CERESiS

ContaminatEd land Remediation through Energy crops for Soil improvement to liquid biofuel Strategies

ceresis@exergia.gr
www.ceresis.eu

@CERESiS project

@CERESiS3

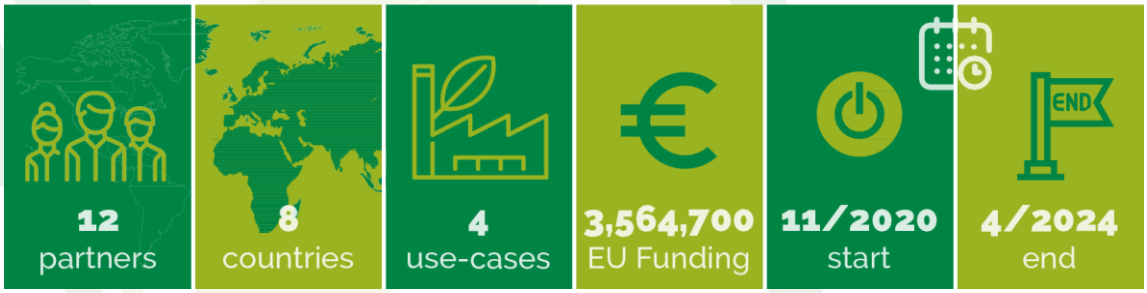
CERESiS Project

NEWSLETTER

Issue # 1 / May 2022

CONTENTS

1. Introduction



CERESiS (ContaminatEd land Remediation through Energy crops for Soil improvement to liquid biofuel Strategies) is a H2020 Project aiming to facilitate land decontamination through phytoremediation, i.e. growing energy crops to produce clean biofuels. In the longer term, this will increase the land available for agriculture, while producing non-ILUC biofuels.

To reach this goal, CERESiS develops a decision support system for stakeholders and policy makers that will take into consideration all the critical parameters affecting the best choice of energy crops, the most appropriate cultivation and harvesting methods, conversion and separation technologies and supply chain design. This tool will propose optimal pathways for each individual case of site, area, region or country for stakeholders wishing to produce biofuels while decontaminating land.

Remediation of large, contaminated areas can lead to the production of sustainable, high quality and high value biomass for biofuels

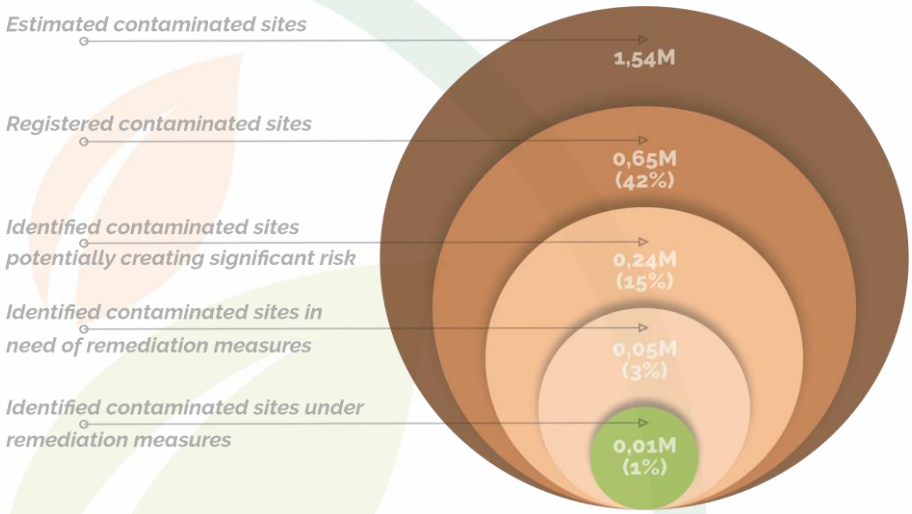
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006717

This project has received funding from the Brazilian Fundação de Amparo à Pesquisa do Estado de Goiás under grant number 202110267000220

