POTENTIALS

RFCS AM PROJECT

Synergistic potentials of end-of-life coal mines and coal-fired power plants, along with closely related neighbouring industries: update and re-adoption of territorial just transition plans

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Deliverable 1.2

Comprehensive overview of the project: State of the art, problem, proposed approach, and outcome

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Executive summary

POTENTIALS project focuses on the unique aspects of coupled end-of-life coal mine sites and coal-fired power plants, along with closely related neighbouring industries, taking advantage of their joint potential to stimulate new economic activities, developing jobs and economic value in Coal Regions in Transition.

To achieve this goal, POTENTIALS will identify and assess their synergistic opportunities by means of a prospective analysis, enabling to develop business models that rely on renewable energy, contribute to the circular economy or scale energy storage, guaranteeing a sustainable and combined use of assets and resources otherwise overlooked in the high-velocity environments of phasing out processes, and supporting the update and re-adoption of territorial just transition plans.

1 Problem

In order to support coal regions in transition, one of the most addressed alternatives is the re-purposing of closed or end-of-life coal-related assets, such as coal mines, coal power plants or other (e.g. coal transport infrastructure, coal preparation plants or heat plants that supply hot water or steam to industrial or residential consumers).

If we also try to ensure that these alternatives contribute to the objectives of the European Green Deal, this will imply that re-purposing should be directed at new or improved technologies and business models that rely on renewable energy or scale energy storage, or contribute to the circular economy, seeking at the same time the use of synergies through sector coupling (e.g. the management, recycling or upcycling of power plant residues, household or industrial wastes, or geomaterials from past mining operations, including the production or enhancement of soil for land/water remediation/restoration, etc.).

The problem tackled by POTENTIALS is that most of the solutions that are being proposed do not consider synergistic opportunities between coupled end-of-life coal mine sites and coal-fired power plants and, moreover, do not consider synergistic opportunities with closely related neighbouring industries, in order to take advantage of their joint potential.

Thus, POTENTIALS will specifically address solutions considering these synergistic opportunities, guaranteeing a sustainable and combined use of assets and resources otherwise overlooked in the high-velocity environments of phasing out processes.

2 Objectives

POTENTIALS objectives are:

1. To valorise the knowledge gained from CoalTech2051, RECPP, and related projects, in order to facilitate synergistic potentials of end-of-life coal mines and coal-fired power plants, along with closely related neighbouring industries, to stimulate new economic activities and jobs and to avoid inflicting substantial economic upheaval on Coal Regions in Transition.

2. To define a set of data that should be collected and integrated from coal mines, coal power plant operators and closely related neighbouring industries prior to closure or planning of phase-out routine.

3. To identify and assess a portfolio of best available assets/infrastructures, resources, and new or improved energy technologies for sustainable business models development, considering the main factors affecting their future successful integration.

4. To build business model scenarios for re-purposing coupled end-of-life coal mines and coal power plants along with closely related neighbouring industries in Coal Regions in Transition, supported by a set of synergistic alternatives to move forward the process of phasing out, utilizing the optimum sustainable approach for their reuse.

5. To evaluate business model scenarios options according to multiple criteria, standards and policies in order to build a successful story, including legal conditions at EU Directive level and permittable uses, and implementing roadmaps in case of existing gaps.

6. To support the update and re-adoption of territorial just transition plans, showing how these synergies can be used to develop new business models, defining concrete prospects and transition plans from different implementation scenarios, and justifying the scenario choice.

7. To assess the economic impact of the proposed business models to determine their economic diversification potential, likely commercial viability, and added value.

8. To address a social impact assessment, analysing the expected job losses and frameworking requalification needs considering skills forecasts, in order to avoid inflicting a substantial economic upheaval in the coal regions in transition identified by the European Commission under its Coal Regions in Transition initiative.

9. To undergo a territorial impact assessment to provide an analysis of the potential territorial impact of the business model proposals, and to anticipate the consequences that the business models will have on regions and local communities.

10. To specify business models outputs and results indicators considering the targets set by the European Green Deal and related taxonomy, Regional Policy common output indicators, and Regional Policy result indicators for the Just Transition Fund.

11. To disseminate and transfer the knowledge and results of the project to the whole European coal industry, policy makers, scientists, trade unions, NGOs and coal industry nearby local communities.

