Call: RFCS-2024

Project no. **101216750**

COFA
COal to FArm

Comprehensive Project Overview Document

Deliverable 2.1.

Marcin Maksymowicz	POLTEGOR
Makary Musiałek	POLTEGOR
Beata Merenda	POLTEGOR
Łukasz Pierzchała	GIG-PIB
Maria Bałazińska	GIG-PIB
Kamila Masłowska	SIENIAWA
Lucie Tichá	VUHU
Lenka Antošová	VUHU
Theodoros Zarogiannis	CERTH
Dimitris-Enias Liolis	CERTH
Nikolaos Koukouzas	CERTH
Christos Roumpos	PPC
Aikaterini Servou	PPC

Version 1.0 | 30.09.2025
Dissemination level | **Public**

Research Fund for Coal & Steel

Funded by the European Union

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2

1. Problem Identification: A Multidimensional Challenge in Post-Mining Land Use 4

1.1. The Ecological Deficit: From Degradation to Restoration 4

1.2. The Socio-Economic Void: The Need for New Opportunities 5

1.3. The Regulatory and Knowledge Gap: Bridging Policy and Practice 5

1.4. The Climate Change Context: A Call for Carbon Farming 6

2. COFA Project Goals 7

2.1. Key Objectives 7

2.2. Expected Outcomes 8

3. Project Implementation Plan 9

3.1. COFA Partners Presentation 11

3.1.1. POLTEGOR 11

3.1.2. GIG-PIB 11

3.1.3. SIENIAWA 12

3.1.4. VUHU 12

3.1.5. CERTH 13

3.1.6. PPC 14

3.2. Substantive Works 15

3.2.1. WP3 - Data Collection and Valorisation of Knowledge on Post-mining Land Degradation and Reclamation 15

3.2.2. WP4 - Social, Environmental and Legal Aspects of Agricultural Reclamation of Post-mining Areas 17

3.2.3. WP5 - Development of Agricultural Toolkit and Agricultural Reclamation & Carbon Farming Scenarios 19

3.3. Areas Focused by COFA 22

3.3.1. The Most Lignite Basin, Czechia 22

3.3.2. The Lignite Basin in Western Macedonia, Greece 23

3.3.3. Sieniawa Lignite Mine - Mining and Post-mining Areas, Poland 25

3.4. Project Management, Communication and Dissemination 27

3.4.1. WP1 - Management of the Project & Collaboration - Overview 27

3.4.2. WP2 – Project Promotion & Dissemination Strategies – Overview 28

4. Potential Impact and Value delivered by COFA 29

4.1. Environmental and Climate Value 29

4.2. Socio-Economic and Policy Value 30

4.3. Strategic and Knowledge Value 30

5. Invitation to Cooperate 31

6. About RFCS Programme 32

6.1. RFCS Programme Goals 32

6.2. Research Projects and Accompanying Measures 33

6.3. The COFA Project as an RFCS Accompanying Measure 33

ANNEX 1 – list of COFA Deliverables

ANNEX 2 – COFA Gantt Chart

EXECUTIVE SUMMARY

The COFA project addresses the critical challenge of post-mining land degradation by transforming former coal and lignite sites into productive agricultural landscapes. This initiative is a response to the urgent need for sustainable land use in transitioning coal regions, providing both ecological restoration and new socio-economic opportunities. Implementation of the COFA project will contribute to achieving national and European goals for emission reduction and the increase of renewables in the energy mix.

A core component of this strategy involves leveraging **energy crops** as a dual-purpose solution. These crops, such as fast-growing grasses and trees, serve as a source of biomass, which is one of the components of the renewable energy mix. Biomass can be converted into biofuels for transportation, or used to generate heat and electricity. By using degraded post-mining land for this purpose, the project not only promotes revitalization of landscapes but also contributes to energy security and reduces reliance on fossil fuels.

Furthermore, the COFA project is strategically aligned with the growing European and global emphasis on carbon sequestration. The project recognizes that agricultural land can act as a significant carbon sink, and it will promote **carbon farming** practices. Carbon farming involves a set of land management techniques - such as minimizing soil disturbance, using cover crops, and applying compost - that increase the amount of carbon stored in the soil and biomass. The project will provide an **Agricultural Toolkit** to help farmers and stakeholders understand and implement these practices.

This focus on carbon farming is particularly relevant given evolving European regulations. The European Union has a clear framework for carbon removals, including the Carbon Removals and Carbon Farming Regulation (CRCF). This regulation establishes a voluntary, EU-wide system for certifying carbon removals and carbon farming activities, which can create new revenue streams for farmers through the sale of certified carbon credits. By promoting these practices, the COFA project will not only improve soil health and resilience but also position participants to benefit from these new economic incentives, ensuring the long-term sustainability and value of the reclaimed land.

The COFA project is structured into a series of interconnected Work Packages (WPs). As an Accompanying Measure (AM) of the RFCS programme, its main focus is not on generating original technical research but on the promotion and dissemination of knowledge. The project synthesizes and transfers existing knowledge to a wide range of stakeholders to accelerate the adoption of sustainable practices in coal regions.

WP3 is dedicated to gathering and consolidating existing knowledge on the agricultural reclamation of post-mining areas. WP4 focuses on analyzing the complex non-technical factors, such as social and legal aspects, that are essential for successful reclamation projects. WP5 is responsible for

synthesizing information from the previous WPs into the **Agricultural Toolkit**, a practical guide for farmers, and for developing specific **scenarios for agricultural reclamation and carbon** farming in the project's focus areas.

The project is designed to deliver a range of tangible and lasting outcomes. COFA will act as a central hub for knowledge on land reclamation and carbon farming, effectively bridging the gap between research and practical application. A key deliverable will be a comprehensive, user-friendly **Agricultural Toolkit** with practical recommendations. The project will also foster improved cooperation among stakeholders and provide valuable insights for policymakers. By promoting certified carbon farming, COFA will open up new revenue streams for local communities, contributing to the long-term economic viability of these regions.

The COFA project has a planned duration of 24 months. The project's official start date is July 1st , 2025, with a planned end date of June 30th, 2027. The total estimated budget for the project are €499,825.15, while the grant provides a 100% funding rate for these eligible costs.

1. Problem Identification: A Multidimensional Challenge in Post-Mining Land Use

The primary challenge addressed by the COFA project is the multifaceted and enduring issue of post-mining land degradation. This problem goes beyond the immediate environmental impact of a mine's closure, encompassing a complex web of ecological, economic, and social consequences that can hinder regional development for decades. Traditional land reclamation efforts have often focused on simple rehabilitation - restoring a basic level of ecological function to the landscape. However, these conventional approaches frequently fall short of transforming former mining sites into truly **productive, sustainable, and economically viable areas**. The COFA project identifies this gap and aims to propose an alternative, holistic solution.

The problem can be broken down into several key dimensions, each of which the project is designed to tackle.

1.1. The Ecological Deficit: From Degradation to Restoration

Surface coal and lignite mining, a practice central to the economies of the project's target regions, results in massive landscape disturbances. This process fundamentally alters the topography, destroys original ecosystems, and disrupts hydrological cycles. The soil itself is a primary casualty, in particular the humus layer of the soil; it is often stripped, mixed, and compacted, losing its structure, nutrient content, and microbial activity. The resulting post-mining landscapes are typically characterized by barren, infertile soil, prone to erosion and incapable of supporting diverse plant life. The problem, therefore, is not merely the physical absence of a healthy ecosystem but the fundamental degradation of the land's capacity to support biological life.

Figures 1-2. Opencast mining operations in Konin, Poland, resulting in land degradation – Kazimierz Opencast (left), Drzewce Opencast (right)(source: https://www.kwbkonin.pl/).

Traditional reclamation has often involved reforestation or the creation of artificial pit-lakes, which are significant but limited in scope. These methods may stabilize the soil and provide some ecological benefit, but they do not fully restore the **land's productive potential.** The COFA project recognizes that for true restoration to occur, the land must be actively transformed to enable new, sustainable land uses such as agricultural lands with carbon farming and CO2 sequestration possibility.

Figures 3-4. Plantation of Energy Willow during harvest (left) (source: https://www.agriland.ie/), plantation of Miscanthus (right) (source: https://energy-now.co.uk/).

1.2. The Socio-Economic Void: The Need for New Opportunities

The closure of a mine leaves a significant socio-economic void in the surrounding community. This includes job losses, a decline in local business activity, and the psychological impact on a population that has historically relied on the coal industry. The problem is compounded by the fact that the vast areas of degraded land are a physical manifestation of this economic decline. They are often seen as permanent scars on the landscape, an unproductive burden rather than a potential asset.

The COFA project addresses this **by proposing a solution that creates new economic opportunities.** By reclaiming post-mining land for agricultural purposes, the project directly links environmental restoration with economic revitalization. This approach transforms a liability - degraded land - into an asset, creating potential new revenue streams through **carbon farming**, **energy crop cultivation**, and traditional agriculture. This not only provides a viable alternative to the former coal-based economy but also contributes to the bio-based economy.

1.3. The Regulatory and Knowledge Gap: Bridging Policy and Practice

A significant barrier to effective post-mining land reclamation is the lack of a standardized, comprehensive framework that integrates agricultural potential. Policies and regulations often lag behind the scientific understanding of what is possible. Stakeholders - from policymakers and land planners to mining companies and local farmers and investors - often lack the specific knowledge

and practical tools to undertake complex agricultural reclamation projects. This includes a lack of accessible information on suitable crop types, soil improvement techniques, and it's economic viability.