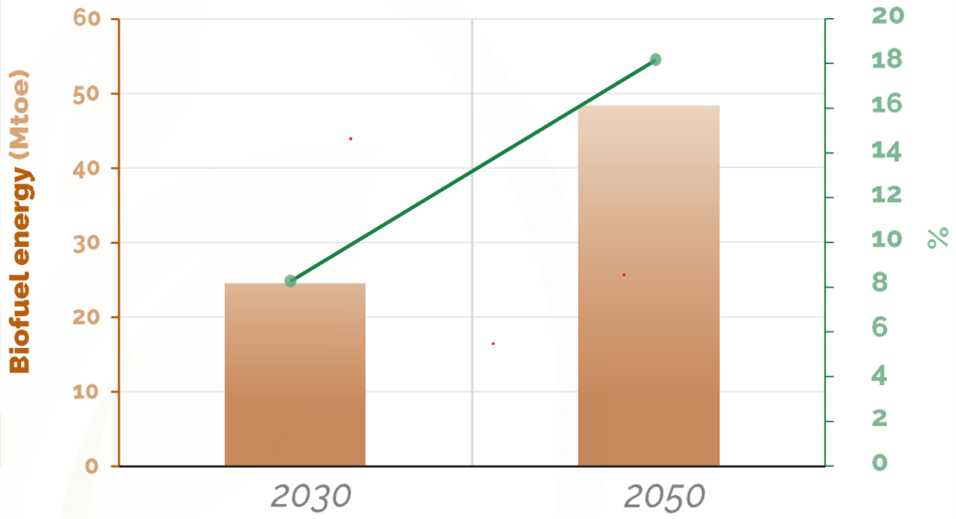
This project has received funding from the Canadian New Frontiers in Research Fund under grant number NFRFG-2020-00148 and the Canadian Fond de recherche Société et culture – Québec under grant number 308509

2. Project background

Across EU-28, 1,54 million of potentially contaminated sites are estimated and out of the 650.000 registered sites only 1 in 10 have so far been remediated. The management cost of European contaminated sites is estimated at €6 billion annually. Meanwhile, meeting the global challenge of feeding growing populations while still reducing greenhouse gas emissions would require less land used for dedicated bioenergy crops.



Bioenergy accounts for 18,9% of renewable energy (2018 data) and is expected to increase to 32% by 2030. Especially in the transport sector, agricultural crops constituted the largest source of feedstock for biofuel production (72% of approx. 14 Mtoe used in transport in 2016). Therefore, sustainable bioenergy crops are essential to expand the future production of biofuels, the latter of which will still play a fundamental role all the way through 2050. The contribution of biofuels to transport is illustrated in the following figure.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006717

This project has received funding from the Brazilian Fundação de Amparo à Pesquisa do Estado de Goiás under grant number 202110267000220

This project has received funding from the Canadian New Frontiers in Research Fund under grant number NFRFG-2020-00148 and the Canadian Fond de recherche Société et culture – Québec under grant number 308509

3. CERESiS Consortium

Nine partners from five European countries (GR, DE, IT, LU and UK) closely collaborate with one Ukrainian NGO (Associated country) and two Universities from Canada and Brazil (international partners) to form the 12 partner Consortium. It is comprised by four leading European Universities and two international ones, two research centres, one large industry, one SME and two NGOs. The consortium expertise covers the entire value chain and addresses all project requirements, demonstrating the inter-disciplinary approach adopted.

4. Pilot sites for use cases

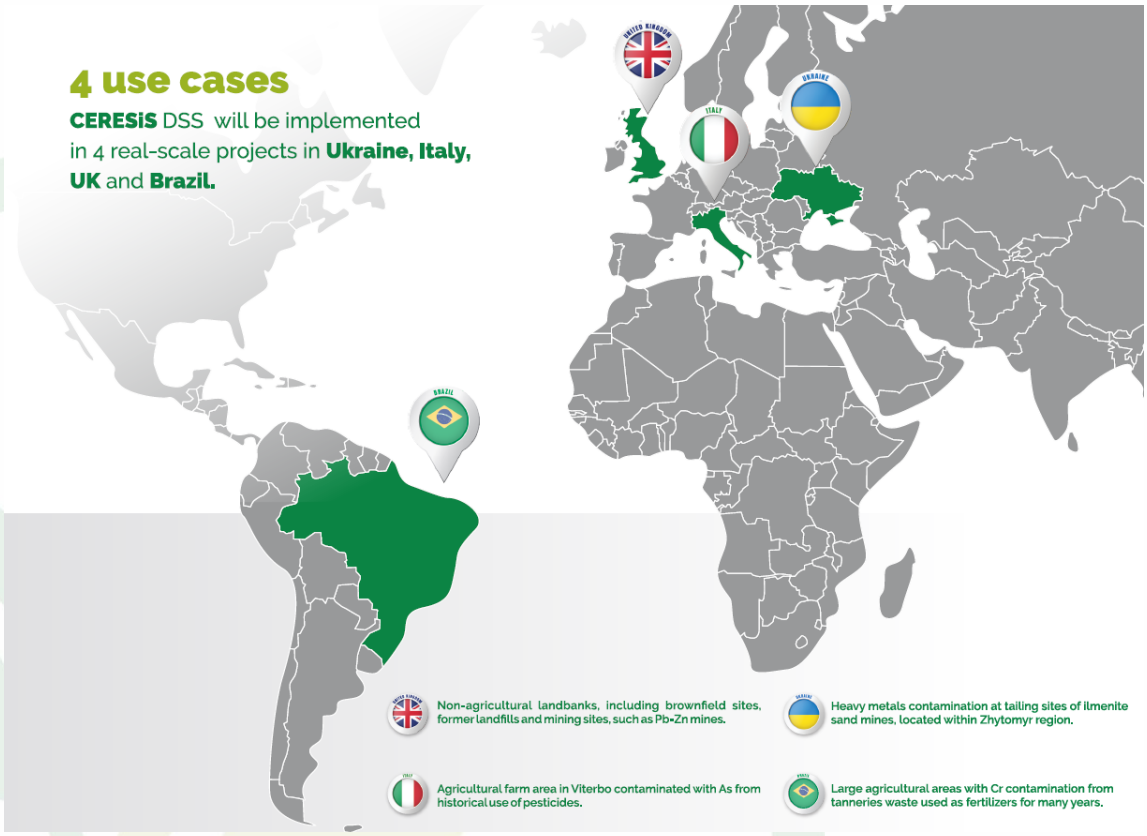
Pilot sites across Europe and America have been identified and selected based on the variety of contaminants found in the soils.