3 Approach

POTENTIALS' approach is premised on the notion that in order to stimulate new economic activities and jobs in Coal Regions in Transition, management decisions should be based on a prospective analysis of business models that rely on renewable energy, contribute to the circular economy or scale energy storage.

Guaranteeing a sustainable and combined use of assets and resources, otherwise overlooked in these high-velocity environments of phasing out processes, is the necessary ingredient for sound decision-making.

POTENTIALS will use prospective analysis to identify the optimum business models that coupled end-of-life coal mines and coal-fired power plants, as well as closely related neighbouring industries, should address. Connecting all their components and revealing the variables is essential to the evolution of this system.

POTENTIALS will use one of the most widely employed methodology to accomplish prospective analysis: the scenario method proposed by Godet (2000), a creative and structured process to undergo strategic foresights, and a differentiating factor in decision-making.

4 Methodology

POTENTIALS will be structured into five work packages (WP) in order to develop the methodology of the project, plus a contingency plan, in order to ensure a consistent approach. Apart from WP1 that address project's coordination and management, the rest of them are presented in Figure 4-1.

4.1 Work Package 1: Project Coordination and Management

This is the work package in which all the coordination tasks are included: overall technical coordination of the project, organisation and management of meetings, distribution of technical data and information among partners, preparation of minutes and integration of reports, and administrative issues, including relations with the European Commission. This work package will also cover the design, implementation & maintenance of the project website.

