2018).
[19] Further information on the competitive calls in 2014-2020 is available at: https://www.efre.nrw.de/wege-zur-foerderung/ and: https://www.leitmarktagentur.nrw/ (in German). Evaluations of the competitive calls in 2007-2013 are available at: http://www.ziel2.nrw.de/1_NRW-EU_Ziel_2_Programm_2007-2013/3_Ergebnisse/index.php (in German).

- A single intermediate body (the Future Markets Agency) is in charge of managing all competitive calls, from call design through application, implementation and monitoring/reporting.

Factors which have helped make this approach successful include: strong political buy-in by the *Land* government; extensive consultation with the other *Land* ministries, business associations and chambers, universities, local authorities, non-governmental bodies, and other public bodies; and Nordrhein-Westfalen's existing innovation strengths, with many highly innovative and research-active businesses, over 70 universities, and many public and private research centres (in a Land of c.18 million people).

In Flanders (Belgium), project support takes place mainly through "**spearhead clusters" and a new dedicated funding instrument**, the Transformation and Acceleration Fund.[20] The fund provides capital investment for projects proposed by groups of firms and finances 'grand projects' within the spearhead areas.

In Slovenia, new dedicated "**Strategic Research & Innovation Partnerships**" (SRIPs) have been set up to implement the Smart Specialisation strategy.[21] The SRIPs are intended to function as long-term partnerships aimed at strengthening the Slovenian position in international value chains, through the provision of a comprehensive support environment for R&I. There will be one SRIP for each of the priority specialisation themes. Each partnership will include 30-60 stakeholders, representing firms (5-10 large, 10-25 SMEs), knowledge institutions and government actors. The SRIPs prepare roadmaps or action plans (business-development strategies) in which they set out:

- Strategic goals
- A roadmap for joint development activities
- An internationalisation roadmap
- A human resources development roadmap
- A roadmap for entrepreneurship and the promotion of joint services
- Proposals to the government for the optimisation of the regulatory framework (for example with permits for investments and "start-up visas").

The action plans/roadmaps are updated regularly, to guarantee that innovation policy keeps its focus and concentration on the selected key areas. The role of the SRIPs means that the **focus and concentration of how funding is allocated is decided by the stakeholders** rather than government. The new approach has generated positive feedback, but there is also awareness that there will be challenges, such as ensuring participation by industrial partners, and the difficulties of coordinating projects of this size.

4.3 Successfully crossing administrative boundaries

The Galicia-Norte border is a very integrated border both from a cultural and an economic point of view. Economically, the two regions share specialisation in common key sectors, such as the textiles and automobile sectors. Cooperation between the two regions has been long-term, sustained and both formal - through successive ETC programmes - and informal - thorough networks of policymakers, entrepreneurs and universities.[22]

At the start of the 2014-2020 Cohesion policy period, the two regions developed a "Joint Investment Plan" to identify strategic priorities for their cross-border Interreg Europe programme. It became clear that there was potential for the development of a joint Smart Specialisation Strategy, due to two key factors:

- both regions were engaged in the development of their regional Smart Specialisation Strategies and common points were quickly emerging from these processes;

[20] European Commission (2016).
[21] Polverari L and Dozhdeva V (2018).
[22] Polverari L (2016).

- changes to how the EU cross-border cooperation programme was set up made the creation of a common framework with common strategic priorities more viable and more compelling.

The coordination of the preparation and implementation work was the responsibility of the Galician Innovation Agency (GAIN) and Regional Coordination and Development Commission of Norte (CCDRN). The drafting work started in October 2014 and entailed a number of participatory events and fora which involved over 200 actors from both sides of the border. The strategy was approved in October 2015 and identifies six strategic collaboration areas (areas where joint work is new, compared to the already existing cooperation).

There were some delays in the approval and launch of the strategy, due to institutional asymmetries linked to the different status of the lead organisations and a change of government in Portugal (and related staff turnover). However, these did not impact on the technical work being carried out and the cooperation between different types of actors. Implementation will rely primarily on funding from Interreg Europe, but the goal is to attract Horizon 2020 funds, as well as funding from the Structural Funds programmes operating in both regions and other EU programmes. In practice, the strategy acts mainly as a strategic umbrella: project selection takes place within the Interreg Europe framework, and the coherence with the joint Smart Specialisation strategy is one of the criteria considered. The joint strategy has already had two effects. It has given prominence to actors who are peripheral in the domestic context (e.g. the University of Trás-os-Montes e Alto Douro), allowing them to participate more actively in international networks and funding bids, and there has been a much more marked focus on RTDI compared to previous European territorial cooperation initiatives.

4.4 Capacity building using Structural Funds

Capacity building efforts may be required where critical mass or capacity is lacking at regional level. In this regard, the Smart Accelerator project funded from the Structural Funds OP for Science, Research and Education 2014-2020 provides capacity-building support to the Czech regions.[23] The project assists capacity building for implementation of Smart Specialisation at regional level and funds activities that regions consider to be crucial for developing their innovation ecosystem. Eligible activities include building the core team, training, twinning, mapping the strategy, pilot-verification projects, publicity, and project management. The project can also support the setting-up of the basic structures, knowledge exchange with foreign innovation centres, training, marketing, analytical tools development etc., with the activities depending on the maturity of the region and its implementation team.

In the South Moravian Region, project beneficiaries include the regional government and the South Moravian Innovation Centre (coordinator of the regional Smart Specialisation Strategy). The project has funded the “Inspirational Journey” of 17 stakeholders from the innovation ecosystem from the South Moravian Region to the “Research Triangle” in North Carolina (USA) for one week in 2018. The Journey is expected to bring long-term effects, and has provided inspiration from a developed innovative region, and encouraged deeper networking among the participating stakeholders. The Smart Accelerator also supported the mapping of Smart Specialisation in the South Moravian Region. This has involved regular interviews with companies operating in the region and external evaluation of the strategy. The project has also helped build capacity in regional marketing/branding.

4.5 Combining funding sources

Wales (UK) has been successful in integrating funding from different sources.[24] Bangor University’s BioComposites Centre provides an example of how synergies in the

[23] Polverari L and Dozhdeva V (2018).
[24] Polverari L (2016).

implementation of research and innovation funds from different sources are delivering the "Stairway to Excellence" effect in Wales.[25] The BioComposites Centre (established in 1989) undertakes collaborative research to develop sustainable bio-based technologies that minimise the impact of materials on the environment. The BioComposites Centre is a key partner in the BEACON project which was established with c. £8 million from the ERDF in 2007-2013. The BioComposites Centre's participation in BEACON used ERDF funding to strengthen the Centre's research and innovation capacity, including infrastructure and equipment in pilot scale processing and increased R&I collaboration between academia and industry. In 2014 the BEACON project won the RegioStars Award in the "Sustainable growth: Green growth and jobs through Bio-economy" category. Improvements in R&I capacities via BEACON have acted as a stepping stone to leverage further funding from a variety of sources comprising Welsh Government, Innovate UK, UK Research Councils, and other EU-funded schemes, including a series of investments from the ERDF-funded SMART Expertise programme administered by the Welsh Government.

The BioComposite Centre's expertise has also led to their engagement in European networks and increased international cooperation, including: as part of COST (European Cooperation in Science & Technology); the Vanguard Initiative; as well as being registered on the list of EU Key Enabling Technology Centres and a European database of pilot scale facilities through the EU funded project Pilots4U. Part of the BioComposites Centre's progression has involved actively exploring opportunities to secure additional R&D funding through Horizon 2020 and the Centre collaborated on a number of applications to the Bio-Based Industries Joint Undertaking (BBI JU) which were not funded. A series of awards from the Welsh Government's SCoRE Cymru scheme helped further facilitate targeted engagement with BBI JU. In December 2017 the BioComponsites Centre's secured BBI JU funding via participation in the PRO-ENRICH project.

A further £8 million of ERDF funding under the 2014-2020 Programme has been awarded to support BEACON Plus. The Beacon Plus project builds on the success and clear smart specialisation of BEACON and will support further R&D collaboration with Welsh businesses to translate the academic excellence into commercial products. The strategic delivery of Beacon Plus will ensure that the BioComposite Centre's European engagement and BBI funded activity delivers maximum downstream benefits to the Welsh regional ecosystem.

5 Monitoring and evaluating Smart Specialisation

An effective Smart Specialisation Strategy must include a sound monitoring and evaluation system in order to ensure that good practice is disseminated and any difficulties are addressed. Examples of where strong efforts are made to monitor the implementation of Smart Specialisation are provided from Pomorskie (Poland) and Emilia-Romagna (Italy), while evaluation specific to Smart Specialisation has been carried out in the Czech Republic, and is planned in Galicia (Spain).

In Pomorskie (Poland), **monitoring of the Smart Specialisation Strategy** is carried out through:[26]

- Analysis of indicators based on statistical data to assess the changes in the socio-economic environment of the region, e.g. to benchmark Pomorskie in comparison to other Polish and European regions. A report will be produced every 1.5 years.
- An analysis to assess the changes occurring as a result of implementation of the measures agreed.

[25] Where a series of funds is used in a coordinated way to support organisations/individuals at different stages, and with projects at different stages of development. This provides a potential 'funding ladder' to encourage and support them moving towards accessing competitive funding sources such as Horizon 2020 in the medium to longer term. See https://gov.wales/sites/default/files/publications/2019-03/horizon-2020-annual-report-2018.pdf (p13).
[26] Polverari L (2016).