The COFA project aims to bridge this knowledge gap by creating a comprehensive **Agricultural Toolkit**. This toolkit will not only provide a geospatial database of successful reclamation practices but will also include **calculators for carbon sequestration and energy crop yields**, offering concrete data to inform decision-making. By engaging with policymakers and stakeholders, the project seeks to translate its findings into actionable policy recommendations, helping to create a more supportive legal and regulatory environment for agricultural reclamation across Europe.

1.4. The Climate Change Context: A Call for Carbon Farming

The global push to decarbonize economies and combat climate change adds a new layer of urgency and opportunity to the problem of post-mining land use. Coal regions are at the forefront of this transition, and the land left behind presents an opportunity for climate-positive solutions. The degraded soil in these areas contains very low levels of organic carbon.

The COFA project addresses this by integrating carbon farming into its reclamation strategy. By promoting farming methods that actively sequester carbon from the atmosphere, the project not only restores the land but also transforms former industrial sites into carbon sinks. Integrating the strategy of carbon farming, the COFA project directly drives the capture of atmospheric CO_2. This process delivers an immediate positive impact at the local scale, significantly boosting soil health and ecosystem vitality. When replicated across the region, this model has the potential to influence the overall regional carbon budget, ultimately contributing to the global reduction of one of the most critical greenhouse gases. This approach aligns with European climate goals and provides a powerful economic incentive for reclamation efforts, as carbon sequestration can be monetized through carbon credit markets.

In summary, the COFA project defines the problem of post-mining land as a multidimensional issue requiring a holistic, innovative, and interdisciplinary solution. By moving beyond simple rehabilitation, it addresses the interconnected ecological, socio-economic, and policy challenges, transforming degraded landscapes into productive agricultural hubs that contribute to regional development and climate change mitigation. This proactive approach ensures that the legacy of coal mining becomes an opportunity for a greener, more sustainable future.

2. COFA Project Goals

The overarching goal of the COFA project is to provide a comprehensive and innovative solution for the sustainable reclamation of post-mining landscapes in Europe's coal regions under transformation. This objective is multifaceted, combining environmental restoration with the creation of new socio-economic opportunities. The project is designed to transition former degraded mining sites from an environmental liability into a productive asset, with a specific focus on agriculture and carbon farming. The Project aims to promote this kind of alternative for traditional reclamation strategies.

2.1. Key Objectives

The project will achieve its overarching goal through a series of interconnected objectives:

- **Develop an Innovative Framework:** The core of the COFA project is the creation of an **Agricultural Toolkit for Supporting Agriculture on Coal Post-Mining Land.** This toolkit will integrate a wide range of data, from geospatial analysis to legal and social considerations, to provide a practical guide for stakeholders. It will serve as a decision-support tool for implementing sustainable land use strategies.

- **Establish Sustainable Land Use Scenarios:** The COFA project will move beyond a one-size-fits-all approach by developing exemplary region-specific agricultural reclamation and carbon farming scenarios tailored to the unique conditions of the three pilot areas: **the Most Basin in Czechia**, Lignite Basin in **Western Macedonia in Greece**, and **Sieniawa Mining and post-mining areas in Poland**. These scenarios will provide concrete, replicable models for land managers, policymakers, and communities.

- **Promote Carbon Farming and Bioenergy:** A central objective is to demonstrate the potential of carbon farming to sequester CO2 in post-mining lands. The project will evaluate the efficiency of specific practices and quantify the carbon sequestration potential. Additionally, it will assess the cultivation of energetic crops as a renewable energy source, providing a dual benefit of land reclamation and bio-based energy production.

- **Address Socio-Economic and Legal Aspects:** The COFA project acknowledges that successful reclamation depends on more than just technical solutions. It will analyze the social, environmental, and legal aspects of agricultural reclamation to identify and overcome barriers. This includes engaging with stakeholders to ensure solutions are accepted and integrated into local communities and policy frameworks.

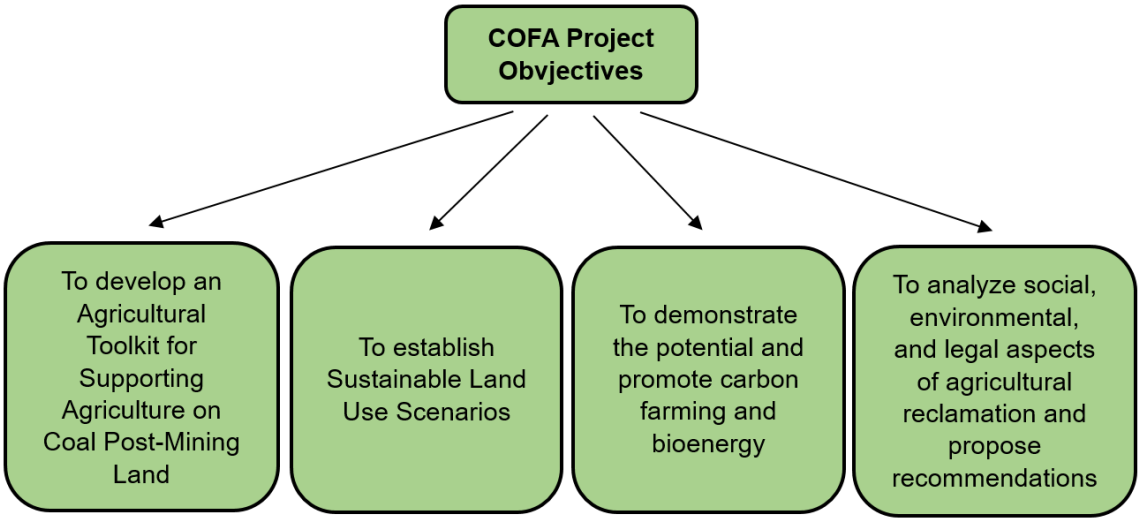

Figure 5. COFA Project Objectives.

2.2. Expected Outcomes

By the project's conclusion, the following key outcomes are expected:

- A Comprehensive "Agricultural Toolkit": A fully functional online platform containing a geospatial database, carbon farming calculators, and practical guides. This toolkit will serve as a central repository of knowledge, providing stakeholders with the tools to make informed decisions.

- Tailored Reclamation Models: Detailed reports and case studies for the three pilot regions, showcasing effective reclamation with energetic crops and carbon farming methods.

- Policy Recommendations: A set of actionable policy recommendations based on project findings to help European and national policymakers create a supportive legislative environment for the sustainable reclamation of post-mining lands.

- Increased Stakeholder Engagement: Through a series of workshops, communication activities, and a dedicated project website, the project will foster a network of engaged stakeholders, from local farmers to international policymakers.

- Published Research: The project's findings will be disseminated through academic publications, ensuring that the knowledge gained contributes to the wider scientific community and informs future research in the field.

- These goals are designed to not only produce a valuable resource but also to create a lasting impact by empowering communities, revitalizing landscapes, and contributing to Europe's broader climate and energy transition goals.

3. Project Implementation Plan

The COFA project is structured to ensure efficient and effective implementation through a collaborative, multi-partner approach. The project is carried out over a duration of 24 months, beginning on July 1st, 2025, and concluding on June 30th, 2027. **The detailed Gantt Chart of the COFA Project constitutes Annex 2 to this document.**

The implementation is led by a consortium of six partners from three European countries, bringing together diverse expertise in mining, environmental science, technology, and research, including:

- **„Poltegor-Institute" Opencast Mining Institute** (POLTEGOR) - Coordinator, Poland
- **Central Mining Institute – National Research Institute** (GIG-PIB) - Poland
- **Brown Coal Mine Sieniawa** (SIENIAWA) - Poland
- **VUHU AS** (VUHU) - Czechia
- **Centre for Research & Technology, Hellas** (CERTH) - Greece
- **Public Power Corporation SA** (PPC) - Greece

This collaborative effort is organized into five distinct Work Packages (WPs), each with a specific focus and a designated lead partner:

- **WP1:** Coordination and Management of the project (led by POLTEGOR)
- **WP2:** Promotion and Dissemination (led by GIG-PIB)
- **WP3:** Data Collection and Valorisation of Knowledge on Post-mining Land Degradation and Agricultural Reclamation (led by VUHU)
- **WP4:** Social, Environmental and Legal Aspects of Agricultural Reclamation of Post-mining Areas (led by POLTEGOR)
- **WP5:** Development of Agricultural Toolkit and Agricultural Reclamation and Carbon-Farming Scenarios (led by CERTH)

This structure ensures a systematic progression from project management and communication to detailed data collection, social and legal analysis, and the final development of the agricultural toolkit and reclamation scenarios. This section will detail the specific roles of the partners, the project timeline, and the activities planned within each work package.