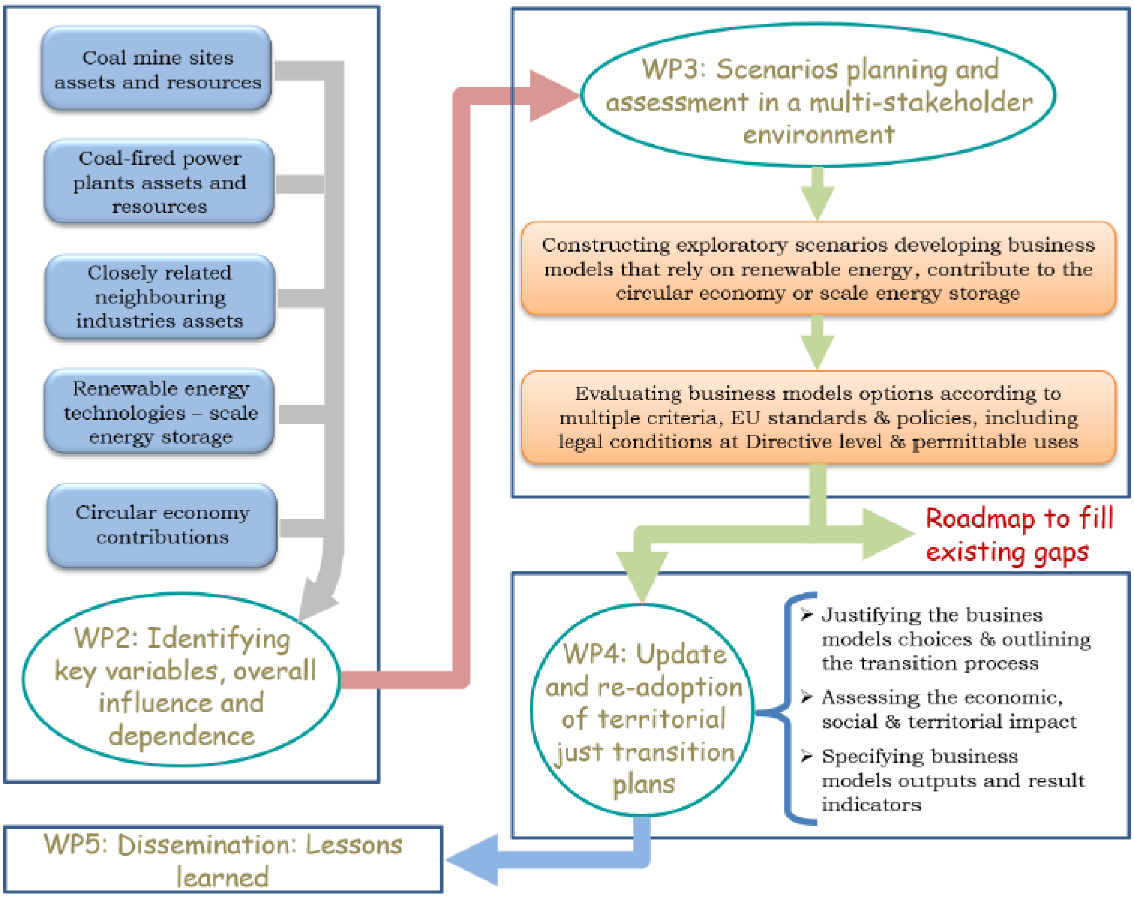

Figure 4-1. Methodology of POTENTIALS

4.2 Work Package 2: Identifying key variables, overall influence and dependence

This work package is aimed at determining the most important key variables addressing the synergistic potentials of end-of-life coal mine sites and coal-fired power plants, along with closely related neighbouring industries, related with the implementation of business models relying on renewable energy, contributing to the circular economy or scaling energy storage. The aforementioned variables will be evaluated through the structural analysis method.

To undergo the structural analysis of this complex system and to properly identify the overall influence and dependence of the different variables involved, POTENTIALS will use the "Cross-Impact Matrix Multiplication Applied to Classification". This methodology, known as MICMAC, has been developed by the Institut d'Innovation Informatique pour l'Entreprise 3IE under the supervision of the LIPSOR Prospective Strategic and Organisational Research Laboratory.

4.2.1 Defining relevant variables

First, the variables that are considered relevant for the project will be identified, analysed, and reduced according to their representability, before proceeding with the structural analysis. Variables, internal and external, will refer to the characterizing of both technical (e.g., water temperature, flying ashes characterisation, waste heaps soil characterisation, etc.), and evaluation criteria (e.g. cost, competitiveness, etc.) related with renewable energy technologies, scale energy storage, assets, resources and circular economy contributions.

The variables of this complex system will be defined based in the knowledge and results gained from CoalTech2051, RECPP and other related projects, as well as in the opinion of experts from the European Network of Clean Coal Technologist established by CoalTech2051, from the stakeholders identified by RECPP, on a brainstorming among the partners of the project, and on literature review. A remote meeting will be organized to achieve this goal.

An unsorted list of variables will be given as an output in this phase. Of course, not all the sources may agree in the importance of the variables or even in identifying what aspects should be formalized as a variable or which should not. Detailed explanation of the variables is essential, allowing a better perception of the relations between these variables further in the analysis. Finally, a homogeneous list of internal and external variables of the system is obtained. Based on scientific literature, this list should not exceed 70 to 80 variables.

4.2.2 Specifying the relations between the variables

With the unsorted list of variables developed in the previous point, a group of experts from the European Network of Clean Coal Technologist, stakeholders identified by RECPP, and other experts selected by POTENTIALS, will state the influence that each variable has over the rest of variables of the system. The group will provide a n x n integer matrix that states these influences, based on the experts' knowledge and expertise. With this information, a Matrix of Direct Influence describing the relation of direct influences between the variables defining the system will be developed.

In a systemic vision, a variable does not exist other than as part of the relational web with the other variables. In addition, structural analysis allows connecting the variables in a two-entry table (direct relations). This entry of the matrix is generally quantitative, adjusting the intensities of the relations among the variables.

This phase of entry helps to put for n variables n x n questions (nearly 5,000 per 70 variables), of which some would have escaped without such a systematic and comprehensive reflection. This procedure of questioning allows not only avoiding errors, but also to order and classify the ideas by creating a common language. It also gives the opportunity to redefine the variables and thus refine the system's analysis. Also, a remote meeting will be organized to achieve this goal.

4.2.3 Identifying the key variables

This is the main step of the structural analysis. Some important measures that give a clue of the degree of importance of the variables can be computed from the Matrix of Direct Influence.

Two methods can be used: the direct method, that estimates the overall direct influence and direct dependence of a variable in the system directly from the matrix, and the indirect method, that estimates the overall influence and dependence of a variable through other variables of the system.

In the direct method, the total of connections in a row indicates the importance of the influence of a variable on the whole system (level of direct motricity). The total in a column indicates the degree of dependence of a variable (level of direct dependence).