- In-depth interviews (individual or group) with entrepreneurs, smart specialisation coordinators and representatives of local government units.
- Discussion panels attended by independent experts to analyse the data obtained, assess the consistency of the monitoring results and explain the results and their causes and recommendations. Meetings of the panels will generally be held every 18 months.
- In order to exchange experiences in the field of monitoring of Smart Specialisation with other European regions, the managing authority for the Structural Funds programme has prepared a Peer-2-Peer application.
- Periodic evaluations of the procedures used will be undertaken as part of the Structural Funds programme's evaluation activity.

An interesting feature of the monitoring system put in place to keep track of implementation of Smart Specialisation in Emilia-Romagna (Italy) is the measurement of **"change indicators"** (alongside the more commonly-used output and results indicators).[27] Change indicators are intended to track changes in the regional economy with reference to the areas of specialisation and include "specialisation" and "transition" indicators. Specialisation indicators cover patents, research grants, value of business-research contracts, share of new start-ups and number of SMEs per specialisation area.

A **mid-term evaluation** of the national Smart Specialisation Strategy is being carried out in the Czech Republic, with publication of the final report planned for June 2019.[28] At the regional level, an external evaluation of the regional innovation strategy of the South Moravian Region (covering the period from 2003-2016) was published in March 2018, confirming the orientation of the strategy.[29]

In Galicia (Spain), **interim and final assessments** are planned for Smart Specialisation.[30] Monitoring data will be used to compare the actual value of indicators with target values, and surveys will be used to gather qualitative data from beneficiaries and stakeholders. The assessments will analyse both the evolution of individual indicators and comparative performance of context indicators, including benchmarking against other Spanish and EU regions.

6 Good practice examples of Smart Specialisation in coal regions

The examples of designing, implementing and monitoring Smart Specialisation strategies have so far focused on a variety of European countries and regions, some of which have a history in coal mining. Since 2014, Smart Specialisation strategies have played a key role in the innovation focus of coal intensive regions, partly using the competitive advantages they may have in the production and transportation of energy sources. For example, various European regions have identified clean coal technologies as a Smart Specialisation priority in their strategies.[31]

This section looks at three (former) coal regions in more depth, particularly at their (S3) innovation strategies and their role in the transition out of coal. The regions are selected based on geographical diversity, phase of transition and sectors of specialisation:

[27] European Commission (2016).
[28] Polverari L and Dozhdeva V (2018).
[29] Technological Centre of the Academy of the Czech Republic, Technopolis Group, IREAS centre (2018): Evaluation of Results of Realization of the Regional Innovation Strategy of the South Moravia Region 2013-2016. Three reports (Assessment of Activities, Overall Contributions, Complete Analytical Report, all in Czech) https://m.kr-jihomoravsky.cz/Default.aspx?ID=327052&TypeID=2.
[30] European Commission (2016).
[31] Alves Dias P et al. (2018), *EU coal regions: opportunities and challenges ahead*. JRC Science for Policy Report. Luxembourg: Publications Office for the European Union.

- Mining in the small but coal-intensive region of **South Limburg** (the Netherlands) ceased in the 1970s. The region has faced several regional development challenges over the past decades.
- A European region that is on the verge of phasing-out mining activity is the autonomous community of **Asturias** (Spain).
- **North-Rhine Westphalia** is a German region that includes several active and closed lignite and hard coal mines. The region has been an active target of federal support for various economic restructurings, for example in the Ruhr area.

Together, the historical processes and current innovation strategies that shape these regions may be an important resource for S3 in coal-intensive regions elsewhere. The following sections describe the regional contexts, achievements, challenges and enabling conditions of each of these areas.

6.1 South Limburg (NL)

South Limburg (*Zuid-Limburg*) is located in the southernmost part of the Netherlands, and was the only region with lignite and hard coal mining in the country. The mines are part of a larger coalfield that ranges from northern Belgium to the Aachen region in Germany. The state-led coal mines were in operation between the end of the 19th century until their closure in 1974. Limburg coal had been the backbone for Dutch energy production for years, but a transition was set in motion in the early 1960s after the discovery of natural gas in the northern Netherlands. In 1966, the first Mining Act declared the closure of the eleven active mines within the next decade. There are similarities to the current trend of transitioning out of coal, but also differences: in the 1960s-70s, coal was replaced by other fossil fuels (natural gas, cheap oil from the Middle East); following the oil crises, (imported) coal made a return to the country in the late 1970s; and climate considerations did not yet play a role.

The national government initiated the phasing out based on the view that market conditions in Europe would be more profitable for natural gas than for coal in the future. Importantly, the national Ministry of Economic Affairs **set the standard for action**: it prevented unilateral action by private mines, which would have made the closing process unmanageable. In 1965, the social democratic Minister adopted the miner's union slogan "No closure without employment", with a view to securing an equal amount of new job opportunities. Redundancy packages - mainly (bridges to) pensions - were prepared, and the majority of miners were retrained or relocated. Foreign and low-skilled workers often went to mines abroad or to other factories in the Netherlands, including the Dutch State Mining enterprise (DSM) which "retrained" itself into a chemical company. Unemployment rates in the province were initially high (over 13% in 1982, twice the national rate), but gradually decreased to match the national level by 1990.

Research and Innovation Policies and Actors

From a policy point of view, the coordination and design of the phase-out and closure as **collective processes** are regarded as major achievements. While managed by the State, the mine management and the trade unions had a strong voice. Both the Catholic and white collar unions had agreed to communicate together with the management of the Dutch State Mines that the future of the mines was limited and a new strategy was needed. This helped create a **common understanding** that there was a superior alternative to coal, that mine owners had an incentive to act before profits would evaporate, and while both state and companies were still able to guarantee good conditions. In addition, the transition was managed as a **long-term process**: it took 25 years, which is a third of the life span of the mining activities (1899-1974). This broadened the scope of regional development in the Limburg province into a wider diversification process of the economy including high-value added sectors such as life sciences and health services, logistics, tourism, business service and horticulture. Industry did not disappear: Dutch State Mines continued as a chemicals factory, which was first active in the petrochemical industry and later in plastics and nutrition. In addition, national institutions such as the statistics office (*CBS*) and pension funds were relocated to a new business park in the 1970s.

More recently, energy innovation strategies have resulted in South Limburg becoming a forerunner in the production of **geothermal energy** and **district heating** distribution networks. Between 2007 and 2014, the previously central mining town Heerlen was one of four pilot cities of a €39.6 million redevelopment project, partly funded by the EU.[32] It dealt with the integration of energy supply and demand to use locally available low-valued renewable energy sources from water in abandoned mines for heating and cooling of buildings. The system was piloted in 2003-2008, and the project upscaled the system to a smart grid in heating and cooling with a full scale hybrid sustainable energy structure by 2014 ("Minewater 2.0"). The system provided heating and cooling for 500,000 m^2 annually, leading to a 65% CO_2 emission reduction (Verhoeven et al., 2014). The new system also led to new commercial opportunities, e.g. bringing in new building owners, trading boiler houses and heat pump installations (as done by the *Minewater Corporation*).

Broader research and innovation structures developed in the 2010s, for instance through the Limburg province Knowledge Axis, the South Netherlands Smart Specialisation Strategy (RIS3, including the provinces of Zeeland and North Brabant), and the emergence of "functional economic regions" (i.e. based on economic linkages rather than administrative boundaries) as tools for inter-governmental collaboration and funding attraction. First, Limburg's labour market underwent large changes in the form of retraining, migration and reorientation of innovation policy towards businesses. The **Knowledge Axis Limburg** (2013), a joint strategic document by the province's educational institutions, played a major role in defining new strategies which addressed recent economic challenges. Four educational hubs in the Limburg province, three of which are located in the South and two directly in the former mining region, are working together as "Brightlands", providing education in the fields of chemicals, materials and related life sciences. The campuses facilitate the construction of pilot plants and acceleration of new SME development. A main component of the Knowledge Axis has been the attraction of cross-border projects, especially with R&D actors in Aachen, Germany.[33]

The 2014-2020 regional Smart Specialisation Strategy, developed by the ERDF managing authority of South Netherlands, extends between the Zeeland, North Brabant and Limburg provinces. The triple helix network organisation *Limburg Economic Development* (LED) was the main South Limburg actor in the entrepreneurial discovery process which informed the South Netherlands strategy. Among the prioritised regional assets are chemicals, logistics and life sciences and health, which are the main focus areas of R&I strategies in South Limburg. *Limburg Economic Development* and its successor *Economic Collaboration South Limburg* (ESZL) have developed three multi-annual programmes in the areas of education and labour market, SME and innovation, and economy and business climate. After several municipalities withdrew from LED, the **triple helix coalition** in the form of ESZL continued with a "lighter" approach to coordinating the programmes in line with the supra-regional RIS3. In early 2019, ESZL published a Strategic Action Plan for mid-South Limburg, a green, rural part of the region bordered by four small cities. Its six action points aim to develop: energy transition and sustainability experimentation; high air quality; high quality agriculture; small businesses; social cohesion; and sustainable tourism.

Most recent research and innovation policies focus on the establishment of local and international R&D&I networks. Instead of positioning the region as the isolated "dead end" of the Netherlands, it focuses on its central location in Europe. This involves a number of **cross-border collaborations** with Belgium and Germany, including Liege, Hasselt and Aachen, together forming the "Eurostad" agglomeration (c. four million inhabitants). Also, internal organisation structures have been developed - with mixed success - such as ESZL and Parkstad. Parkstad City Region (c. 220,000 inhabitants) is an inter-municipal structure that includes seven towns in the former mining region. They intend to operate as an urban

[32] https://smartcities-infosystem.eu/sites-projects/projects/remining-lowex.

[33] https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/news/increasing-regional-competitiveness-through-developing-knowledge-axis-limburg.

conglomeration in economy and tourism, housing and restructuring, spatial planning and mobility. Between these themes, most innovation project focus on tourism and sustainable energy development, including hydropower. For instance, Parkstad adopted the German IBA (*Internationale Bau Austellung)* transformation strategy to attract innovation projects in these areas (see also Section 6.3).