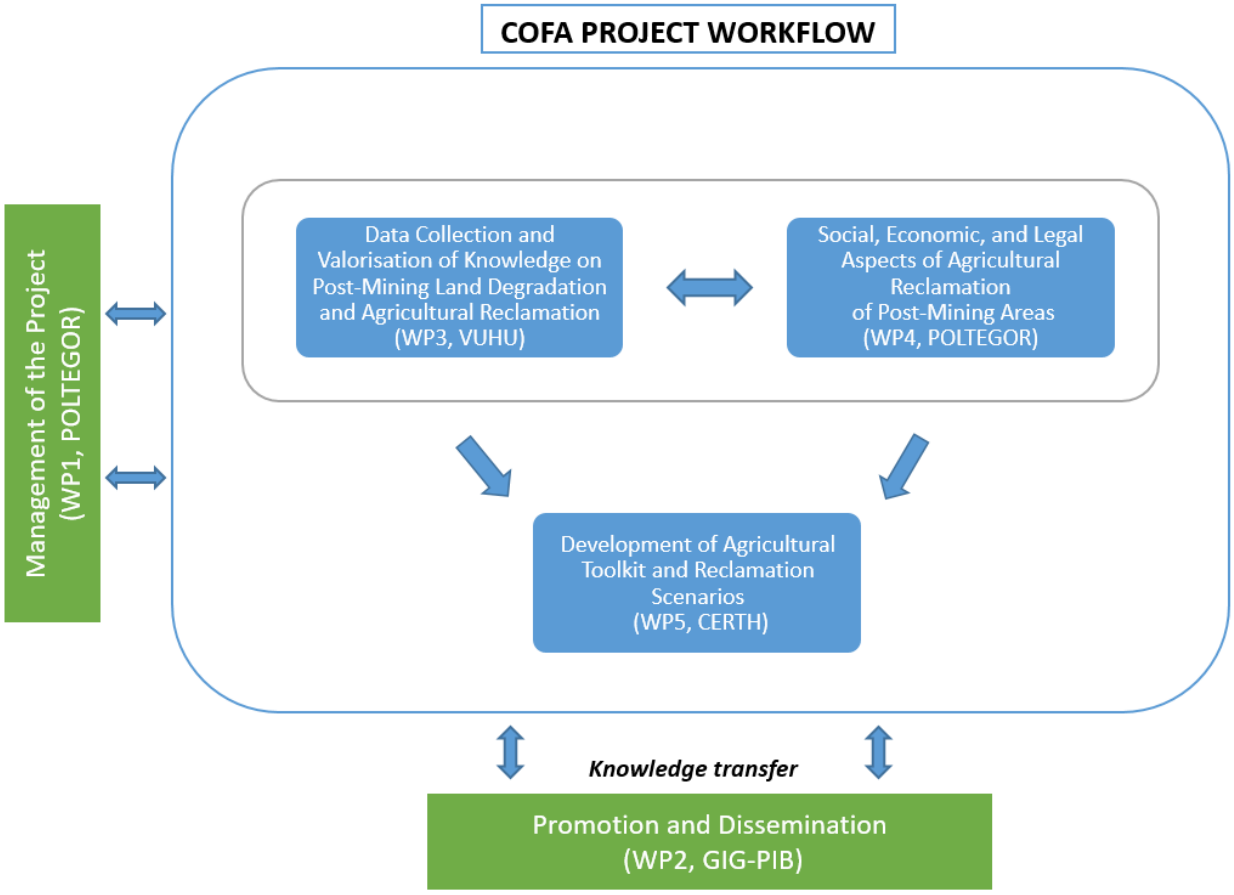

Figure 6. Overview of COFA work packages and interrelations.

The project's substantive work packages are deeply interconnected, forming a logical progression from data collection to solution development. WP3 serves as the foundation, where essential data on post-mining land degradation and existing reclamation knowledge is collected and analyzed. This scientific and technical information is then fed into WP4, which adds a crucial layer of social, legal, and environmental context. WP4's analysis of stakeholder needs, community concerns, and regulatory frameworks ensures that the technical solutions are practical and viable. Finally, WP5 synthesizes the data from WP3 and the contextual insights from WP4 to develop the core outputs of the project: the Agricultural Toolkit and the specific reclamation and carbon-farming scenarios. This sequential and integrated approach ensures that the final tools and recommendations are not only scientifically sound but also socially and legally robust, ensuring their real-world applicability and impact.

3.1. COFA Partners Presentation

3.1.1. POLTEGOR

“POLTEGOR-INSTITUTE” is a leading Polish research institution specializing in open-pit mining and land reclamation. For decades, the institute has been a key player in developing and implementing eco-friendly technologies, leading numerous research and development projects. Their participation in initiatives like the REECOL project, which focuses on the ecological reclamation of post-mining landscapes, demonstrates their strong commitment to sustainable land rehabilitation. With a team of approximately 50 experts in geological, geotechnical, and environmental specialties, POLTEGOR brings extensive experience and a legacy of innovation to the COFA project.

As the coordinator of the COFA project, their contributions are multifaceted and essential for the project's success. They are responsible for ensuring the overall management of the project, including administrative, financial, and collaborative aspects (WP1). Their deep-seated expertise in post-mining land reclamation is crucial for the technical work packages (WP3, WP4, and WP5), where they are involved in data collection, knowledge valorization, and the development of the Agricultural Toolkit. Their role as the project leader ensures that the strategic direction and daily operations align with the project's goals of transforming degraded lands and promoting sustainable practices.

3.1.2. GIG-PIB

The Central Mining Institute – National Research Institute (GIG-PIB), has long-standing experience in supporting scientifically and technically coal mining companies in environment monitoring and protection. Designing activities in the field of reclamation and revitalization of post-mining areas is one of the key area of activity.

In the COFA project, leveraging analytical tools, GIG-PIB will assess post-mining sites for their suitability for agricultural use and develop guidelines for allocating specific areas to different types

of crops. Agricultural reclamation scenarios, will also be developed to provide stakeholders with valuable tools and knowledge to transform post-mining areas into sustainable agricultural landscape. Additionally, within COFA, GIG-PIB is responsible for promotion and communication, by preparing social media content for you and managing the project's website.

3.1.3. SIENIAWA

Sieniawa Lignite Mine Ltd. is the smallest and oldest operating lignite mine in Poland, with continuous extraction activities since 1853. Alongside mining operations, the company carries out reclamation of post-mining areas towards agricultural and forestry use, restoring their biological activity and ecological value. The company also develops innovative applications of lignite in agriculture by conducting research into the production of humic substances.

Within the COFA project, Sieniawa serves as an industrial partner and Polish case study site. The scope of involvement includes: providing data and expertise related to mining operations and land reclamation; developing an agricultural reclamation scenario for the Sieniawa area; testing the online toolkit supporting reclamation (geodatabase, carbon farming and energy crop calculators); supporting stakeholder engagement processes and public consultations. The participation of partners such as Sieniawa provides access to real field conditions, enabling the practical validation of tools and the development of solutions with high implementation potential.

3.1.4. VUHU

VUHU, the research institute was established in Most in 1953, as one of the first organizations focused on solving and documenting the complex issues of the development of brown coal open-pit mining in Czechia. In recent years, the company's activities have focused on providing a comprehensive portfolio of environmental, science, engineering, laboratory and environmental services, including ecological methods of coal treatment and use, and the use of lignite combustion and desulphuration products.

In the COFA project VUHU leads WP3, which focuses on data collection and evaluation of the agricultural potential of post-mining areas. As part of WP3, VUHU: maps degraded areas in the Most Basin suitable for agricultural reclamation; analyzes soil dysfunctions and proposes regeneration methods; assesses the suitability of these areas for carbon farming and energy crop cultivation. The goal is to provide a foundation for transforming former mining sites into productive agricultural landscapes that support regional sustainability and climate protection.

3.1.5. CERTH

CERTH (Centre for Research and Technology Hellas) is one of Greece's leading research centres specializing in environmentally friendly technologies with industrial and societal impact, sustainable energy solutions, advanced digital solutions and innovative scientific research. Founded in 2000, CERTH employees more than 1600 people (engineers and scientists in their majority), in 7 regions and 9 cities of Greece and is essentially a self-supported Research Centre generating an average annual turnover of more than 63 million euros coming from: competitive research projects, bilateral industrial research contracts and government institutional funding. CERTH's research efforts place it 1st in Greece and 11th among distinguished research organizations in Europe, in terms of attracting funding from European competitive programs.

With extensive experience from EU-funded projects, including the development of interactive web-based tools, CERTH brings strong technical and scientific expertise to the COFA project, ensuring the integration of sustainable practices and advanced technological approaches. Within the COFA project, CERTH plays a central role in WPs 4 and 5. In WP4, it is responsible for leading the Stakeholder Engagement Plans, including collecting surveys and ensuring input from diverse local and regional stakeholders. In WP5, CERTH takes the lead, coordinating the development of the Agricultural Toolkit, which includes building the geospatial databases, preparing calculators for carbon farming and energy crops, and delivering the Manual for Agricultural Reclamation Toolkit. Through these contributions, CERTH ensures that scientific knowledge is translated into practical, user-friendly tools and that stakeholders remain actively engaged, enabling the project to deliver sustainable agricultural and legally compliant reclamation strategies for post-mining areas.

3.1.6. PPC

PPC (Public Power Corporation) was founded in 1950. It is the leading electricity generation and supply company in Greece, with activities in the generation, distribution and sale of electricity to consumers. It is the largest electricity supplier in Greece, serving approximately 5.6 million customers throughout the country, with a total capacity of 11.1 GW, including thermal, hydro and RES power plants (https://www.ppcgroup.com/en/ppc/).

Energy production in Greece in the past, had historically relied on lignite mining, primarily operated by the PPC, encompassing the Ptolemais and Amyntaion complex mines (located in the Kozani and Florina provinces respectively, in the Western Macedonia region of Northern Greece), as well as Megalopolis mines (in the Arkadia province, Peloponnese region, Southern Greece), and the Aliveri mine. Today, only the Mavropigi and South Field mines are in operation, and they are expected to cease exploitation by 2026.

In the context of decarbonization and mine closure, PPC systematically conducts reclamation work in parallel with exploitation work in its mining areas. In recent years, final reclamation works have been employed, and new land uses have been established in the post-mining areas, including agriculture, forestry, and renewable energy sources. Approximately 88 km² have already been reclaimed (end of 2024). PPC Group has prioritised a strategic transformation aimed at becoming a leading player in the production and trade of modern energy solutions, with a significant focus on renewable sources and the development of innovative business initiatives. As a key player in the green transition, the Group places Renewable Energy Sources (RES) at the core of the strategy, supported by the expansion of energy storage infrastructure and the adoption of green hydrogen technologies (Sustainability report, PPC Group, 2023).