With the indirect method, it will be possible to detect the hidden variables thanks to matrix multiplication. This allows studying the diffusion of the impacts by the paths and the loops of feedback, and consequently to sort the variables: by order of influence (considering the number of paths and loops of length 1, 2... n resulting from each variable), or by order of dependence (considering the number of paths and loops of length 1, 2... n arriving on each variable). Generally, the classification becomes stable after multiplying the matrix by itself 3, 4 or 5 times.

The comparison of the results (direct and indirect classification) obviously gives the possibility to confirm the importance of certain variables, but also to reveal certain variables which, because of their indirect actions, play a dominating role (and which the direct classification did not allow to reveal).

Therefore, the comparison of the hierarchy of the variables in the various classifications is rich in information, giving the key variables of the system.

4.3 Work Package 3: Scenarios planning & assessment in a multi-stakeholder environment

This work package will undergo in first place the construction of exploratory scenarios developing business models that rely on renewable energy, contribute to the circular economy or scale energy storage. In second place, a reduction of the initial number of exploratory scenarios to a small number of promising combinations will be accomplished.

4.3.1 Constructing exploratory scenarios

Morphological analysis will be used as the methodology to explore possible recombinations of the elements that make up the studied system. This method is used primarily for the construction of scenarios developing business models that rely on renewable energy, contribute to the circular economy or scale energy storage, but is equally well suited for both technological forecasting and creating potentially new products or services through the recombination of technologies.

The MORPHOL tool, also developed by the Institut d'Innovation Informatique pour l'Entreprise 3IE, will be used for this purpose.

The system will be broken down into subsystems or components, in our case as a result of the structural analysis developed in Work Package 2.

It is a delicate operation as the components must be as independent as possible and taken together must comprise the entire system under study. A certain balance is required as too many components will render the analysis impossible and too few components will result in a poor analysis.

A given scenario (business model) is characterized by a specific configuration of components. There will be as many possible scenarios as there are possible combinations of components.

Possible combinations represent the entire field of possibilities called the "scenarios space".

4.3.2 Evaluating business models options by Multicriteria assessment

Here the aim is to evaluate business models options from coupled coal mines and coal-fired power stations in the process of phasing out, as well as closely related neighbouring industries, by Multicriteria assessment.

Evaluation will be developed via questionnaires that will be sent to different stakeholders: European coal industry, policy makers, scientists, trade unions, NGOs and coal industry nearby local communities. To achieve a consensus, a remote meeting will be organized.

For every relevant criterion, standard and policy (including legal conditions at EU Directive level and permittable uses), an average score to business models is assigned, creating a ranking of profiles from which the best business model options can be obtained.

Moreover, once business models options have been evaluated according to multiple criteria, standards and policies, in case of significant existing gaps that drastically reduce some of the scores from business models that can be considered as really interesting, specific roadmaps will be implemented to fill these gaps.

4.4 Work Package 4: Update and re-adoption of territorial just transition plans

As every complex system has its specific characteristics and constraints, POTENTIALS will justify the best business models options and show how they should be adapted according to the expected transition process, in order to cooperate in the updating and re-adoption of territorial just transition plans.

4.4.1 Justifying the business models choices and outlining the transition process

The business models choices will be justified (e.g., contribution to the transition to a climate-neutral economy and lead to substantial reductions in greenhouse gas emissions going below the relevant benchmarks) and adapted according to the expected transition process, with a timeline for ceasing or scaling down activities such as coal and lignite mining or coal fired electricity production.

Based on this, an outline of the expected transition process will be developed, pointing out how this process can be in line with the objectives of different National Energy and Climate Plans and other existing transition plans.

4.4.2 Assessing the economic, social and territorial impact

POTENTIALS will include an economic impact assessment (including CAPEX, OPEX, cash flows and expected financial outcomes) to determine the economic diversification potential, the likely commercial viability and the added value of the proposed business models that, in addition, should be permittable by planning authorities.

POTENTIALS will also address a social impact assessment, analysing expected job losses and requalification needs, in order to avoid inflicting a substantial economic upheaval in the coal regions in transition identified by the EC under its Coal Regions in Transition initiative.

Finally, POTENTIALS will undergo a territorial impact assessment to provide an analysis of the potential territorial impact of the business models proposals, and to anticipate the consequences that the scenarios will have on regions and local communities.