The flexible **new governance structures**, fostering more intensive organisation of a region traditionally characterised by small-scale economic development, have led to increased self-organisation of R&D strategies in functional territorial areas (in line with the supra-regional RIS3). In this capacity, the former mining region Parkstad secured various national and European **innovation funds**, including through participation in the Interreg Europe programme, Horizon2020 (using the Knowledge Axis) and a Region Deal (€80 million), which is co-funded by the national government. It specifically targets multiple and integrated societal challenges, such as population decline, labour market adaptation, economic capacity and cross-border collaboration.

Challenges

Between 1965 and 1974, the phasing out of coal mining in South Limburg meant a loss of 45,000 direct and 30,000 indirect jobs. These jobs had a rather regionalised character: in 1965, 87% of miners were Dutch, of which the large majority originated from the Limburg province (Langeweg, 2012). This situation complicated **labour market restructuring**, as the existing work force was relatively uniform and with a low education level. The mining period, despite lasting only around 70 years, had left a physical imprint on the region: a new working class developed, new neighbourhoods were constructed and a regional "miners' identity" was built. Despite the relative success of the transition programmes, the shift to other (manufacturing) jobs or to an early pension was not always positive. The Parkstad region continued to lose population and business activity. In 2010, the Dutch national government earmarked South Limburg as a "**region in decline**". This resulted in a number of national programmes targeted at job creation and R&I investment in declining regions across the country, of which the Region Deal can be seen as the latest addition. Most recent programmes, including Parkstad and ESZL, also refer to the lack of **cross-border infrastructure** in the region, particularly given its ambitions in the logistics sector and around the multi-national Eurostad (and potentially also cross-border labour markets). The previously mentioned **intergovernmental collaboration issues** could be a limitation to the recent attempts to transition South Limburg into a competitive, euro-centric region.

Enabling conditions for smart specialisation and transitions out of coal

- Presence of other energy sources within the national borders (natural gas in the northern Netherlands);
- Political will for a long-term strategic approach: the Minister of Economic Affairs is cited to have found mining "inhumane" (Gales & Hölsgens, 2017) and persistent national support for economic transition;
- Development and self-organisation of municipalities and provinces into functional economic regions, developing their own R&I strategies (e.g. Parkstad);
- Presence and extension of knowledge-producing institutions with an international outlook (e.g. Maastricht University, Zuyd University of Applied Sciences, Chemelot Campus); and
- New sources of national and EU financing, including the Region Deal (public-private Dutch fund for integrated societal challenges), and networks and access to Horizon 2020, Interreg, ESF and ERDF funds.

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Region Deal: https://www.limburg.nl/actueel/nieuws/nieuwsberichten/2018/augustus/limburgse-regiodeal/; https://www.rijksoverheid.nl/documenten/kamerstukken/2019/07/15/kamerbrief-aanbieding-regio-deal-parkstad-limburg.

6.2 Asturias (ES)

Description

The Asturias Principality (*Principado de Asturias*) is one of the 17 Spanish autonomous communities and is located in the northwest of the country. It borders the Cantabrian Atlantic Coast and the Castile and León community, which has similar characteristics when it comes to the mining history, and uses the same principal hard coal and lignite fields of northern Spain. The share of coal in electric power is under 20%, which is relatively low compared to other countries. Asturias' commercial coal mining history is considerably longer than that of South Limburg (> 200 years) and, together with the steel industry, has been a longstanding driver of the regional economy. The energy crisis of the 1970s, the dependence of the region on public investment (national and European regional development funds) and industrial changes in wider Spain led various authors to describe the region as a "prototype of an old industrial area". Besides its industrial activity, Asturias is largely rural and relatively sparsely populated (c. one million inhabitants, i.e. 96 inhabitants per km^2). The weight of the industrial sector over time is well reflected by the number of people employed, decreasing from around 117,000 in 1980 to around 55,000 in 2012.

The revenues of the mining companies gradually increased until 2011. However, the national coal extraction framework, which provided State aid to their economic activities for many decades, expired in 2018. The reconversion of the coal industry has been a **long-term process**: the number of direct mining jobs has gradually decreased from 45,000 in 1990 to 1,700 in 2018. The last Activity Framework (*Marco de Actuación*, MA) ran from 2013 to 2018 and focused on 1) coal production; 2) employment support; 3) economic boost for mining regions; and 4) cleaner coal technologies.[34] Coal production support decreased, so that opencast mining would remain unsupported by 2015 and underground mining by 2019. The employment support included a diverse range of measures: social support to compensate voluntary redundancy; early retirement; relocation of workers; re-training; and mitigation of environmental impact (landscape restoration). The economic boosting measures came in the form of large grants for infrastructural and SME projects. The current closure (2019) of the

[34] Del Río P (2017), *Coal Transition in SPAIN, IDDRI and Climate Strategies.*

underground mines is financed by the national government, which agreed a deal worth €250 million with the mining unions nationwide, to be spent between 2018 and 2028.

Research and Innovation Strategies

R&I strategies in the energy sector are focused on the development of **renewable energy networks**. They include the use of forests as a resource for biomass, the development of hydro energy projects and the development of storage technologies for renewable energy sources. The hydroelectric technological facilities are particularly advanced, as closed mines can be used for a combination of hydroelectric energy storage, compressed air energy storage and geothermal applications. For example, the network of tunnels in the Central Coal Basin will soon become available for such facilities. This 'new' structure can hold approximately 200,000 m^3 at depths ranging between 300m and 600m. Nine projects have been implemented in mines that are currently not flooded.[35]

Besides the energy production sector, Asturias has a variety of funded projects which are rolling out an electric mobility system (as part of the Cantabrian e-Corridor) and is the first region in Spain that experimented with trains running on natural gas. Given that most train lines are not electrified, this could particularly reduce environmental impacts and **increase transport opportunities**. Further economic diversification is sought in the tourism sector: increasing the emphasis on its natural resources, medieval and pre-Roman heritage, coastal landscapes in the north and a mountain range in the south (*Cordillera Cantábrica*), including two ski stations, has led to relative success of Asturias' **regional tourism policies**. In addition, recently growing sub-sectors such as zero-carbon tourism and rural tourism are considered in current innovation strategies by the Regional Ministry of Economy, Industry and Tourism. Last, new economic activities are found in the new leisure sector and centre on the opportunities of the closure of opencast mines. The Interreg-funded RECORE project (2000-2006) introduced trout and salmon to such a mine lake, leading to the attraction of tourists.

Lastly, the education sector and knowledge society are given a prominent role in recent R&I strategies, both regionally and locally. In the example of the medium-sized town of Langreo (similar developments occur in Avilés and Gijón), the **protection of the industrial and mining heritage** and reutilisation of central parts of town open opportunities to create new values and identities, for instance through converting industrial buildings into work spaces located in vicinity of colleges and residences. Other elements of the revitalisation are the improvement of transport links within the town and with other urban areas and improve the overall quality of urban life (Trigo, 2011). **Regional R&I policies** focus on the existing regional strengths in the areas of metallurgy, industrial materials and dairy products. Among the large technology stakeholders based in the region is the Barredo Foundation (*Fundación Barredo*), which promotes the development of applied research, technological development and education in subterranean industries.[36] Other important actors at the intersection of knowledge and technological development are the University of Oviedo's energy research centres, the Oceanographic Centre of Gijón and the Spanish Institute of Oceanography.

In a broader context, the majority of Spanish RIS3 strategies attempt to strengthen SME innovation and coordinate their links to knowledge institutions. SMEs have been the main source of Spanish I&D since the 2008-09 financial crisis. The Asturian potential in the **renewable energy sector** is an important resource for the Climate Change and Energy Transition bill, which is currently drafted by the national government. The National Energy and Climate Plan (NECP) for 2021-2030, required by the European Commission following energy union and climate action rules, anticipates positive effects on employment. It is expected that 42% of the nation-wide €236 million investment will be spent on renewable energy projects. The 2019 national Just Transition Strategy (*Estrategia de Transición Justa*) is expected to have important effects for Asturias, given the prominent role given to rural regions and areas with

[35] Menéndez J, Loredo J, Fernandez JM & Galdo M (2018), Underground pumped-storage hydro power plants with mine water in abandoned coal mines. *Proceedings of the IMWA 13th International Congress.*
[36] http://www.fundacionbarredo.es/category/proyectos_idi/.

large ecological resources.[37] Lastly, **supra-national partnerships** with other European peripheral maritime regions, such as the Atlantic Arc Commission, have resulted in intensified policy coordination (on thematic sectors but also in R&D&I) and joint attraction of EU funding.

Challenges

- The challenge of transitioning out of coal production is multiple: steel production is being phased out at the same time as coal (Díaz Aguado, 2018);
- Mining legacy and industrial path dependency. Mining territories have been a monoculture, and the dispersed population, small towns, lack of infrastructure and environmental (soil) deterioration constrain opportunities for new businesses in the region (MINETUR, 2013);
- Sparse population: new gas and electricity infrastructures (e.g. constructing the Cantabrian e-Corridor) are costly and dependent of public investments; and
- Targeted strategies needed to mitigate negative effects: polluted areas, landscape restructuration; employment quality.

Enabling conditions for smart specialisation and transitions out of coal

- High use of renewable energy sources (17% in 2015, projected to increase to 42% in 2030 according to the NECP);
- New legislative conditions by national strategies and EU regulations, as well as higher efficiency and lower costs of imported coal;
- Low share of national coal in Spain's electricity provision (2.3%) and of coal-fired power in general (under 20%);
- University of Oviedo's energy research centres and advanced R&D institutions; and
- Industrial and service-oriented economic diversification (including tourism, transportation, natural and industrial heritage).