As a key industrial partner, PPC will provide industrial knowledge and feedback, as well as aid the COFA project's efforts to design solutions that align with industry realities. PPC’s involvement will focus on the practical application and validation of the toolkit’s components in the context of the post-mining land use in Greece.

3.2. Substantive Works

3.2.1. WP3 - Data Collection and Valorisation of Knowledge on Post-mining Land Degradation and Agricultural Reclamation

The main objective of WP3 is to gather and assess data on land degradation in post-coal mining areas and to evaluate the potential for agricultural reclamation and sustainable land use in terms of energy crops and carbon farming. This work package focuses on generating valuable insights for the development of effective land reclamation strategies and assessing the feasibility of various agricultural and ecological practices on degraded post-mining lands.

The specific objectives linked to WP3 include:

- **Degraded Land Mapping**: To systematically map and assess degraded lands within post-coal mining areas, identifying those suitable for agricultural reclamation. This includes analyzing land cover, vegetation, soil types, terrain morphology, and human impact, ensuring a detailed understanding of potential reclamation sites in the Czechia, Greece, and Poland.
- **Soil Dysfunction Analysis**: To identify and categorize soil dysfunctions specific to post-mining areas, drawing from existing literature and data. This analysis will inform the development of effective agricultural reclamation strategies tailored to the unique challenges of these lands.
- **Evaluation of Reclamation Practices**: To review and assess the effectiveness of various soil regeneration and agricultural reclamation techniques. The objective is to compile and recommend best practices that enhance the viability of reclaiming post-mining lands for agricultural purposes.
- **Assessment for Carbon Farming and Energy Crops**: To evaluate the potential of post-mining areas for carbon farming and energy crop cultivation. This includes determining the specific soil requirements for these crops and assessing the feasibility of implementing sustainable agricultural practices that contribute to CO2 reduction and environmental conservation.

WP3 consists of four interrelated tasks:

Task 3.1 - Mapping of degraded lands suitable for agricultural reclamation in coal post-mining areas

This task is a crucial foundational activity in WP3, focusing on the detailed mapping and identification of degraded lands within former coal mining regions. By collecting and analyzing extensive GIS data on land cover, vegetation indices, and soil types, this task aims to accurately determine areas that hold potential for agricultural reclamation. The analysis also includes terrain morphology, topography, and water availability, as well as the impact of urbanization and human activities, to ensure a comprehensive understanding of the land's current condition. Data will be sourced from leading

global and European environmental databases. Additionally, this task involves identifying key habitat factors necessary for the effective cultivation of food and energy crops, which is essential for determining the viability of reclamation efforts. The result will be a preliminary delimitation of suitable sites within each mining district, considering the region as a whole rather than focusing on individual mines. This broader approach allows for more strategic land use planning across the Czechia, Greece, and Poland.

Task 3.2 - Defining of soil dysfunctions of post-mining lands for different agricultural production

This task delves into the intricate challenges associated with soils in post-mining areas by focusing on the identification and classification of various soil dysfunctions specific to these environments. Through an extensive review of existing literature and data, this task aims to develop a comprehensive understanding of the soil issues that hinder successful agricultural reclamation. Soil dysfunctions will then be categorized to determine their impact on the viability of agricultural reclamation efforts. The output of this task will guide the reclamation strategies needed to restore soil health for different types of agricultural production, including both food and energy crops.

Task 3.3 - Analysis of soil regeneration and agricultural reclamation practices

Building upon the insights gained from Task 3.2, Task 3.3 focuses on compiling and evaluating a diverse range of methods and techniques specifically designed for soil regeneration in post-mining lands, with a particular emphasis on their application in agricultural reclamation. This task functions as a comprehensive resource, offering a detailed analysis of existing soil regeneration practices applicable to post-mining areas, ensuring that the most effective and sustainable approaches are identified. Through a thorough review of current soil regeneration and agricultural reclamation practices, this task evaluates the effectiveness of various techniques, considering their potential to restore the health and fertility of degraded lands. The collaborative effort across partner countries - Czechia, Greece, and Poland - ensures that the guidelines and recommendations developed are well-informed and applicable across different environmental and geological contexts. Additionally, this task contributes to the creation of the best and worst practice examples catalogue, which will serve as a valuable resource for future reclamation projects. The information gathered will be made available online and integrated into the Agricultural Toolkit developed within WP5, maximizing its accessibility and impact for practitioners involved in the reclamation of post-mining areas.

Task 3.4 - Assessment of suitability of post-mining areas for carbon farming and energy crop cultivation

This task marks a crucial advancement in the COFA project by integrating agricultural reclamation with the exploration of both carbon farming and energy crop cultivation opportunities in post-mining areas. This task emphasizes sustainable land use and environmental conservation, focusing on the dual goals of reclaiming degraded lands and promoting practices that contribute to climate change

mitigation. Through the collection and analysis of data on carbon farming practices and energy crop cultivation, this task provides a comprehensive assessment of how former coal mining areas can be transformed into productive and environmentally responsible agricultural lands. By identifying the specific soil parameters required for successful cultivation of food and energy crops, this task ensures that the agricultural practices recommended are well-suited to the unique conditions of post-mining areas. This holistic approach addresses both the technical challenges of land reclamation and the potential for agricultural practices to contribute to carbon sequestration and renewable energy production. As part of the task, guidelines for best practices in both carbon farming and energy crop cultivation will be developed, contributing to the best and worst practice examples catalogue. The insights and data gathered will be presented within WP5, providing valuable resources for future projects aimed at promoting sustainability, carbon reduction and renewable energy production in reclaimed post-mining areas.

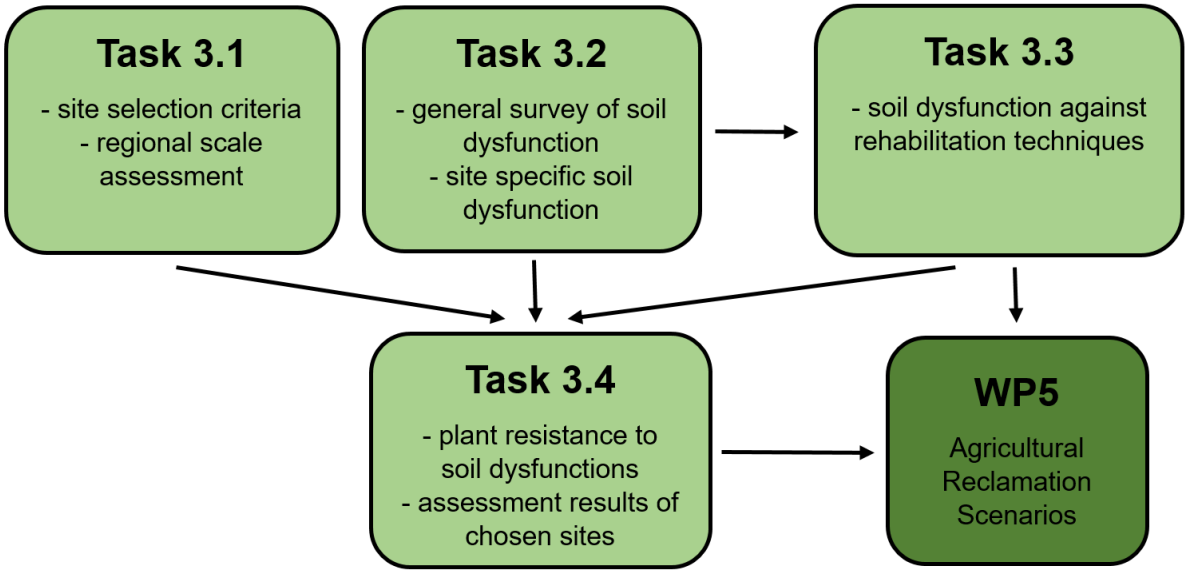

Figure 7. WP3 tasks results as inputs to WP5 (Agricultural Reclamation Scenarios).

3.2.2. WP4 - Social, Environmental and Legal Aspects of Agricultural Reclamation of Post-mining Areas

WP4 focuses on addressing the comprehensive social, environmental, and legal dimensions necessary for the successful agricultural reclamation of post-mining areas. This work package aims to ensure that the transition from coal mining to agricultural use is technically feasible, legally compliant, economically viable, and socially accepted, with a special emphasis on the specific contexts of Poland, Greece, and Czechia.

The objectives of WP4 include:

- **Legal and Social Aspects:** This aspect involves reviewing existing legal frameworks and policies related to land use in post-mining areas, identifying legal barriers and opportunities, and developing guidelines and recommendations to support the reclamation process.

Additionally, the social implications of reclamation will be evaluated, particularly in terms of job creation and working conditions, ensuring that the transition benefits local communities.

- **Stakeholder Engagement:** WP4 emphasizes the importance of involving key stakeholders in the reclamation process. This includes identifying stakeholders in agricultural reclamation, carbon farming, and energy crop cultivation, and gathering their opinions through surveys. Based on this data, stakeholder engagement plans will be developed to foster active participation and support for the reclamation activities.
- **Environmental Costs and Benefits:** The environmental impact of agricultural reclamation, carbon farming, and energy crops will be thoroughly assessed. This includes evaluating the effects on CO2 emissions, biodiversity, and land surface thermal emissivity. A cost-benefit analysis will be conducted to determine the economic viability of the proposed activities, and the ecosystem services provided by these practices, such as CO2 sequestration, will be valued in the context of climate change adaptation and mitigation.

Through these efforts, WP4 aims to create a sustainable and holistic approach to transforming post-mining landscapes into productive agricultural areas, ensuring that all relevant social, environmental, and legal factors are adequately addressed.