The assessment related to the territorial dimension should limit the risk of "causing an unbalanced territorial or spatial distribution of costs and benefits for different regions", with the explicit goal of providing information on the territorial distribution of impacts for the different business models.

4.4.3 Specifying business models outputs and result indicators

POTENTIALS will also specify business models outputs and results indicators taking into account the targets set by the European Green Deal and related taxonomy, Regional Policy common output indicators, and Regional Policy result indicators for the Just Transition Fund.

4.5 Work Package 5: Results dissemination: Lessons learned

This work package refers to the activities that will be undertaken to support the dissemination and transfer of the Accompanying Measure knowledge and results to the whole European coal industry, policy makers, scientists, trade unions, NGOs and coal industry nearby local communities, ensuring a relevant impact on stimulating new economic activities, developing jobs and economic value, especially in relation to Coal Regions in Transition.

As POTENTIALS will be finished in mid-2023, it can make a strong contribution in the future update and re-adoption of territorial just transition plans by providing a roadmap considering for the first time the synergistic potentials of end-of-life coal mines and coal-fired power plants, along with closely related neighbouring industries, an approach that nowadays is completely inexistent.

Apart from delivering presentations in international conferences and the dissemination via the web page, where all the documents to be developed within the project will be posted, an international workshop will take place in Poland at the end of the project in order to present the final results from POTENTIALS, to which all previously mentioned stakeholders will be invited.

5 Impact

The Just Transition Mechanism will cover those territories most negatively affected based on the economic and social impacts resulting from the transition. In particular with regard to expected adaptation of workers or job losses in fossil fuel production and use, and the transformation needs of the production processes of industrial facilities with the highest greenhouse gas intensity.

The strategic importance of POTENTIALS for the European coal industry is based on the fact that in order to get access to the Just Transition Mechanism, each Member State will have to draw up territorial just transition plans in order to create the necessary investment to help workers and communities that rely on the fossil fuel value chain.

These territorial just transition plans should be updated and re-adopted when necessary, notably in case of an update of the National Energy and Climate Plans and in the mid-term review of the programmes supported by the Just Transition Fund.

While the mid-term review will take place in 2025, allowing the re-allocation within each Member States of the Just Transition Fund resources, it will also provide the opportunity to allocate the funding for the years 2026 and 2027, which will be set aside at the start of the next period.

As POTENTIALS will be finished in mid-2023, it can make a strong contribution in the future update and re-adoption of territorial just transition plans by giving a clear roadmap considering for the first time the synergistic potentials of end-of-life coal mines and coal-fired power plants, along with closely related neighbouring industries, an approach that nowadays is completely inexistent.

This novel approach can be perfectly contrasted regarding the focus of the projects and the international literature previously analysed.

POTENTIALS will have direct impact on:

- EU regulations and standards: POTENTIALS will evaluate scenario options according to multiple criteria, standards, and policies, including legal conditions at EU Directive level and permittable uses, implementing roadmaps in the case of existing gaps. Within the European Standards, special attention will be given to the ones related with improving interoperability between products or services and adopted by the European Committee for Electrotechnical Standardisation (Cenelec) and the European Committee for Standardisation (CEN).

- Potential application at industrial level: The potential application of the project at industrial level will be twofold. Firstly, it will consider for the first time the synergistic potentials of coupled end-of-life coal mine sites and coal-fired power plants, and closely related neighbouring industries, in order to develop new industrial projects and to guarantee their application. Secondly, it will assess how these neighbouring industries can benefit from different scenarios, e.g. greening power purchases as part of overall sustainability and corporate social responsibility goals, allowing to adopt climate mitigation or renewable energy targets.

- Exploitation of new market opportunities: POTENTIALS will explore business models that rely on renewable energy, contribute to the circular economy or scale energy storage, in order to identify and assess new market opportunities given by the synergies among coupled end-of-life coal mine sites and coal-fired power plants, and closely related neighbouring industries.

6 Anticipated benefits

The industrial benefits given by the project will be, in first place, to deliver a set of synergistic opportunities on feasible reuse options for coupled end-of-life coal mines and coal-fired power plants (and related infrastructure), along with closely related neighbouring industries, to stimulate the development of new industrial projects and guarantee their application.

In second place, it will assess how these neighbouring industries can benefit from different scenarios, e.g., greening their power purchases as part of overall sustainability and corporate social responsibility goals, allowing these industries to adopt climate mitigation or renewable energy targets.