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37 https://ec.europa.eu/energy/sites/ener/files/documents/5.3_workshop_on_necp_and_long_term_strategy.pdf.

6.3 North-Rhine Westphalia (DE)

Description

There are multiple historic coal areas in North-Rhine Westphalia (NRW), notably the Ruhr area (*Ruhrgebiet*) and the Rhineland area around Aachen. The Ruhr area has a long industrial history and is one of the most densely populated areas of Germany with over five million people. It has been the target of federal support for various economic restructurings for over 60 years, accompanied by steady decline of the coal sector that employed around 600,000 people in 1957 (6,000 in 2016). Initially, restructuring was motivated by the relatively high costs of maintaining the deep mines and water management in former mines. At the same time, the powerful influence of the coal and steel industry delayed the phase-out substantially. In total, regional and federal governments invested c. €300 billion between the 1960s and the 2000s to keep uncompetitive coal mining animated. Similar to South Limburg, imported oil and hard coal began to substitute local coal since the 1970s. In contrast, the Rhineland area around Aachen continues to have lignite mining activity, and is a central subject of the current restructuring policies to phase-out German coal production by 2038.

Although the perception of the Ruhr area has changed from an old industrial region (based on coal and steel) to a diversified and strong economy with an increased quality of life, unemployment rates have always been higher than the NRW and German averages. Initially, this was related to rapidly increasing labour productivity - industrial mechanisation led to fewer required person hours - but was driven in part by mine closure. Unemployment peaked in 1987 (15.1%) and continues to be around four percent points higher than the NRW average.[38] Regional policy action dates back to 1958 and has included unemployment payments, economic reorientation and re-industrialisation. This top-down approach was revised in the 1980s, when economic reorientation strategies were formulated at the city level, following the idea that the coal and steel industries would never be replaced by a new sector that covered the entire Ruhr area. **Cluster policies and European support from the European Regional Development Fund** (ERDF) provided a further boost for diversification and economic competitiveness in the Ruhr area, including the identification of future markets (early 2000s) and innovation strategies (after 2007). Figure 6.1 shows the different programmes involved, as well as the development of hard coal production (orange) and the number of employees (black line). Currently, the Ruhr area is regarded as a successful region in terms of the creation of new economic possibilities, overcoming industrial 'lock-in' and changing regional reputation. However, **unemployment rates are persistently high**.

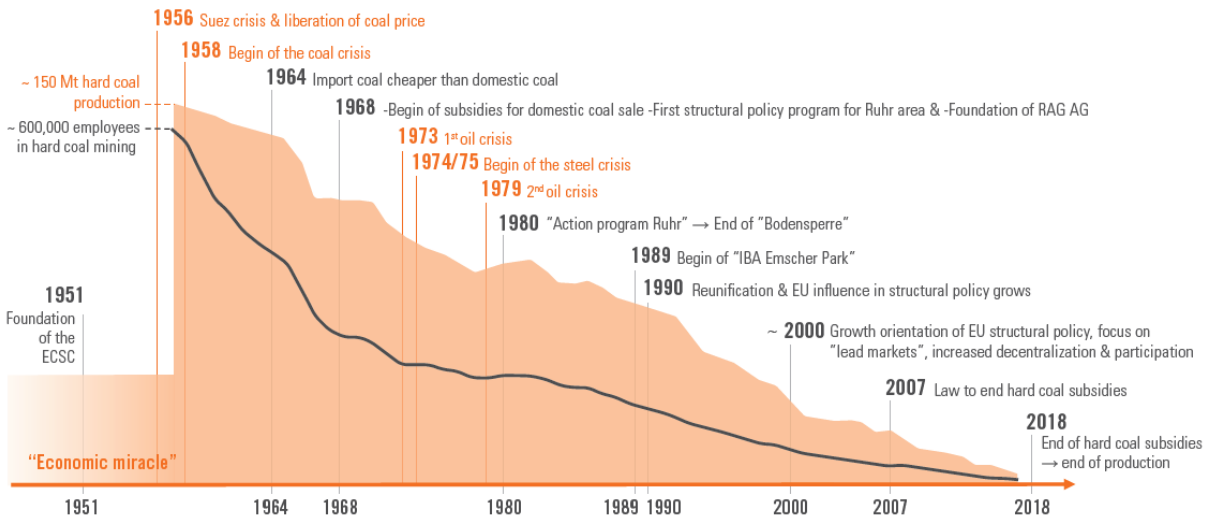

Figure 6.1: History of coal-related policy programmes in the Ruhr area (Source: Herpich et al., 2018.

[38] Herpich et al. (2018).

Transition Policies, Research and Innovation

Probably the most famous examples of large-scale structural policy programmes in Germany are the successive regional support programmes for the Ruhr area (*Entwicklungsprogramm Ruhr*). Although policy programmes since the 1980s had mixed results, a key lesson is that they were most successful when local actors were involved, and less successful when regulations were directly imposed from the NRW Land or federal level. Examples of local stakeholder involvement are "coal roundtables" in the 1990s. Although they prolonged the subsidising of mining, the consensus reached (for eventual phase-out) was widely supported, led to minimal unrest and finally ended the region's mono-structural dependence.[39] The effects of **long-term transition policies** are demonstrated in the following domains:

- Employment and citizen activity: retraining and new education opportunities (e.g. new universities). The German renewable energy industry is a particular sector that requires large numbers of highly skilled employees.
- Economy and industry: the **tertiary sector and knowledge society** are now important economic pillars, including the health sector, and are of an increasingly polycentric nature.
- Infrastructure: the first structural programmes focused on facilitating (labour) mobility in a region that traditionally built homes near the (industrial) workplaces.
- Education and research: between 1965 and 2014, the number of universities in the Ruhr area grew from zero to 22. This led to a growth of high-skilled workers and attractiveness of the region to citizens and companies.
- Quality of life: cultural and leisure amenities replayed environmentally damaging features (e.g. air pollution, industrial waste, polluted water, etc.).[40]

The Rhineland coal area continues to produce lignite, and is one region currently targeted by federal government action.[41] Support for restructuring coal regions has become an important focus in all of Germany since the agreement of the Federal Protection Plan 2050 in November 2016. The Commission on Growth, Structural Change and Employment (launched in June 2018) analysed the situation facing Germany's coal regions from climate protection, energy policy and economic development perspectives, and proposed measures a) focused on the energy sector and b) aimed at supporting structural change and employment in the coal regions.[42] The federal government is committed to following the Commission's recommendations for ending coal-fired power generation nation-wide by 2038, and allocating federal funding of c. €40 billion for the coal regions, which includes the Rhineland in NRW.

- First, a programme for 2019-2021 will draw on the €500 million per annum allocated in the federal coalition agreement for 'regional structural policy / structural change in coal policy', including federal funding of up to €240 million per annum for existing federal programmes in the three largest lignite regions.
- Second, a new "Structural Strengthening Law for the Coal Regions" (*Strukturstärkungsgesetz Kohleregionen)* will have two financial elements: the federal government will allocate €14 billion by 2038, 37% of which will go to the Rhineland coal region, and €26 billion will be allocated by 2038 for priority investment projects. In the next five years, funding for NRW will include up €2.6 billion.[43]

The existing Enterprise Coal Area programme (*Unternehmen Revier*) is one of the instruments through which the federal resources will be channelled. The programme was launched in 2017, with €4 million annually over a ten year period from Germany's Energy and Climate Fund

[39] Schultz & Schwartzkopff (2016).
[40] Herpich et al. (2018).
[41] Federal Ministry for the Environment, Nature Protection and Nuclear Safety (2016) Federal Climate Protection Plan 2050, Berlin.
[42] BMWi (2019a) *Kommission "Wachstum, Strukturwandel und Beschäftigung: Abschlußbericht*, Berlin.
[43] BMWi (2019c) *Eckpunkte zur Umsetzung der strukturpolitischen Empfehlungen der Kommission "Wachstum, Strukturwandel und Beschäftigung' für ein "Strukturstãrkungsgesetz Kohleregionen", Berlin, May 2019.*

(*Energie- und Klimafonds*), targeted at the four lignite regions including the Rhineland area. In contrast to most other federal support mechanisms, the **strategies are defined by the regions** themselves. The overall legal and political framework is set by the Federal Ministry for Economic Affairs and Energy, but funding is managed and project calls are implemented by each region (although the Federal Ministry's approval is needed for any projects costing over €100,000).[44] In the case of the Rhineland area, its main innovation strategy aims for the development of a "model region for climate protection and energy transition", involving the industry, technology and knowledge sectors. Furthermore, the strategy analyses the current situation, outlines decision-making structures, and defines an investment plan and pilot projects.[45] The regions will allocate funding via competitive calls for new ideas, pilot projects and creative approaches to regional (sub-Land) economic development.

A last example of new regional innovation strategies in NRW is found in the International Architecture Exhibition (*Internationale Bau Ausstellung*), which lasted between 1989 and 1999.[46] As noted in Section 6.1, this approach has now been adopted in Parkstad (South Limburg), but it was originally a German national tool to foster urban renewal from a regionalised, bottom-up perspective. In the case of the Ruhr area, various projects targeted the environmental and social problems around the river Emscher, including a new sewage system, renovating brownfields, and improving water quality. This resulted in enhanced attractiveness of the region for citizens and new business, as well as restoration of natural areas, leading to new opportunities for tourism and culture while preserving the region's coal history.