WP4 includes 3 tasks:

Task 4.1 - Legal and Social Aspects of Agricultural Reclamation and Possibilities of Food Production and Energy Crops on Post-mining Areas

This task focuses on the legal and social dimensions of transforming post-mining areas into productive agricultural landscapes. The primary objective is to review and analyze existing national legal frameworks and policies relevant to agricultural reclamation in Poland, Greece, and Czechia. This review will identify potential legal barriers and opportunities that could impact the reclamation process. The task will discuss the limitations and controversial aspects surrounding existing technological solutions and emerging dilemmas. Furthermore, alignment with the EU regulatory framework for energy crops grown on polluted mining areas used for energy production will be addressed. Additionally, the task will assess the potential for job creation and the quality of working conditions in these newly reclaimed areas, ensuring that social benefits are maximized. The findings will be used to develop legal guidelines and recommendations that align with the specific legal contexts of each partner country, facilitating a smooth and compliant transition to agricultural use.

Task 4.2 - Stakeholders Engagement in Agricultural Reclamation

This task is dedicated to engaging key stakeholders in the agricultural reclamation process, including those involved in carbon farming and energy crop cultivation. The first step involves identifying all relevant stakeholders, such as local communities and farmers, government agencies, mining industry representatives, and environmental groups. Following identification, surveys will be conducted to gather stakeholders' opinions, insights, and concerns regarding the transition from

mining to agriculture. These surveys are crucial for understanding the needs and expectations of different stakeholder groups. Based on the collected data, the task will develop tailored stakeholder engagement plans aimed at fostering collaboration, securing buy-in, and ensuring that the reclamation process is inclusive and responsive to the interests of all parties involved.

Task 4.3 - Environmental Costs & Benefits of Agricultural Reclamation, Carbon Farming, and Energy Crops Utilization

Task 4.3 is focused on evaluating the environmental impacts and economic viability of agricultural reclamation, carbon farming, and energy crop cultivation in post-mining areas. The task will begin with a thorough identification of environmental impacts, including effects on CO2 emissions, biodiversity, and changes in land surface thermal emissivity, using tools developed within WP5. Following this environmental assessment, a cost-benefit analysis (CBA) will be conducted to determine the economic feasibility of the proposed activities. Additionally, this task will involve valuing ecosystem services provided by these agricultural practices, particularly in terms of their capacity to contribute to climate change adaptation and mitigation, such as CO2 sequestration. The outcomes of this task will guide decision-making, showing that the reclamation activities can be not only environmentally sustainable but also economically sound.

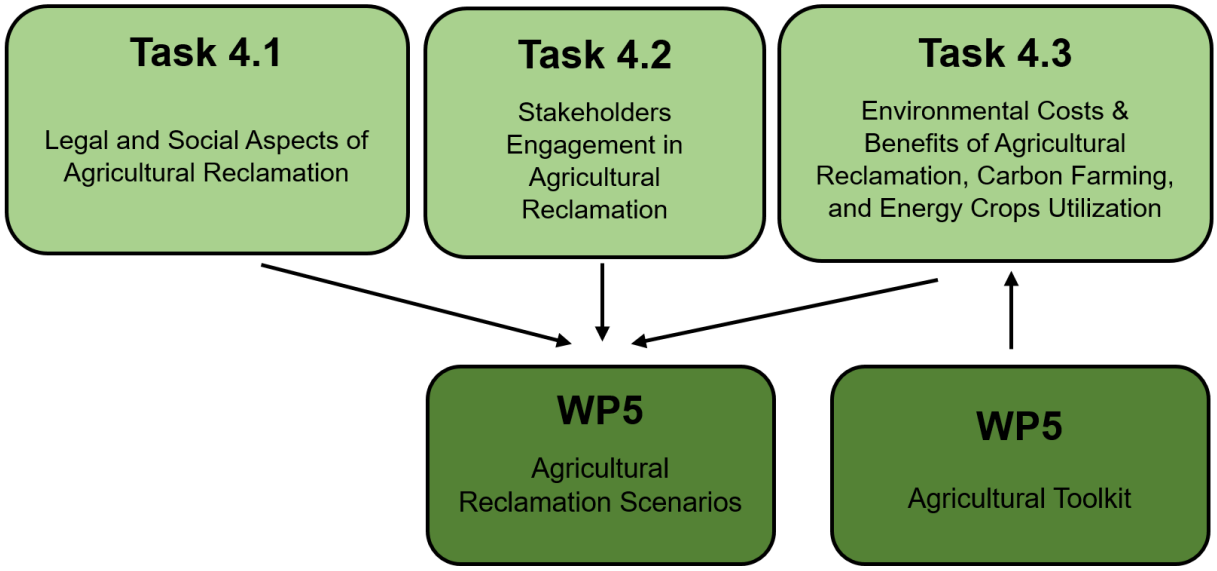

Figure 8. WP4 tasks results as inputs to WP5 (Agricultural Reclamation Scenarios). Agricultural Toolkit as a tool supporting environmental costs & benefits analyses in Task 4.3.

3.2.3. WP5 - Development of Agricultural Toolkit and Agricultural Reclamation & Carbon Farming Scenarios

WP5 is dedicated to creating a comprehensive agricultural toolkit and developing detailed scenarios for the reclamation of post-mining areas and the implementation of carbon farming practices. This work package aims to integrate previous research findings and tool developments to provide actionable solutions and guidelines for transforming coal post-mining land into productive agricultural

areas. The focus is on both traditional agricultural practices and innovative carbon farming and energy crops cultivation approaches.

The first main objective of WP5 is **development of Agricultural Reclamation Toolkit**:

- **Agricultural Geodatabase:** Establish a geodatabase to support agricultural reclamation efforts. This involves defining the tool's key functionalities based on previous tasks and end-user feedback, collecting and integrating relevant geospatial data, and designing a user-friendly database structure and interface.
- **Carbon Farming and Energy Crop Calculators:** Develop specialized calculators that allow users to assess the potential of carbon farming and energy crops cultivation in post-mining areas. These calculators will help stakeholders estimate carbon sequestration potential and the feasibility of energy crops based various environmental factors.
- **Toolkit Design and Publication:** Create and publish an online agricultural toolkit that incorporates the geodatabase and other resources, providing users with practical tools and information for agricultural reclamation.

The second main objective of WP5 is **preparation of Reclamation and Carbon Farming Scenarios**:

- **Scenario Development:** Prepare diverse scenarios for agricultural reclamation and carbon farming tailored to selected case study areas. These scenarios will illustrate various possibilities based on the toolkit and address different types of land use, considering environmental, social, and economic aspects.
- **Comparison and Recommendations:** Compare the proposed scenarios to identify the most effective approaches for each area. Develop a roadmap or guidelines with recommendations for implementing agricultural reclamation and carbon farming on coal post-mining land.

WP5 includes two tasks:

Task 5.1 - Development of Toolkit for Supporting Agriculture on Coal Post-mining Land

This task focuses on the design of a comprehensive toolkit to support agricultural reclamation and carbon farming on coal post-mining land. The toolkit will consist of several key components:

- Agricultural Geodatabase: A geodatabase will be established, integrating essential geospatial data such as land cover, vegetation indices, soil types, water availability, and climate data. This database will serve as the foundation for assessing the suitability of post-mining areas for different types of agricultural activities, including food and energy crops cultivation.
- Carbon Farming and Energy Crop Calculators: Special calculators will be developed to allow users to estimate the carbon sequestration potential and viability of energy crops in post-mining areas. These tools will be crucial for guiding stakeholders in adopting sustainable land use practices that contribute to climate change mitigation.

- Reports, Guides, and Manuals: The toolkit will also include practical reports and guidelines on topics such as soil dysfunctions, soil regeneration methods, and successful examples of post-mining land reclamation. A legal guide will help navigate the regulatory landscape. The toolkit will be published online, providing users with access to valuable resources for effectively planning and implementing agricultural reclamation strategies in coal post-mining areas. The key stakeholders will be involved in the process of creating and evaluating the tool under development.

Task 5.2 - Preparation of Agricultural Reclamation Scenarios

This task involves the development of detailed scenarios for agricultural reclamation of post-mining areas specific areas designated for reclamation, with a special focus on carbon farming and the cultivation of energy crops. These scenarios will be tailored to specific case study areas, integrating the unique environmental, social, and economic conditions of each region. The primary goal is to explore how degraded post-mining land can be transformed into productive agricultural areas, with an emphasis on practices that promote carbon sequestration and the sustainable production of energy crops. By utilizing the tools designed in Task 5.1, these scenarios will offer a data-driven approach to land reclamation, allowing stakeholders to make informed decisions based on comprehensive environmental and economic analyses. Additionally, the scenarios will compare the benefits and challenges associated with each approach, providing clear recommendations for the most effective land use strategies. The scenarios will be developed in line with the pre-established plans of the industrial partners, ensuring that they align with the ongoing and planned reclamation activities. These recommendations will guide the implementation of agricultural reclamation projects that not only restore the land but also contribute to climate change mitigation through carbon farming and energy crop cultivation.