As it is fair to assume that communities, commercial entities, and industries would gradually migrate to neighbouring areas and cities in pursuit of economic opportunities, these patterns will exacerbate the negative impacts on the social and economic activities of a once bustling area.

To minimise these negative impacts, the project will facilitate economic benefits by allowing the implementation of opportunities to avoid inflicting substantial economic upheaval on Coal Regions in Transition, specifying the added value of the proposed synergistic alternatives, and leading to economic diversification and reconversion.

Regarding social benefits, the project will support the update and re-adoption of territorial just transition plans, assessing the expected job losses and requalification needs, allowing to create the necessary investment to help workers and communities that rely on the fossil fuel value chain, and giving support for bridging differences between and inside of Member States.

Moreover, the project will undergo a territorial impact assessment to analyse the potential territorial impact of the scenario proposals, and to anticipate the economic and social consequences that the scenarios will have on the regions and local communities.

The assessment related to the territorial dimension should limit the risk of "causing an unbalanced territorial or spatial distribution of costs and benefits for different regions", with the explicit goal of providing information on the territorial distribution of impacts for the different scenarios.

Finally, addressing the environmental benefits, the scenario planning and assessment will identify the strategies reconciling climate action with economic stability and social strategy, contributing to the transition process towards a climate-neutral economy, essential to achieve the Union's 2030 target for climate set out in Regulation (EU) 2018/1999 and to reach carbon neutrality by 2050.

Moreover, the project will consider the targets set by the European Green Deal and related taxonomy.

Annex: State of the art

1. Relevant ongoing and closed projects

Previous RFCS Accompanying Measures

There are one past and one currently running RFCS Accompanying Measures of strong interest to this project:

COALTECH2051 (RFCS-794369-2018)

An RFCS Accompanying Measure on European coal research in light of EU policy objectives to 2050 and future global trends in coal use. It was completed in 2020.

It responded to EU policy imperatives about the “energy transition”, promoting the knowledge gained from the RFCS Research Programme and sharing experiences with the international research community. The aim was to develop, with stakeholders, a strategic research agenda for the Programme that was aligned with the EU’s Energy Union vision for 2050 and to establish a European Network of Clean Coal Technologists that complements the European Commission’s targeted platforms to support the energy transition in the coal regions.

POTENTIALS will take advantage of the strategic research agenda developed by CoalTech2051 as well as of the European Network of Clean Coal Technologist.

RECPP (RFCS-899225-2019)

Re-purposing Coal Power Plants during Energy Transition. To be completed in 2022.

The project is a study about the status, the mapping and screening of the re-purposing potential of coal power plants. Sustainable solutions for infrastructure re-uses will be listed up regarding their boundary conditions and with concern to circular economy and sector coupling approach to assess savings for infrastructure re-use.

POTENTIALS will take advantage of some of its solutions for infrastructure re-use and from the stakeholders that will be identified, in order to help specifying the relations between the variables selected by POTENTIALS and to undergo the multicriteria assessment.

RFCS Projects

CERES (RFCS-2016-709868)

Co-processing of coal mine and electronic wastes: Novel resources for a sustainable future (completed in 20219). It introduced a series of technological improvements to reduce risks associated with managing coal wastes.

COALBYPRO (RFCS-2017-754060)

Innovative management of coal by-products leading also to CO2 emissions reduction (completed in 2020). A laboratory scale study of mineral carbonation of coal fly ash for CO2 sequestration and the capture of CO2 in the zeolites in order to used them for the environmental management of coal mines after closure.

LoCAL (RFCR-CT-2014-00001)

Low-Carbon After-Life: sustainable use of flooded coal mine voids as a thermal energy source - a baseline activity for minimising post-closure environmental risks (completed in 2017). It aimed to unlock the commercially viable potential of mine waters as a thermal energy source.

METHENERGY PLUS (RFCS-2017-754077)

Methane recovery and harnessing for energy and chemical uses at coal mine sites (completed in 2020). It includes the development of mine infrastructure for energy recovery from mine water of abandoned coal mines.

MINRESCUE (RFCS-2019-899518)

From Mining Waste to Valuable Resource: New Concepts for a Circular Economy (to be completed in 2023). It addresses developing innovative concepts for managing, recycling and upcycling waste geomaterials generated by coal mining activities across Europe.