Challenges

- Influence of industrial companies delayed the phase-out of coal production, economic diversification and made the Ruhr area highly dependent of subsidies;
- Substitution of coal energy consumption by the steel sector (high technology costs, continued demand);
- Lagging development of production and infrastructure around renewable energy sources; and
- Including active mining regions (i.e. Rhineland) in the diversifying economic structure of other German regions.

Enabling conditions

- Technical and administrative capacity to shift to other energy sources;
- Large and long-term strategic investment in economic restructuring, including physical infrastructure and environmental remediation;
- Significant public and private investment in education and training (e.g. via the creation of regional universities), as well as research, development and innovation;
- Tradition of participatory regional economic planning, resulting in a greater voice of sub-regional actors in regional and federal reform strategies; and
- Central location in Europe, creating opportunities for a positive business climate.

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[44] BMWi (2017) Bekanntmachung: Richtlinie zur Förderung von Maßnahmen zur Strukturanpassung in Braunkohlebergbauregionen im Rahmen des Bundesmodellvorhabens „Unternehmen Revier". Bundesanzeiger, 3 November 2017, https://www.bmwi.de/Redaktion/DE/Downloads/B/bundesanzeiger-foerderung-massnahmen-zur-strukturanpassung-in-braunkohlebergbauregionen.pdf?__blob=publicationFile&v=6

[45] https://www.bmwi.de/Redaktion/DE/Artikel/Wirtschaft/strukturwandel-in-den-braunkohleregionen.html

[46] https://www.open-iba.de/en/geschichte/1989-1999-iba-emscher-park/

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7 Implementing the Strategic Energy Technology (SET) Plan

This section provides an introduction to the European Strategic Energy Technology (SET) Plan, describes the 13 SET Implementation Plans which are relevant to the TRACER project, outlines which countries are currently involved in SET Plan activities and identifies potential opportunities related to SET Plan implementation which may be of interest to TRACER target regions. The section concludes with descriptions of three best practice projects which support the achievement of SET Plan targets, in Brandenburg, Wales and Bosnia Herzegovina and a look ahead to other future opportunities.

7.1 Introduction – The European SET Plan

The EU's energy policies aim to ensure that European citizens can access secure, affordable and sustainable energy supplies. As key reference framework for the policy, the Energy Union strategy, was launched in February 2015.[47] The Energy Union is made up of five closely related and mutually reinforcing objectives:[48]

- security, solidarity and trust: diversifying Europe's sources of energy and ensuring energy security through solidarity and cooperation between EU countries
- a fully integrated internal energy market: enabling the free flow of energy through the EU through adequate infrastructure and without technical or regulatory barriers
- energy efficiency: improved energy efficiency will reduce dependence on energy imports, lower emissions, and drive jobs and growth
- decarbonising the economy: the EU is committed to a quick ratification of the ***Paris Agreement*** and to retaining its ***leadership in the area of renewable energy***
- ***research, innovation and competitiveness***: supporting breakthroughs in low-carbon and clean energy technologies by ***prioritising research and innovation to drive the energy transition and improve competitiveness***.

It is thereby widely acknowledged that improving EU research and innovation performance is urgently required to meet the new ambitious targets for 2030: a share of 32% renewable energy consumption, as well as a 32.5% improvement in energy efficiency and 40% CO_2 emission reductions.

[47] European Commission (2015) A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (COM(2015) 80 final).

[48] http://ec.europa.eu/research/energy/index.cfm?pg=policy&policyname=set

The Strategic Energy Technology (SET) Plan has been the research and innovation (R&I) pillar of the EU's energy and climate policy since 2007. It was revised in 2015 to effectively line up with the EU's Energy Union R&I priorities. It coordinates low-carbon research and innovation activities in 32 European countries (EU Member States, Iceland, Norway, Switzerland and Turkey). The SET Plan helps structure European and national research programmes and triggers substantial investments on common priorities in low-carbon technologies.

Thus, the SET Plan aims at accelerating the development and deployment of low-carbon technologies, at improving new technologies and at bringing down their costs, by coordinating national research efforts and facilitating financing of projects in the energy sector. Its goal is to promote innovation partnerships across Europe by supporting the most impactful technologies that will contribute to the EU's transformation to a low-carbon energy system.

A good overview of SET Plan objectives, activities and results is presented in the recent publication “SET Plan delivering results: The Implementation Plans – Research & Innovation enabling the EU’s energy transition”[49].

7.2 Development of Implementation Plans

Ten key R&I actions of the integrated SET Plan have been identified which are fully aligned to the Energy Union’s objectives. A consultative process was launched in 2016 identifying key priorities and setting targets through so-called ***Declarations of Intent*** for each of the ten key actions.[50]

The following ***10 key Research and Innovation Actions*** form the backbone of the European Strategic Energy Technology (SET) Plan (see Figure 7.1):

1. Develop performant renewable technologies integrated in the energy system
2. Reduce the cost of key renewable technologies
3. Create new technologies and services for consumers
4. Increase the resilience and security of the energy system
5. Develop energy efficient materials and technologies for buildings
6. Improve energy efficiency for industry
7. Become competitive in the global battery sector (e-mobility)
8. Strengthen market take-up of renewable fuels
9. Drive ambition in carbon capture and storage/use deployment
10. Increase safety in the use of nuclear energy

[49] https://publications.europa.eu/en/publication-detail/-/publication/a3b22c5b-ed41-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-803647918

[50] https://setis.ec.europa.eu/actions-towards-implementingintegrated-set-plan

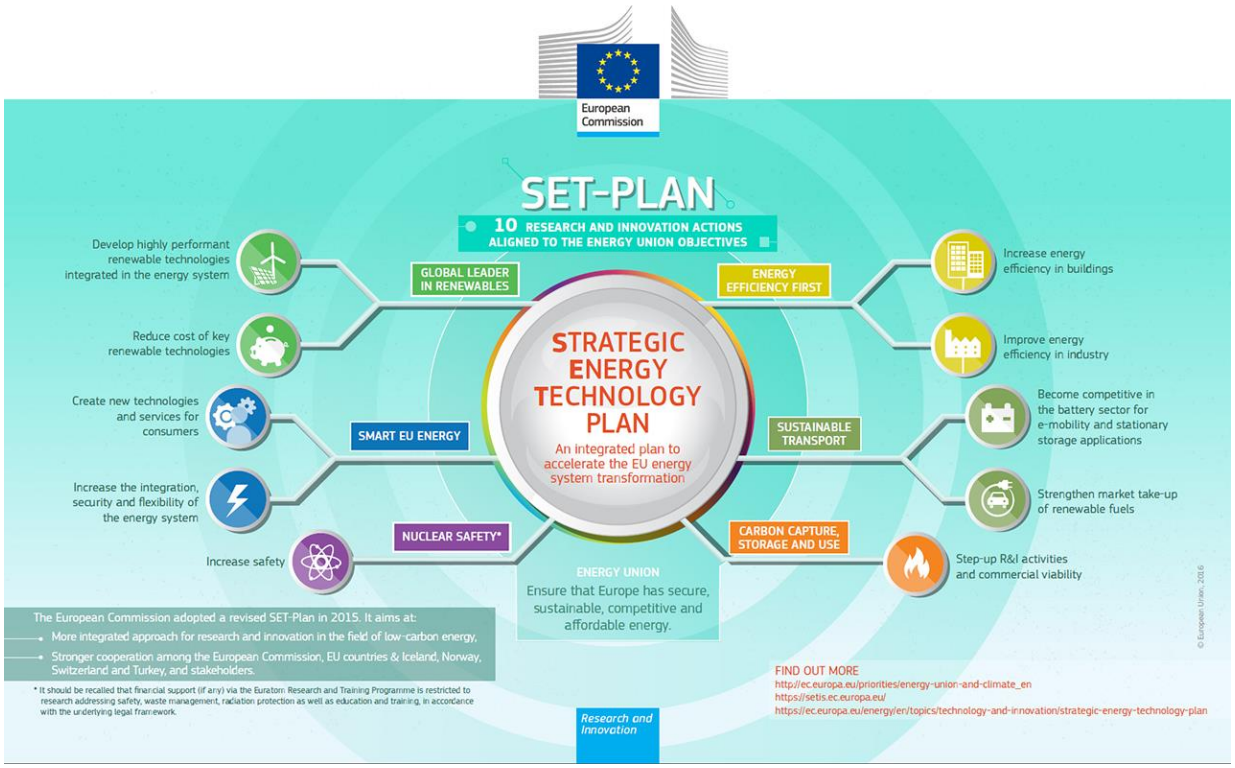


Figure 7.1: SET Plan Research & Innovation Actions

SET Plan ***Implementation Plans***[51] were drafted and endorsed by bringing together interested SET Plan countries and relevant industrial and research stakeholders to identify R&I activities in order to accelerate the energy transition. The participants in this process debated the main R&I priorities for each SET Plan Action and identified the best areas for future cooperation among SET Plan countries and relevant industrial actors. The outcome of this work is reflected in fourteen (14) Implementation Plans for the corresponding energy technologies (or energy sectors) that are considered as having the greatest potential. The Implementation Plans include specific R&I actions needed to achieve the set targets.

[51] https://setis.ec.europa.eu/actions-towards-implementingintegrated-set-plan/implementation-plans

The following 13 Implementation Plans (IP), excluding the IP on nuclear energy, are relevant to the TRACER project.