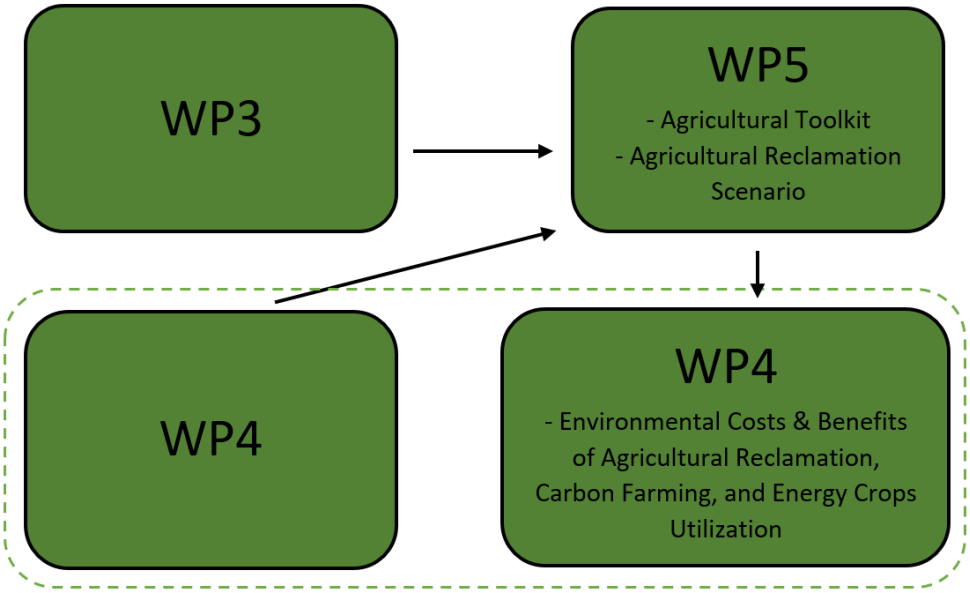

Figure 9. Results of other WPs as inputs to develop Agricultural Reclamation Scenarios. Agricultural Toolkit developed in parallel as tool used in environmental costs & benefits analyses.

3.3. Areas Focused by COFA

3.3.1. The Most Lignite Basin, Czechia

The Most Coal Basin area is known for its largest Czech brown coal deposit. It is situated in the region of North Western Bohemia - Czech mining region. The main mining companies are the North Bohemian Mines, j.s.c. and the Seven Group j.s.c. The main mining localities are the Bílina opencast mine, the Libouš opencast mine, the Vršany opencast mine and the CSA opencast mine. The Most Coal Basin is in general known as the dry part of Czechia.

When choosing a post-mining area in the Most Basin that is suitable for energy crops agricultural reclamation and its surroundings, the history of reclamation research, the geological and pedological diversity of the reclaimed soils and the planned reclamation use of the area should be considered. The application of various reclamation methods, including natural succession, the occurrence of areas not yet reclaimed, the presence of long-term monitored experimental areas and possibilities of ecological use of the site are important.

Figure 10. A post-mining area in the Most Basin – aerial view. The external dump of the ČSA opencast mine.

The extensive scale of the opencast mines - particularly Bílina and Vršany - provides vast tracts of land that are highly suitable for large-scale agricultural transformation. Given the Basin's status as the dry part of Czechia, utilizing land for drought-resistant energy crops presents a vital, low-input option for economic revitalization, minimizing competition with traditional food crops that require more water.

The imperative to investigate energy crops and CO2 sequestration strategies here is twofold:

- Climate Mitigation: the large, degraded surface areas, typically low in organic carbon, offer maximum potential for carbon farming. By establishing robust plant cover and improving soil structure, these sites can be effectively transformed into significant, measurable carbon sinks, directly supporting both Czech and EU climate goals.
- Economic Transition: the transition away from coal requires a viable, new large-scale economic activity. Energy crop cultivation provides a sustainable source for bioenergy and the bio-based economy, offering an alternative revenue stream to local communities affected by mine closures.

Due to the immense size and varying stages of reclamation across the Most Basin, the COFA project will adopt a multi-scalar approach for its analyses:

- Regional Scale: initial analyses, such as the regional assessment of socio-economic needs and identification of the most promising areas for reclamation (like parts of the Bílina and Vršany mines), conducted at the regional level.
- Local Scale: detailed field research on soil quality, and precise carbon sequestration calculations will be carried out in selected, experimental areas within the Basin.

This approach contrasts with smaller sites, like the Sieniawa mine, where analyses primarily remain local due to its limited geographic scope. The ultimate goal is to use the validated local data and findings from the Most Basin to create robust WP5 scenarios that model and demonstrate the potential for successful agricultural reclamation to be upscaled from local success to regional policy and national strategy.

3.3.2. The Lignite Basin in Western Macedonia, Greece

Starting in the early 1950s, the lignite industry has critically shaped the development of Western Macedonia. The lignite deposits of Western Macedonia are located within an elongated sedimentary basin measuring 250 km in length, which extends northwest into the southwestern territories of north Macedonia (Louloudis et al., 2020). Boreholes retrieved by the Geological and Mineral Exploration (IGME), Athens, Greece, and Public Power Corporation of Greece (PPC), Athens, Greece, demonstrate continuous sedimentation from the Upper Miocene to the Middle Quaternary. The intra-basin Neogene deposits tend to thicken towards the SE (Athanassas et al., 2022). The basin is divided into two elongated grabens with different stratigraphic evolution and subsurface morphology. The stratigraphic architecture, as well as the deformation pattern, seems to be different between the two grabens. In the southern graben, the Neogene deposits exhibit greater thickness and continuous tectonic subsidence, which is particularly pronounced at the Miocene-Pliocene boundary, resulting in an accumulated throw of at least 400 m. In the northern graben, the equivalent deposits appear underdeveloped, while rifting seems to have favoured the widening of the northern graben (in contrast to the deepening of the southern graben), which was intensified during Pliocene-Lower Quaternary (Athanassas et al., 2022).

The Western Macedonia Lignite Centre includes the Ptolemais and Amyntaion complex surface mines. Currently, there are only two lignite mines in operation (Mavropigi and South Field in the Ptolemais mining area), and they are expected to be completed by 2026, according to the current mine plan.

In parallel with the mining operations, reclamation works are carried out, and several new land uses have been established in the former mining areas. Such areas constitute agricultural, forest land uses, as well as recreational areas and RES areas. In the context of agricultural reclamation and a sustainable post-mining era, investigating the soil's potential for carbon farming and energy crop cultivation would be highly interesting, as electricity production via power plants fuelled by natural gas is expected to continue in the broader area.

The Ptolemais-Amyntaion complex represents one of the largest reclamation challenges and opportunities in Europe. The sheer scale of the formerly mined areas - currently transitioning from active extraction to large-scale decommissioning - provides an extensive surface area for climate-positive land use. The main justification for investigating agricultural reclamation and energy crops and CO2 sequestration strategies in this region is the need to:

- Support Decarbonization and Energy Security: Considering the diversity of energy mix, utilizing post-mining land for dedicated biomass cultivation could strengthen regional bioenergy supply chains .
- Maximize Climate Benefits: the large tracts of post-mining land offer maximum potential for enhanced CO2 sequestration through carbon farming practices. Transforming this expansive industrial legacy into a carbon sink provides a measurable ecological and economic asset (via carbon credits).
- Validate Toolkit Applicability in Diverse Climates: the Mediterranean climate of Western Macedonia presents a distinct set of climate challenges compared to the Central European sites (Most Basin, Sieniawa). Successful application of the COFA Toolkit here will validate its robustness and transferability across various European climatic and geological conditions.

The COFA project's analyses in Western Macedonia are strategically scaled to maximize both policy relevance and technical depth:

- Regional Scale: an initial assessments of the entire mining region including comprehensive socio-economic analyses, mapping of available land, and general suitability assessment for agricultural reclamation – will be conducted at the regional level.
- Local Scale: a detailed, high-resolution field work focusing on soil improvement techniques and precise CO2 sequestration rate measurements will be carried out in selected, highly representative reclaimed areas within the Ptolemais and Amyntaion complexes. These sites benefit from existing long-term monitoring by PPC.

- Comparison and Upscaling: this multi-scalar approach will contrast with smaller investigated sites, such as the Sieniawa mine, where analyses are primarily confined to the local scale due to its limited area. The large-scale data and validated methods from Western Macedonia are then critical inputs for developing WP5 scenarios, which model and demonstrate the economic and environmental potential for successful reclamation to be upscaled from local pilot projects to regional policy and national strategy.

Figure 11. A post-mining area in Western Macedonia (aerial view). The reclamation has been employed in the outside dumping area near Mavropigi mine in Ptolemais mining area.

3.3.3. Sieniawa Lignite Mine - Mining and Post-mining Areas, Poland

The exploitation of lignite in the Sieniawa area took place within two documented deposits: Sieniawa 1 and Sieniawa 2. Mining at the Sieniawa 1 deposit began at the end of 2002 and ended in 2017. Exploitation of the Sieniawa 2 deposit began in 2017 and continues to this day.

The mining concerned a shallow lignite seam, which had been deformed (folded) during the last glaciation. As a result of glaciotectonic processes, basins and elevations were formed, which are reflected in the morphology of the terrain and influenced the mining process. Open-pit works were carried out in the elevated parts of the rock mass (the top sections of the coal-bearing thrust slices). Surrounding them were overburden rocks consisting of disturbed Neogene sediments (mainly white quartz-feldspar sands with a high content of silt fraction) and undisturbed Quaternary sediments (sands, gravels, and locally layers of glacial till with large erratic boulders).

The first aquifer is located deep (on average 10–40 meters below the ground surface). Locally, perched groundwater occurs above lenses of impermeable layers (e.g., clays or silts). The soil in the deposit area is highly variable depending on the type of bedrock. Alternating sandy or clayey sediments in the subsoil influenced soil genesis. The thickness of the soil layer ranges from 0.00 to 0.50 m (on average 0.30 m). In areas of elevated sandy sediments, soil is absent. In depressions, the soil layer is thicker. Small water bodies, remnants of glacial kettle processes, also occur in the depressions.