- **Brazil:** Large agricultural areas with Cr contamination from tannery waste used as fertilizer for many years
- **Italy:** Agricultural farm areas in Viterbo contaminated with geogenic As from historical use of pesticides
- **UK:** Non-agricultural landbanks, including brownfield sites, former landfills and former mining sites, such as coal mines
- **Ukraine:** Heavy metals contamination at tailing sites of ilmenite sand mines, located within Zhytomyr region

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006717

This project has received funding from the Brazilian Fundação de Amparo à Pesquisa do Estado de Goiás under grant number 202110267000220

This project has received funding from the Canadian New Frontiers in Research Fund under grant number NFRFG-2020-00148 and the Canadian Fond de recherche Société et culture – Québec under grant number 308509



5. Progress in the first 18 months

During the first 18 months of CERESiS, significant progress has been made in all of the project's components, despite the COVID-19 pandemic.

In terms of the **phytoremediation pillar**, biomass has now been planted in 15 different field or greenhouse trials using soils from 8 contaminated sites in the UK, Italy, Ukraine and Brazil. Together with biomass samples from 7 existing field trial sites this includes 11 different plant species. So far, these contaminated and brownfield sites include former metal mines, oil refineries, coal ash/landfills, shipyard/railway land and agricultural land impacted by pesticide manufacture or use, lubricating oils or tannery effluent. 19 bulk samples of contaminated biomass from both the existing and newly planted sites have now been collected and prepared for treatment, including both organic and inorganic contaminants.

In terms of **technologies**, numerous experiments in Supercritical Water Gasification of contaminated plants have been successfully performed. Successful experiments on the decontamination and separation of contaminants of the SCWG and pyrolysis products have been performed. Regarding the pyrolysis technology, several experiments have been performed with the lab scale plant. The pilot scale plant has been completed.

Regarding the **overarching work**, existing approaches for characterization of contaminated land have been investigated, as well as the related regulatory and policy framework.

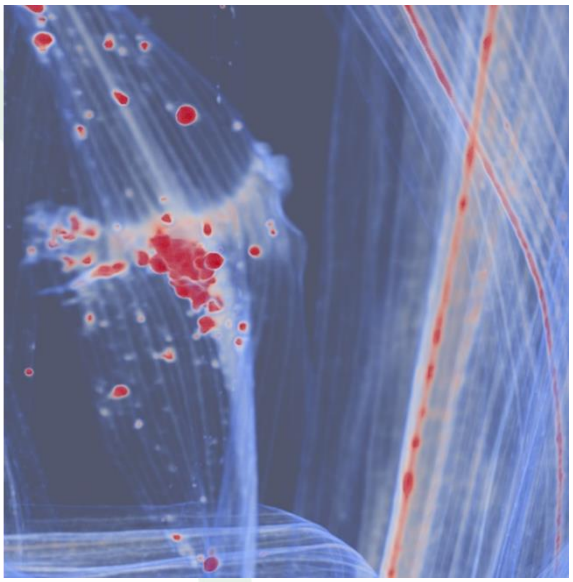
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006717

This project has received funding from the Brazilian Fundação de Amparo à Pesquisa do Estado de Goiás under grant number 202110267000220

This project has received funding from the Canadian New Frontiers in Research Fund under grant number NFRFG-2020-00148 and the Canadian Fond de recherche Société et culture – Québec under grant number 308509

Finally, in terms of the **Decision Support System** development, the first attempt to define the user requirements has been made providing valuable insights into different requirements and perspectives. The user requirement definition process is ongoing with further engagement of potential end users. The focus is currently on defining the DSS architecture and on developing the first biomass-to-biofuel supply chain optimization model, considering also the potential use of mobile biomass processing facilities.