Sustain technological leadership in renewables (RES)

- Solar Photovoltaics (PV) IP
- Concentrated Solar Power / Solar Thermal Electricity (CSP/STE) IP
- Offshore Wind Energy IP
- Deep Geothermal Energy IP
- Ocean Energy IP

A smart consumer-centric energy system

- Smart Solutions for Energy Consumers IP (3.1)
- Towards Positive Energy Districts for Sustainable Urbanisation IP (3.2)
- Energy Systems IP (4)

Develop and strengthen energy efficient systems

- Energy Efficiency in Buildings IP (5)
- Energy Efficiency in Industry IP (6)

Energy Options for Sustainable Transport Systems

- Batteries for E-Mobility and Stationary Storage IP (7)
- Renewable Fuels and Bioenergy IP (8)

Carbon Capture Utilisation and Storage (CCUS) IP (9)

7.3 Country involvement in SET Plan activities

The process of development and implementation of SET Plan Implementation Plans is performed under the leadership of EU Member States (MS) in close cooperation with the European Commission and a wide range of stakeholders from research and industry within so-called Implementation Working Groups (IWGs). Strategies and activities towards the implementation of the SET Plan Implementation Plans are currently being developed by MS, the EC and stakeholders.

Figure 7.2 provides an overview of the Implementation Plans including the involvement of Member States in the corresponding energy technologies or sectors. Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, and UK are specifically active MS within the Implementation Plans (“Stars” in the figure below indicate the role of a MS as Chair of the respective IWGs).

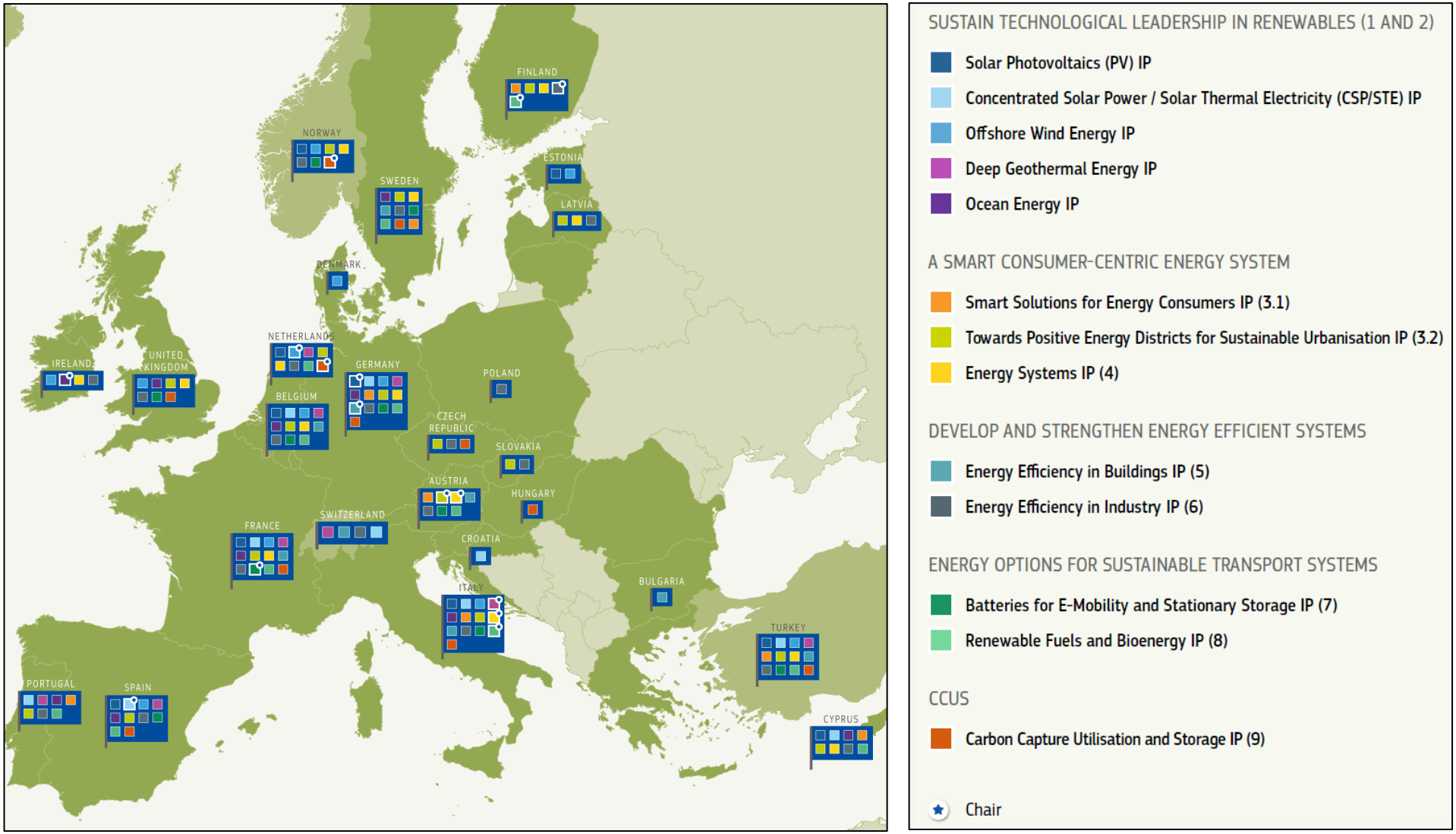


Figure 7.2: Overview of the Implementation Plans by country (Source: SET Plan delivering results)

7.4 Implementation Plan Opportunities for TRACER Regions

The implementation of SET Plan Implementation Plans (IP) is currently not directly linked with existing R&I strategies for the transition in coal intensive regions. However, the coming years will certainly produce opportunities and potential synergies for SET Plan IP with activities in TRACER target regions facilitating their transition towards a sustainable energy system.

TRACER Target regions

- **Southeast Region (BG34),** Bulgaria
- **North West Bohemia (CZ04)**, Czech Republic
- **Lusatia Region, Brandenburg (DE40) and Dresden (DED2)**, Germany
- **West Macedonia (EL53)**, Greece
- **Upper Silesia (PL22)**, Poland
- **West Region / Jiu Valley (RO42)**, Romania
- **Kolubara Region**, Serbia
- **Donetsk Region**, Ukraine
- **Wales (UKL1, UKL2)**, United Kingdom

It should be noted that TRACER regions from Serbia and Ukraine are not involved in the European SET Plan, and the EU Member States Romania and Greece are not yet involved in SET Plan IP activities.

Based on the involvement of Bulgaria, Czech Republic, Germany, Poland and United Kingdom in SET Plan IPs as well as the overall importance of several research and innovation priorities for TRACER target regions, the following relevant Implementation Plans are identified.

Solar Photovoltaics (PV) IP: Germany (Lead country)

The Photovoltaics (PV) Implementation Plan is contributing to the development of higher performance, lower cost PV technologies. The six technology related priority activities proposed in this IP cover: Building-Integrated PV (BIPV) and similar applications, technologies for silicon solar cells and modules with higher quality, new technologies and materials, development of PV power plants and diagnostics, manufacturing technologies (for crystalline silicon (c-Si) and thin films), and cross-sectoral research at lower TRL.

The targets set in the IP for 2030 relate to: the efficiency of crystalline silicon and thin films technologies and of new concepts; the reduction of their cost; enhancing the lifetime, quality and sustainability of PV modules, hence improving their performance; enabling more “(near) Zero Energy Buildings” through the use of BIPV; advancing manufacturing, installation and maintenance methods of PV modules.

Towards Positive Energy Districts for Sustainable Urbanisation IP (3.2): Czech Republic, Germany, United Kingdom

This Implementation Plan aims to support the planning, deployment and replication of 100 “Positive Energy Districts” (PED) for sustainable urbanisation by 2025. PED are energy efficient districts that have net zero carbon dioxide (CO_2) emissions and work towards an annual local surplus production of renewable energy (RES). Such districts help raise the quality of life in European cities, while reaching the COP21 targets and making Europe a global role model. An open innovation framework with cities, industry, investors, research institutes and citizens’ organisations working together will help develop PEDs and the necessary R&I activities. The approach integrates the technological, spatial, regulatory, financial, legal, environmental, social and economic perspectives.

Energy Efficiency in Buildings IP (5): Bulgaria, Germany (Lead country)

Buildings account for a substantial share of the EU’s total energy consumption. This Implementation Plan (IP) addresses how energy demand could be reduced and security of supply improved. The potential to reduce high CO_2 emissions is significant given that heating and cooling in buildings comes mainly from natural gas, fuel oil and coal, and very little is from RES.

Targets set by the IP for heating and cooling by 2025 are: 50 % reduction of cost of heat pumps compared with 2015 market price; increasing renewable heat in DHC (District Heating & Cooling) by 25% while ensuring quality and cost effectiveness; 20% decrease in costs of DHC substations for residential buildings (compared with 2015 prices); 50% cost reduction for equipment and installation of micro-combined heat and power (CHP) and combined cooling, heat and power (CCHP); 20% increase in the energy efficiency of micro-CHP/CCHP (compared with 2015 levels), and 25% improvement of energy storage performance compared with 2015 levels.

Energy Efficiency in Industry IP (6): Czech Republic, Germany, Poland, United Kingdom

Research and innovation in industrial energy and resources efficiency is crucial to ensure that the European industry contributes to climate change targets and increases its export competitiveness. R&I investment especially in technology sectors such as iron/steel, chemicals or pharma, where the energy efficiency potential remains significant for European companies, are instrumental in boosting the EU's technological leadership and innovation know-how.

Batteries for E-Mobility and Stationary Storage IP (7): Germany, United Kingdom

Europe produces less than 1% of global lithium-ion (Li-ion) battery cells. Absence of domestic Li-ion batteries cell manufacturing in the EU affects competitiveness of European electric vehicle producers and energy storage service providers. Competing with foreign global economies in the batteries sector on a cost-only basis is not enough. Instead, Europe needs to differentiate itself on battery aspects other than cost including environmental and performance aspects. Europe supports the development of a domestic green battery value chain consisting of high performant, safe and sustainable battery cells with the lowest environmental footprint possible.