Open-pit mining of lignite from the Sieniawa 1 and Sieniawa 2 deposits required land reclamation of degraded areas. The main directions of reclamation included agricultural, forestry, and water uses. Reclamation works were carried out continuously due to the adopted mining system, which differed from standard lignite mining in large open pits (e.g., Konin, Bełchatów). At present, most of the land subjected to mining has been reclaimed and returned to use, supported by relevant administrative decisions.

In some cases, reclamation processes increased the utility value of the restored land, e.g., by softening and reshaping steep slopes and applying a thick layer (avg. 40 cm) of humus (soil). In areas where slopes were left in reference to the original landform, trees and shrubs were planted. These areas were selected, among others, based on their close proximity to natural forested areas. Afforestation was also carried out in enclaves with terrain depressions filled with water. These locations now serve as habitats or sites of occurrence for many animals and plants.

Currently, the areas requiring land reclamation cover less than 2 hectares. They will be fully reclaimed and returned to use within the next few months.

Figures 12-13. Mining area in August 2020 with active mining operations (left). The same post-mining area in November 2022 reclaimed in agricultural direction (right).

3.4. Project Management, Communication and Dissemination

This section outlines the non-substantive, yet essential, work packages that ensure the project's smooth execution and widespread impact. These activities are critical for maintaining project cohesion, ensuring stakeholder engagement, and maximizing the visibility of project results.

3.4.1. WP1 - Management of the Project & Collaboration - Overview

Project management and collaboration are a central pillar of the COFA project, encompassing all the activities of WP1. The primary objective is to ensure that the project is executed efficiently, on time, and within budget, with effective coordination among all six consortium partners. This involves establishing clear lines of communication, facilitating regular monitoring of progress against project goals, and proactively managing any risks or challenges that may arise.

WP1, led by POLTEGOR, provides the essential operational framework that allows the scientific and technical work of the other work packages to proceed without friction. The management strategy focuses on three key areas:

- Administrative and Financial Management: This involves setting up and maintaining the project's legal, administrative, and financial structures. It includes preparing progress reports, handling financial statements, and ensuring compliance with the RFCS funding rules. This guarantees the project's sustainability and accountability.

- Scientific and Technical Coordination: The WP ensures that the project’s scientific direction remains aligned with its original objectives. This includes organizing regular meetings, workshops, and virtual conferences to facilitate the exchange of technical data, knowledge, and best practices across national borders. This coordination is vital for integrating the diverse expertise of the consortium partners from Poland, Czechia, and Greece.

- Risk and Quality Management: A proactive approach to risk management is employed to identify potential roadblocks - such as delays in data collection, unforeseen technical challenges, or changes in regulatory frameworks - and develop mitigation strategies. Quality assurance measures are also implemented to ensure that all project deliverables and outputs meet the highest scientific and technical standards.

In essence, WP1 ensures that the project team operates as a cohesive, unified entity, providing the necessary infrastructure to support the complex research and development tasks carried out in the substantive work packages.

3.4.2. WP2 – Project Promotion & Dissemination Strategies – Overview

Effective promotion and dissemination are vital for ensuring that the COFA project's findings and results reach the right audiences, from policymakers to the public. These strategies are a key focus of Work Package 2 (WP2), led by GIG-PIB. The project will engage in a variety of activities to share its progress, results, and achievements.

While the detailed communication and dissemination plan is comprehensively laid out in a separate deliverable (Deliverable 2.2), this section provides a brief overview of the strategic approach. The project will aim to maximize outreach and ensure that all stakeholders have a clear understanding of the project's scope, findings, and potential for creating a positive impact. Key activities will include:

- Digital Presence: The project will establish a strong digital footprint with a dedicated project website serving as the central hub for all project-related information, including an executive summary, news, and publications. This website will be designed to be accessible to both technical and non-technical audiences. Complementing the website, an active social media presence will be maintained on platforms such as X, Facebook, and LinkedIn. These channels will be used to share regular updates, project milestones, and key findings, engaging a wider audience and building a community around the project's mission.
- Stakeholder Engagement: Targeted communication will be used to engage specific stakeholder groups. This includes organizing workshops and webinars for policymakers, industry professionals, and local communities to present the project's findings and collect valuable feedback. This direct engagement is crucial for ensuring that the project's outputs, particularly the Agricultural Toolkit, are relevant and user-friendly.
- Dissemination to the Scientific Community: To ensure the project's scientific results are recognized and utilized by the broader research community, the consortium will publish its key findings in high-impact academic journals. This includes sharing methodology, data, and conclusions on soil reclamation, carbon sequestration, and the cultivation of energetic crops. This academic dissemination will validate the project's work and contribute to the global body of knowledge on sustainable land use.

These measures collectively ensure that the COFA project's legacy extends beyond its duration, creating a lasting impact on policy, practice, and scientific understanding.

Figure 14. COFA Project Logo.

4. Potential Impact and Value delivered by COFA

The COFA project is more than a research initiative; it is a catalyst for a sustainable future in Europe's transitioning coal regions. The value delivered extends far beyond academic publications, aiming to create tangible, lasting impacts for a wide array of stakeholders and to fundamentally change how we view post-mining landscapes. Our goal is to be heard - to demonstrate that former coal and lignite mining areas are not a burden but an opportunity for a vibrant, agricultural renaissance.

The project's potential impact can be summarized in three key areas:

- Environmental and Climate Value
- Socio-Economic and Policy Value
- Strategic and Knowledge Value

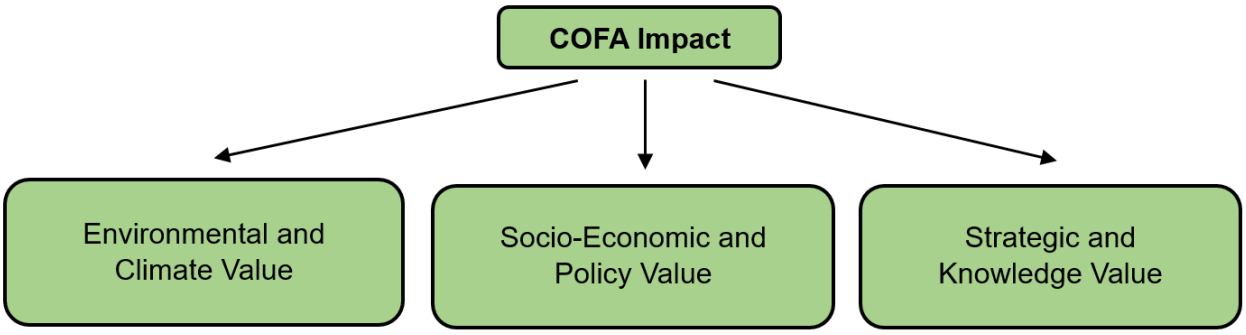

Figure 15. Potential Impact and Value delivered by COFA.

4.1. Environmental and Climate Value

COFA will deliver a new paradigm for environmental restoration. By shifting from simple land rehabilitation to a proactive agricultural development model, the project will demonstrate how post-mining areas can become active contributors to climate change mitigation.

- Carbon Sequestration: The project's focus on carbon farming will provide a clear, quantifiable model for how agricultural practices can increase soil organic carbon (SOC) levels. This not only improves soil health but also turns degraded land into a significant carbon sink, helping Europe meet its climate neutrality goals.

- Enhanced Biodiversity and Ecosystem Services: By introducing diverse agricultural systems and energetic crops, the project will restore biological activity to barren soils, leading to enhanced biodiversity and a return of vital ecosystem services, such as soil fertility and water retention.

- Sustainable Resource Use: The valorization of post-mining land for the cultivation of energetic crops offers a dual benefit: it revitalizes the soil and provides a renewable source of biomass for bioenergy production, contributing to energy security and reducing reliance on fossil fuels.

4.2. Socio-Economic and Policy Value

The project offers a blueprint for regional economic revitalization and a just transition for coal-dependent communities.

New Economic Opportunities: By providing a clear framework and toolkit, COFA will empower farmers, entrepreneurs, and local communities to develop new agricultural business models on reclaimed land. This creates alternative revenue streams and jobs, revitalizing economies that are grappling with the decline of the coal industry.

Actionable Policy Recommendations: The project will bridge the gap between scientific research and policy-making. By analyzing the legal, social, and economic barriers to agricultural reclamation, we will provide policymakers at the local, national, and European levels with concrete recommendations for creating a supportive regulatory and incentive-based environment.

Empowering Stakeholders: Through our targeted engagement and dissemination efforts, we will ensure that local authorities, land managers, and civil society have the tools and knowledge necessary to advocate for and implement sustainable land use strategies, giving them a voice in their own transition.

4.3. Strategic and Knowledge Value

COFA will produce a legacy of knowledge and tools that can be scaled and replicated across Europe.

- **The Agricultural Toolkit:** This open-access online tool will be the project's flagship output, serving as a comprehensive, living resource. It will provide a geospatial database of best practices, calculators for carbon and energy crop yields, and practical guides. This tool will simplify the reclamation process and provide a tangible path forward for anyone interested in transforming post-mining land.
- **A Model for Replication:** The region-specific scenarios developed for areas in Czechia, Greece, and Poland will serve as case studies for similar regions across Europe and beyond. By documenting what works and why, the project provides a proven model that can be adapted to different geological, climatic, and socio-economic conditions.
- In short, the COFA project's value lies in its ability to transform an historical problem - post-mining degradation - into a forward-looking solution that promotes environmental health, economic vitality, and social well-being. Our message is clear: the future of Europe's coal regions is green, and it can grow from the ground up.