RECOVERY (RFCS-2018-847205)

Recovery of degraded and transformed ecosystems in coal mining-affected areas (to be completed in 2023). It focuses on land rehabilitation and ecological restoration of coal mining-affected areas, aiming to accelerate the recovery of degraded and transformed ecosystems to a good ecosystem status.

SUMAD (RFCS-2018-847227)

Sustainable Use of Mining Waste Dumps (to be completed in 2022). It is related to the investigation of the future use of made-ground consisting of coal-mining spoil with a focus on the geotechnical, sustainability, environmental, socio-economic, and long-term management challenges.

TRIM4POST-MINING (RFCS-2019-899278)

Transition Information Modelling for transition from coal exploitation to a re-vitalized post-mining land (to be completed in 2023). It supports decision making during the transition from coal exploitation to a re-vitalized post-mining land scape enabling infrastructure development for agricultural and industrial utilization and contributing to recover energy and materials from coal mining dumps.

H2020 Programme

BESTRES (H2020-2016-2019)

Best practices and implementation of innovative business models for renewable energy aggregators (completed in 2019). The aim of the project is to identify best practices business models for renewable electricity generation in Europe and to improve these further taking into account new opportunities and synergies.

CIRCEUIT (H2020-2016-721909)

Circular European Economy Innovative Training Network (completed in 2020). The project studied circular business models, based on providing functionality rather than products, often called Product Services Systems, that are widely seen as a way how business can create sustainable jobs and growth.

CIRCULAR X (H2020-2020-850159)

Experimenting with Circular Service Business Models (to be completed in 2025). The project will experiment with circular service business models (CSBMs) and specifically, it will develop a new field in sustainability: CSBM experimentation.

COOLHEATING (H2020-2016-691679)

Market uptake of small modular renewable district heating and cooling grids for communities (completed in 2018). It supported the implementation of small modular heating and cooling grids.

HRE (H2020-2016-695989)

Heat Roadmap Europe (HRE): Building the knowledge, skills, and capacity required to enable new policies and encourage new investments in the heating and cooling sector (completed in 2019). The goal of this project was to develop low-carbon heating and cooling strategies in order to support the decarbonization of the heating and cooling sector in Europe.

SCREEN (H2020-2016-730313)

Synergic Circular Economy across European Regions (completed in 2018). It aims at the definition of a replicable systemic approach towards a transition to Circular Economy in EU regions within the context of the Smart Specialization Strategy, thus contributing to novel future eco-innovative and horizontal business models across different value chains.

TRACER (H2020-2019-836819)

Smart strategies for the transition in coal intensive regions. The overall objective of the project is to support a number of coal-intensive regions around Europe to design (or re-design) their Research and Innovation (R&I) strategies in order to facilitate their transition towards a sustainable energy system.

Interreg Programme

DGE-ROLLOUT (INTERREG Northwest Europe-2018)

Roll-out of Deep Geothermal Energy in NorthWest Europe (to be completed in 2022). It is planned to foster the expansion of deep geothermal energy as a climate and environmentally friendly energy resource in North-West Europe, and subsequently nurture the region´s economics and the wellbeing of the citizens.

Framework Programmes

HYPERBOLE (FP7-ENERGY-608532)

Hydropower plants performance and flexible operation towards lean integration of new renewable energies (completed in 2017). Its aim was to develop a complete methodology for predicting and assessing the dynamic behaviour of hydropower stations operating outside of their rated operating ranges and in transient conditions.

Other international projects

U.S.: Bent Mountain coal mine in eastern Kentucky

EDF Renewables, a global company with dozens of U.S. projects in play, plans to turn Bent Mountain into a utility-scale solar farm if it can secure government approval (launched in 2019).

SOUTH AFRICA: Eskom Decommissioned Power Station Repurposing

The state-owned South African utility Eskom has issued an expression of interest for "Decommissioned Power Station Repurposing" seeking proposals on how to repurpose old, dirty power plants with technologies that support low-carbon growth, enterprise development, and sustainable job growth (launched in 2020).

2. International literature

No specific papers can be found about synergistic re-purposing of end-of-life coal mine sites and coal-fired power plants, along (or not) with closely related neighbouring industries.

Closure and re-purposing of coal mines

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Just transitions

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