The targets are differentiated into performance, cost and manufacturing targets for Li-ion batteries and future technologies for use in automotive and stationary storage applications.

Performance: Energy density at cell level: >350 Wh/Kg and > 750 Wh/L

Cost: Automotive battery pack: 75 €/kWh; Stationary energy storage: 0.05 €/kWh per cycle

Manufacturing: Automotive: 50 GWh/year; Stationary: 10 GWh/year

Renewable Fuels and Bioenergy IP (8): Germany

Bioenergy is essential for reaching EU's renewable energy targets and the Paris Climate Agreement. Development of low-carbon renewable fuels decreases greenhouse gas emission (GHG); furthermore, advanced biofuels and other renewable fuels play an important role in decarbonising transport, as well as integrating electricity, heating, transport and industrial sectors. The following main R&I needs are addressed by this IP: enhanced economies of scale, reduced production costs and optimised greenhouse-gas performance of all bioenergy products. The targets set address: bioenergy; renewable fuels; intermediate bioenergy carriers, and biomass Combined Heat and Power (CHP).

Carbon Capture Utilisation and Storage (CCUS) IP (9): Czech Republic, Germany

Carbon capture, utilisation and storage (CCUS) represents an important set of technologies for the decarbonisation of power generation and energy-intensive industries. Pilot projects and other R&I activities are under way in the sector aiming to make CCUS a cost-effective measure against climate change. The SET Plan's key R&I objectives for carbon capture, utilisation and storage (CCUS) are: to demonstrate and to deploy on a commercial scale the full CCUS value chain; to reduce the costs of CO_2 capture; to demonstrate safe CO_2 storage.

7.5 Best Practice 1: "Big Battery" Project in Brandenburg

An excellent example of an initiative which is fully in line and supporting the achievements of targets under the SET Plan "**Batteries for E-Mobility and Stationary Storage IP"** is the recently launched project "BigBattery" to be implemented in the TRACER target region Lusatia, Brandenburg, Germany.[52]

The Lusatian energy company LEAG will build a battery storage facility with utilisation capacity of 53 megawatt hours (MWh) at the Schwarze Pumpe power plant industrial site. BigBattery Lausitz thereby combines modern power plant infrastructures with storage technology in a completely new order of magnitude. In this field, the project is to date the only one of its kind in Europe. The storage facility, which is based on Li-ion technology, will make power generation more flexible and help protect the power grid from fluctuations. BigBattery Lausitz is characterised by innovative charging management and the use of a new type of power plant control system. LEAG is thus contributing to facilitate further system integration of renewable resources.

The BigBattery will be built next to the Schwarze Pumpe power plant. Thirteen containers have been planned on an area of 110 by 62 metres to accommodate Li-ion batteries. The battery storage system will be connected to the grid at high-voltage level (110 kilovolts) and connection to the extra-high voltage grid is also provided.

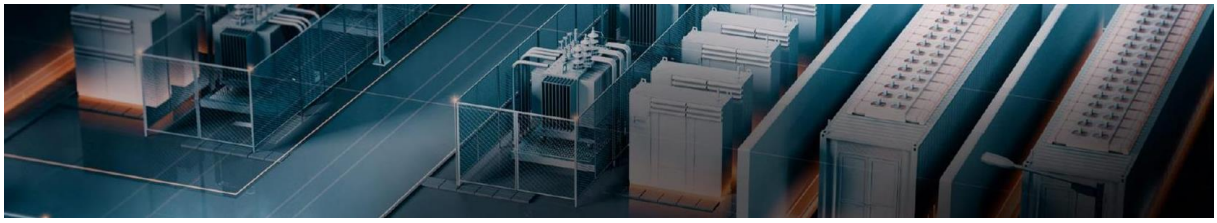


Figure 7.3: Schematic view of project "BigBattery" (Source: LEAG)

Construction work for "BigBattery" is scheduled to start in early summer 2019 and the commercial commissioning is foreseen in summer 2020. The investment is estimated to be approximately €25 million.

The main contractor for the construction is the Czech energy company EGEM, which intends to cooperate with regional service providers from Lusatia. The project is supported by subsidies from the federal state of Brandenburg, and is an integral part of the R&I transition strategy in the Lusatia Region.

[52] https://www.leag.de/en/business-fields/bigbattery-lausitz/

7.6 Best Practice 2: FLEXIS (Flexible Integrated Energy Systems) Initiative, Wales

FLEXIS (Flexible Integrated Energy Systems) is a £24 million research operation designed to develop an energy systems research capability in Wales which will build on the world class capability that already exists in Welsh Universities.[53] FLEXIS is led by Cardiff University, Swansea University and the University of South Wales, and will be delivered in the two TRACER target regions: West Wales and the Valleys, and East Wales. FLEXIS has received £15 million in funding support through the Welsh European Funding Office (WEFO).

The initiative aims at developing flexible energy systems and driving innovation to create jobs and produce real economic impact by attracting new companies to locate in Wales.

FLEXIS partners will support cluster development through collaboration with private and public sector research organisations in Wales, throughout Europe, and worldwide targeting to promote the products of Welsh research and to educate research engineers needed to make Wales one of the global leaders in energy research. Specifically, FLEXIS will address fuel poverty, particularly amongst the elderly, which is of growing importance as energy prices increase to accommodate ever more complex renewable energy systems and the associated new infrastructure. Thereby, socio-economic aspects of this challenge including public perceptions and communication about energy research and development, and the associated costs and benefits are tackled in an interdisciplinary approach.

FLEXIS is comprised of eight research themes with integrated research, development and innovation activities. Specifically, the FLEXIS Demonstration Area based in Neath Port Talbot (see Figure 7.4) is closely linked with several R&I priorities under the SET Plan.

The electrical generators within the demonstration site include two biomass power stations ("Renewable Fuels and Bioenergy IP"), a CCGT (Combined Cycle Gas Turbine) power station, a Solar farm ("Solar Photovoltaics IP"), a wind farm and the proposed Tidal Lagoon (Ocean Energy IP"). Furthermore, FLEXIS will model the energy and CO_2 flows in the region with the aim to improve the resource efficiency within the demonstration area, but also to improve the flexibility of the energy networks, reduce waste and CO_2 emissions from the area. The CO_2 emissions will be modelled to determine any net emission reductions and to assess the potential implementation of Carbon Capture and Utilisation and Storage ("Carbon Capture Utilisation and Storage IP").It is envisaged that FLEXIS will not only help to improve the success of those businesses within the demonstration area but also highlight the potential for new business and regional development.

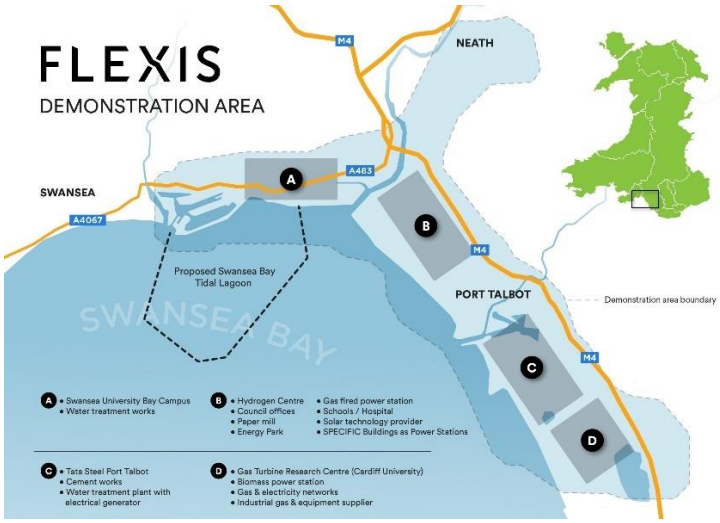


Figure 7.4: FLEXIS demonstration area in Wales

[53] http://www.flexis.wales/

7.7 Best Practice 3: Biomass Conversion of CHP unit in Bosnia Herzegovina

The following best practice serves as example of the conversion of a coal-fired Combined Heat and Power (CHP) unit to biomass use within a coal-intensive region in Bosnia Herzegovina. Thus, this best practice is in line with targets under the SET Plan "**Renewable Fuels and Bioenergy IP"** and may offer replication opportunities in coal intensive TRACER regions.

As operator of Kakanj power plants, the publicly owned utility JP Elektroprivreda BiH (EPBiH), Bosnia and Herzegovina, currently investigates the opportunity of full biomass repowering of Unit 5 of its power plant with an electrical capacity of 118 MWe. The unit also supplies heat to the city of Kakanj via its local district heating network. Locally available woody biomass resources will be considered for displacing the brown coal currently used as fuel.

Figure 7.5: Planned full biomass conversion of a CHP unit in Kakanj, Bosnia Herzegovina

Kakanj Thermal Power Plant is one of Bosnia and Herzegovina's largest coal-fired power plants having a total installed electric capacity of 450 MWe and producing around 2.3 billion KWh of electricity per year.

Kakanj has been a coal mining area since 1898. Construction of the coal-fired power plant started in 1947 and the first unit was commissioned in 1956. By 1988 six more units were put in operation. Currently a new 300 MW steam unit is in planning and a 100 MW Combined Cycle Gas Turbine (CCGT) block may be built to replace an old 32 MW sets. The Kakanj power station burns approximately 1.8 million tons of coal from mines Kakanj, Breza and Zenica, and in smaller amount mines Gračanica, Bila and Livno.

Planning activities for the biomass repowering of Unit 5 of the Kakanj power plant are supported in the framework of the Horizon 2020 project BIOFIT – Bioenergy Retrofits for Europe's industry – aiming to facilitate the introduction of bioenergy retrofitting in five industry sectors: first-generation biofuels, pulp and paper, fossil refineries, fossil firing power and combined heat and power plants.