5. Invitation to Cooperate

The COFA project is a collaborative effort, and its success hinges on the active participation and insights of a broad community of stakeholders. We warmly invite you to join us on this journey to influence Europe's post-mining landscapes. Your expertise, experiences, and feedback are invaluable as we work together to build a sustainable and prosperous future. Here is how you can get involved and help shape the future of post-mining land reclamation:

Participate in Our Workshops: Throughout the project, we will be hosting a series of workshops and webinars. These events will provide a platform to discuss project findings, share best practices, and co-create solutions. Your active participation will ensure that the tools and scenarios we develop are practical and directly applicable to real-world challenges.

Contribute Your Knowledge: We will be distributing questionnaires to gather specific insights from professionals, land managers, and community members. By sharing your experiences, you can help us refine our research and ensure that our solutions are well-informed and relevant.

Stay Connected: Follow us on our social media channels (X, Facebook, and LinkedIn) and visit our project website. We will be sharing regular updates, key milestones, and insights from our research. This is the best way to stay informed about our progress and join the conversation.

Figures 15-16. COFA Website (left) - https://cofa.gig.eu/; COFA LinkedIn profile (right) - https://www.linkedin.com/company/cofa-project/.

Seek Advice and Share Your Story: If you have questions about specific reclamation challenges, or if you are considering a similar project in your region, please do not hesitate to contact us. We are here to provide advice and learn from your experiences.

Explore Collaboration Opportunities: The COFA consortium is always open to new collaborations. If you are working on a related project or are interested in potential future partnerships, please reach out to us. Together, we can build a larger network of initiatives focused on the sustainable revitalization of former industrial areas.

By engaging with us, you are not just following a project; you are becoming an integral part of a movement to unlock the agricultural and environmental potential of post-mining areas. We look forward to hearing from you and working together.

6. About RFCS Programme

The COFA project is a proud recipient of funding from the Research Fund for Coal and Steel (RFCS) programme, a key European Union initiative that supports research and innovation in the coal and steel sectors. Established to continue the legacy of the European Coal and Steel Community (ECSC), the RFCS programme has evolved to address the new challenges of the European Green Deal, focusing on decarbonisation and a just transition for coal regions.

Figures 17-18. Logos of European Commission and RFCS Fund.

6.1. RFCS Programme Goals

The RFCS programme is designed to complement the broader Horizon Europe framework. Its objectives for the coal sector are particularly relevant to our work and can be broken down into three main pillars:

- Supporting the Just Transition of Coal Regions: The programme provides funding for projects that help coal-dependent communities and regions adapt to the phase-out of coal. This includes supporting new economic activities, repurposing former mining sites and infrastructure, and ensuring a fair and equitable transition for the workforce.

- Improving Health and Safety: A continuous focus of the programme is to enhance the health and safety standards within the coal industry, particularly for those mines still in operation and for the long-term management of closed sites.

- Minimising Environmental Impacts: The RFCS funds research aimed at reducing the environmental footprint of coal-related activities. This includes projects on land reclamation, water management, and the mitigation of greenhouse gas emissions from coal mines in transition.

6.2. Research Projects and Accompanying Measures

The RFCS programme supports a variety of projects, each with a distinct role in achieving its goals:

- Research Projects: These projects focus on investigative and experimental work to generate new knowledge and develop new or improved products, processes, and services. They form the core of the programme's innovation efforts.

- Pilot and Demonstration Projects: These initiatives take research results from the laboratory and test them in real-world, industrial-scale settings. They are crucial for gathering the technical and economic data needed for the eventual commercial exploitation of new technologies.

- Accompanying Measures (AMs): These projects, like COFA, are an essential part of the RFCS framework. They are not focused on technical research themselves but on promoting the use of knowledge generated by other projects. AMs achieve this through the organization of workshops, conferences, and other dissemination activities. They are designed to ensure that the findings of RFCS-funded research reach and are adopted by the relevant stakeholders, from policymakers to industry and the public.

By funding a diverse portfolio of activities, the RFCS programme ensures that the transition of Europe's coal and steel sectors is driven by cutting-edge research, is proven in practice, and is supported by a comprehensive strategy for knowledge transfer and stakeholder engagement.

6.3. The COFA Project as an RFCS Accompanying Measure

While the COFA project is rooted in research, it is formally classified under the Research Fund for Coal and Steel (RFCS) programme as an Accompanying Measure (AM). This crucial distinction highlights its fundamental role and objectives, which extend beyond traditional research and development activities.

Classifying COFA as an Accompanying Measure is a deliberate strategic choice that maximizes its impact. Instead of focusing on a single, narrow research aspect, the project acts as a knowledge catalyst and broker. Its purpose is to:

- Connect and Strengthen Networks: By organizing workshops and meetings, COFA creates a platform for dialogue among scientists, policymakers, entrepreneurs, and local communities.

- Simplify Access to Knowledge: The project gathers and synthesizes complex research findings from various sources, then transforms them into accessible tools (such as the "Agricultural Toolbox") and recommendations that can be easily used by practitioners in the field.

- Increase the Adoption of Innovation: Through promotional and advisory activities, COFA encourages stakeholders to implement sustainable agricultural practices on post-industrial lands, directly leading to real-world change at the regional level.

In this way, COFA not only contributes to scientific development but, most importantly, ensures that research achievements are widely accessible and effectively utilized, driving a just transition and the development of an alternative economy in Europe's coal regions.

Annex 1

List of COFA Deliverables

No.	Deliverable	Date expected
D1.1	Project Management Plan	September 25
D1.2	Publishable report	June 27
D2.1	Comprehensive Project Overview Document	September 25
D2.2	Communication and Dissemination Plan	December 25
D2.3	Project Website and Social Media Launch	June 27
D2.4	Final Conference	June 27
D2.5	Workshop Report	June 27
D3.1	Regional Agricultural Reclamation Suitability Maps	April 26
D3.2	Soil Dysfunction Classification Report	January 26
D3.3	Guidelines for Soil Regeneration and Reclamation Practices	May 26
D3.4	Suitability Assessment Report for Carbon Farming and Energy Crops	June 26
D4.1	Legal and Social Framework Report	October 26
D4.2	Stakeholder Engagement Plans	October 26
D4.3	Environmental and Economic Impact Assessment Report	January 27
D5.1	Manual for Agricultural Reclamation Toolkit	May 27
D5.2	Report on Agricultural Reclamation Scenarios	May 27

Research Fund for Coal & Steel

Funded by the European Union

Annex 2

COFA Gantt Chart

Work package/ Task	Deliverable	Milestone	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26	Jun-26	Jul-26	Aug-26	Sep-26	Oct-26	Nov-26	Dec-26	Jan-27	Feb-27	Mar-27	Apr-27	May-27	Jun-27
WP1 Management of the project																										
Task 1.1 - Establishment of project management structures and tools	D1.1 Project Management Plan	MS8 Project Management Plan established						**D1.1 MS8**																		
Task 1.2 - Regular monitoring and reporting of project progress																										
Task 1.3 - Preparation of the publishable report	D1.2 Publishable report																									**D1.2**
WP2 Promotion and dissemination																										
Task 2.1 - Comprehensive Project Overview Document	D2.1 Comprehensive Project Overview Document				**D2.1**																					
Task 2.2 - Communication and Dissemination Plan	D2.2 Communication and Dissemination Plan	MS1 Project website established MS2 Dissemination events conducted			**D2.2**																					
Task 2.3 - Project Website and Social Media Launch	D2.3 Project Website and Social Media Launch						**MS1**																			**D2.3**
Task 2.4 - Final conference	D2.4 Final Conference																									**D2.4**
Task 2.5 - Organization of Workshops for Toolkit Dissemination	D2.5 Workshop Report																									**D2.5 MS2**
WP3 Data collection and valorisation of knowledge on post-mining land degradation and agricultural reclamation																										
Task 3.1 - Mapping of degraded lands suitable for agricultural reclamation in post coal mining areas	D3.1 Regional Agricultural Reclamation Suitability Maps	MS3 Degraded lands in case study areas mapped									**D3.1 MS3**															
Task 3.2 - Defining of soil dysfunctions of post-mining lands for different agricultural production	D3.2 Soil Dysfunction Classification Report								**D3.2**																	
Task 3.3 - Analysis of soil regeneration and agricultural reclamation practices	D3.3 Guidelines for Soil Regeneration and Reclamation Practices												**D3.3**													
Task 3.4 - Assessment of suitability of post-mining areas for carbon farming and energy crop cultivation	D3.4 Suitability Assessment Report for Carbon Farming and Energy Crops													**D3.4**												
WP4 Social, environmental and legal aspects of agricultural reclamation of post-mining areas																										
Task 4.1 - Legal and social aspects of agricultural reclamation and possibilities of food production and energy crops on post-mining areas	D4.1 Legal and Social Framework Report	MS4 Surveys from stakeholders collected														**MS4**		**D4.1**								
Task 4.2 - Stakeholders engagement in agricultural reclamation	D4.2 Stakeholder Engagement Plans																	**D4.2**								
Task 4.3 - Environmental cost and benefits of agricultural reclamation, carbon farming, and energy crops utilization	D4.3 Environmental and Economic Impact Assessment Report																				**D4.3**					
WP5 Development of an agricultural toolkit and agricultural reclamation and carbon-farming scenarios																										
Task 5.1 - Development of Toolkit for Supporting Agriculture on Coal Post-Mining Land	D5.1 Manual for Agricultural Reclamation Toolkit	MS5 Geodatabase established MS6 Manual for Agricultural Reclamation Toolkit MS7 Carbon farming and energy crop calculators												**MS5**			**MS6**								**D5.1**	
Task 5.2 - Preparation of Agricultural Reclamation Scenarios	D5.2 Report on Agricultural Reclamation Scenarios																								**D5.2**	