A photo of the Phalaris arundinacea (reed canary grass) that was grown in the fields of the University of Tuscia – Viterbo experimental farm.



X-ray computed tomography (XCT) by the University of Strathclyde to gain a better understanding of the location and nature of contaminants within plants.

Energy crops piloted in Brazil

Capiahu grass

Napier grass

Sugar cane

Energy cane

Energy crops can be a suitable and effective solution for contaminated land remediation, exhibit high mass productivity and lead to sustainable biofuel production when coupled with appropriate conversion processes

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006717

This project has received funding from the Brazilian Fundação de Amparo à Pesquisa do Estado de Goiás under grant number 202110267000220

This project has received funding from the Canadian New Frontiers in Research Fund under grant number NFRFG-2020-00148 and the Canadian Fond de recherche Société et culture – Québec under grant number 308509

6. Newsletter focus: Regulatory & Policy issues

Early in the project, an analysis of the regulatory & policy aspects of contaminated land management and biofuels has been performed in order to review relevant EU policies and examine how successfully these policies are being pushed down to national, regional and local level initiatives. The barriers and constraints encountered along this top-down process have also been explored. Two broad sets of policies were examined: a) policies related to **contaminated land management** and b) policies related to the market uptake of **biofuels** produced via the processing of suitable feedstock originating from contaminated land.

According to the analysis conducted, the main findings indicate that **soil protection and contaminated land management has not been subject to a specific legislative instrument at EU level.** The lack of a comprehensive and coherent policy and regulatory framework to protect land and soil is a key gap that reduces the effectiveness of the existing incentives and measures and may limit Europe's ability to achieve future objectives. Moreover, the high percentage of non-legally binding tools at EU level indicates that great efforts have been made to protect soils but there is no consistent agreement allowing for the development of a legal framework that guarantees soil protection.

Overall, it is concluded that **a unified overarching legislative framework** under which the two sectors (contaminated land management and biofuels production from sustainable biomass) can "communicate" on a solid basis **is not in place**. The new EU Soil Strategy, provides a unique opportunity for EU Member States, that will ensure a solid policy and regulatory background for contaminated land management, land decontamination and phytoremediation. A specified policy and legislative framework should therefore be adopted for bridging the gap between phytoremediation strategies and clean biofuel production in a sustainable and optimum manner.

Remarkably, the role of policy and regulation in squaring the circle between phytoremediation and biofuel production will be further discussed and explored in a **dedicated online workshop** taking place on May 12, 2022, within the context of the 30th European Biomass Conference and Exhibition. The aim of the workshop will be to highlight existing regulatory and policy gaps and blind spots, with a view to develop relevant proposals overcome them. The vision is to facilitate the use of biomass grown in contaminated land for the purpose of phytoremediation to produce clean biofuels for the transport sector.

The workshop will be organized on the basis of preliminary findings from three H2020 projects (CERESiS/GOLD/Phy2climate). For more infromation please check here.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006717

This project has received funding from the Brazilian Fundação de Amparo à Pesquisa do Estado de Goiás under grant number 202110267000220

This project has received funding from the Canadian New Frontiers in Research Fund under grant number NFRFG-2020-00148 and the Canadian Fond de recherche Société et culture – Québec under grant number 308509

7. Dissemination activities

Dissemination activities are an integral part of CERESiS project as they ensure the visibility of the project results. It is among the project's main concerns to ensure that the generated information will reach industrial, political and social stakeholders in an effective manner. The CERESiS dissemination strategy ensures that the key messages are sufficiently highlighted and effectively communicated towards appropriately targeted stakeholders.

Within the first 18 months, CERESiS partners have been actively involved in dissemination and communication activities; the project frame and its preliminary results have already been presented in the context of 8 conferences, 2 exhibitions and 2 webinars. Moreover, on the basis of CERESiS work, 7 courses and other educational activities have been prepared by our university partners while one research article has been already produced, with more being currently under preparation!

For further information

Project coordinator Asst. Prof. Athanasios Rentizelas

https://www.ceresis.eu

ceresis@exergia.gr

CERESiS project

@CERESiS3

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006717

This project has received funding from the Brazilian Fundação de Amparo à Pesquisa do Estado de Goiás under grant number 202110267000220

This project has received funding from the Canadian New Frontiers in Research Fund under grant number NFRFG-2020-00148 and the Canadian Fond de recherche Société et culture – Québec under grant number 308509