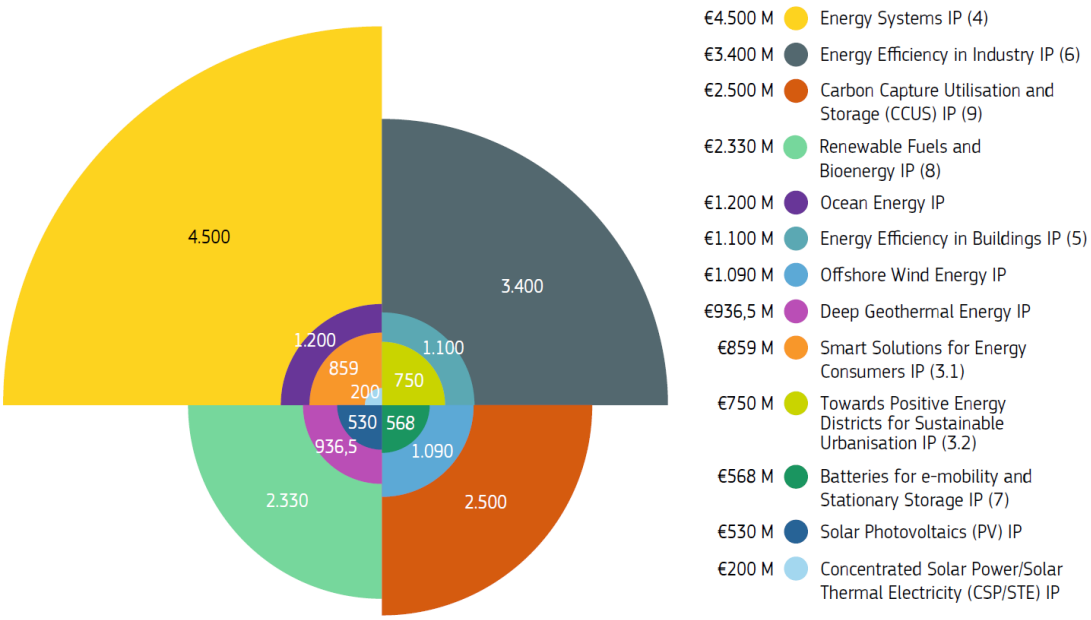
Progress and news about this initiative are reported on the website of the BIOFIT project.[54]

[54] https://www.biofit-h2020.eu/elektroprivreda-bih-kakanj-bosnia-herzegovina-chp/

7.8 Outlook – Expected future investments

Based on the efforts undertaken in the framework of the European Strategic Energy Technology (SET) Plan since 2007 and the recent development of a set of Implementation Plans, European governments, industry, research organisations and the European Commission will continue working together for the coming years to reshape Europe's energy future and accelerate the transformation of European Energy System through innovation. The priority is now to step up public and private investments in the R&I priorities identified in these IPs under the umbrella of the SET Plan to maximise national and EU investments.

As proposed in the Implementation Plans, up to 2030 an estimated aggregated total of more than €20 billion is expected to be invested in R&I activities with the highest impact for clean energy transition, as well as for the competitiveness of Europe in low carbon technologies (see Figure 7.6). This will be part of a wider effort to decarbonise the EU energy system and further mobilise significant shares of R&I investments to meet the long-term EU strategy for the reduction of GHG emissions, in accordance with the Paris Agreement.



Source: https://setis.ec.europa.eu/actions-towards-implementing-integrated-set-plan/implementation-plans

Figure 7.6: Expected volume of investment in R&I activities as identified in the Implementation Plans (in € million)

It is anticipated that the total investment of €20 billion in R&I activities towards future secure, affordable and sustainable energy supplies - jointly mobilised by the private sector, national programmes and European funds under the SET Plan - will in part also benefit coal-intensive regions all over Europe and support them in their transition to a sustainable energy system.

Therefore, within TRACER close cooperation links will be established with several Implementation Working Groups (IWGs) on key R&I priorities relevant for the TRACER target regions.

8 Conclusion

The three case study regions explored in detail in this report – South Limburg (Netherlands), Asturias (Spain) and North-Rhine Westphalia (Germany) - share a history in coal mining, while being diverse in terms of their geographies, transition stages and sectors of specialisation. However, within these different contexts, Smart Specialisation strategies have played a key role in the innovation focus of such regions and in their transition out of coal, partly using the competitive advantages they may have in the production and transportation of energy sources. While their experience and contexts are diverse, some common messages emerge:

- **Transition is a long-term process and often already ongoing** in the form of labour market changes and economic restructuring programmes i.e. falling employment and profitability has already been underway for half a century in these regions, so that action on climate change is simply "tipping them over the edge".
- **Cooperation, coordination and broad stakeholder participation** have been of particular importance in the design and implementation of transition strategies).
- **Investment in education, training, technological innovation and the knowledge economy** has been key to economic renewal and diversification into new future-oriented sectors in all three regions.
- A range of **other interventions have also supported transition,** notably investment in physical infrastructure, environmental and landscape renewal, and support for businesses, particularly SMEs.
- National/regional **State authorities have played vital roles in ensuring strategic continuity and in providing an overarching framework** for implementing strategies, combined with regional / local flexibility.
- An important component of economic diversification policies and restructuring programmes has been the **preservation of industrial and mining history** (e.g. converting buildings in Asturias, leisure opportunities in mine lakes in Asturias, tourism and culture in North-Rhine Westphalia, DSM and technical education in South Limburg, renewable energy infrastructure in all three).
- **Cross-border cooperation with stakeholders in neighbouring EU Member States** has contributed to strategies and economic regeneration in all three regions.

These messages echo many of the requirements of the Smart Specialisation process. The design and implementation of S3 can be a **lengthy process**. Undertaking an extensive and inclusive EDP at national and regional levels takes a long time, for example the work in Slovenia was carried out in several phases over a period of three years. EDP is also an **iterative and ongoing process**, requiring that plenty of time is allowed for open discussion. This facilitates stakeholders in making their needs known. The **need for actors to work together** can be embedded at an early stage, for example by requiring cooperative submissions from groups of stakeholders. Where available, S3 should build on existing experience, as in the current regional strategy in the South Moravia region of the Czech Republic, and even here extensive additional stakeholder engagement took place. Participatory consultation processes benefit from drawing on existing networks of actors and pre-existing regional innovation dynamics, as in Portugal. On the other hand, it is important to try to involve actors who have not previously been included in consultative processes e.g. as with the civil society in Slovenia and the universities in South Limburg (Netherlands).

Participation of stakeholders should be encouraged and supported into the S3 implementation phase. However, keeping the EDP going can be challenging. If the process starts to lose momentum, it may require **action to ensure ongoing animation** (as in Pomorskie region in Poland). Stakeholder participation can be encouraged by setting up bespoke structures (e.g. councils, platforms or working groups with a role in strategy implementation, as in Portugal, Greece and Wielkopolskie (Poland)). It is important to **build trust among the participants** in the process, for example through focus groups and project development labs as in Greece, or investment in collaborative projects which promote spillovers (as in Franche-Comte).

Priorities may need to be aligned between difference governance levels (e.g. local-regional as in Bilbao) or types of area within a region (e.g. rural-urban as in Extremadura in Spain). It may

be helpful for strategies to cross administrative boundaries, exploiting synergies, and an example of this can be found in Galicia-Norte (Spain/Portugal).

The practical implementation of the strategies can take place in different ways – countries and regions have chosen different ways to deliver innovative projects. External experts can play a useful role at various stages - in providing feedback on draft strategies, helping with the prioritisation exercise, or evaluating the results of calls for proposals. Where capacity is lacking, various funding sources can potentially be used to support stakeholders, as in Czech Republic. An example of combining funding sources to pursue Smart Specialisation goals can be found in Wales (UK), where a project has combined funds in a “Stairway to Excellence” approach.

An effective Smart Specialisation Strategy must include a **sound monitoring and evaluation system**. Strong efforts are being made to monitor the implementation of Smart Specialisation in Pomorskie (Poland) and Emilia-Romagna (Italy), while evaluation specific to Smart Specialisation has been carried out in the Czech Republic, and is planned in Galicia (Spain).

The **European Strategic Energy Technology (SET) Plan** has been the research and innovation (R&I) pillar of the EU's energy and climate policy since 2007. It was revised in 2015 to line up effectively with the EU's Energy Union R&I priorities. The SET Plan aims at accelerating the development and deployment of low-carbon technologies, at improving new technologies and at bringing down their costs, by coordinating national research efforts and facilitating financing of projects in the energy sector. Its goal is to promote innovation partnerships across Europe by supporting the most impactful technologies that will contribute to the EU's transformation to a low-carbon energy system.

In recent years **Implementation Plans (IP)** have been drafted and endorsed for a number of key energy technologies (or energy sectors) by bringing together interested SET Plan countries and relevant industrial and research stakeholders to identify R&I priorities and activities in order to accelerate the energy transition.

Even though initiatives implemented under the SET Plan are currently not directly linked with existing R&I strategies for transition in coal intensive regions, the coming years will certainly produce opportunities and potential synergies for SET Plan Implementation Plans with activities in most of the TRACER target regions, facilitating their transition towards a sustainable energy system. Specifically, the total investment of €20 billion in R&I activities towards future secure, affordable and sustainable energy supplies anticipated in the SET Plan Implementation Plans - jointly mobilised by the private sector, national programmes and European funds under the SET Plan - will certainly in part also benefit coal-intensive regions all over Europe and support them in their transition to a sustainable energy system.

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