A global approach for recovery of arable land through improved phytoremediation coupled with advanced liquid biofuel production and climate friendly copper smelting process

Deliverable D7.7:

2nd project workshop at the EUBCE

presented by Phy2Climate project consortium

N°	Short	Beneficiary	Role
1	ITS	ITS Foerderberatung GmbH	CO
2	Fraunhofer	Fraunhofer Gesellschaft	BEN
3	AUR	Aurubis AG	BEN
4	LEITAT	LEITAT Technological Center	BEN
	CUJ	Central University of Jharkand	IL3P
5	IFVCNS	Institute of Field and Vegetable Crops	BEN
6	SUT	Silesian University of Technology	BEN
7	ETA	ETA Florence Renewable Energies	BEN
8	UHA	University Hasselt	BEN
9	INTA	National Institute of Agricultural Technology Argentina	BEN
10	UNSPMF	University of Novi Sad - Faculty of Sciences	BEN
11	BVA	Biovala	BEN
12	PWMCVV	Public Water Management Company Vode Vojvodine	BEN
13	LTC	Litoclean SL	BEN
14	CLH	Compania Logistica de Hidrocarburos S.A.	BEN
15	PUW	Pro Umwelt	BEN
16	UCB	Umwelttechnologie Cluster Bayern	BEN

CO: Coordinator, BEN: Beneficiary, IL3P: International linked 3rd party under article 14a

Firenze, 25.07.2023

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General Information

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Responsible Person/s:	Stefano Capaccioli, Chiara Zavattaro, Emma Fromant
Dissemination Level:	Public

Document Type		
PRO	Technical/economic progress report (internal work package reports indicating work status)	
DEL	Technical reports identified as deliverables in the Description of Work	**X**
MoM	Minutes of Meeting	
MAN	Procedures and user manuals	
WOR	Working document, issued as preparatory documents to a Technical report	
INF	Information and Notes	

Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	
CON	Confidential, only for members of the Consortium	

Version History				
Version number	Date	Reasons for release	Responsible	Comments
1.0	05/09/2023	Internal review	Coordinator	---
2.0	20/10/2023	Internal review	WP Leaders	---

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1 EXECUTIVE SUMMARY

The Phy2Climate D7.7 is a public report with the description of the second workshop aligned with the European Biomass Conference and Exhibition (EUBCE) www.eubce.com, annually organized by ETA in different locations across Europe. EUBCE gathers biomass experts of academia and companies dealing with RTD from 80+ countries all around the world. Speakers were Phy2Climate partners and high-level experts (chosen from EU and international organizations, companies and associations) to guarantee inspiring round tables and debates with a specialized audience. Its due date is M36 and it applies to the Task 7.3. The first half-day event (as workshop), aligned with the European Biomass Conference and Exhibition (EUBCE), was organized in the first part of the project.

This report is strictly related and linked to the deliverables D7.1 - D7.3: Preliminary Communication & Dissemination Plan & periodic updates (First plan for communication, outreach and dissemination of the project results to different networks, stakeholders from public and private organisations and the scientific community, and to the deliverable D7.6: 1st project workshop at the EUBCE (Organisation of a workshop, open to public and private stakeholders – policy and market experts, researchers – for the dissemination of the project results, held at the EUBCE).

The workshop was organized on the based of preliminary and consolidated findings from three H2020 projects: CERESiS, GOLD and Phy2Climate.

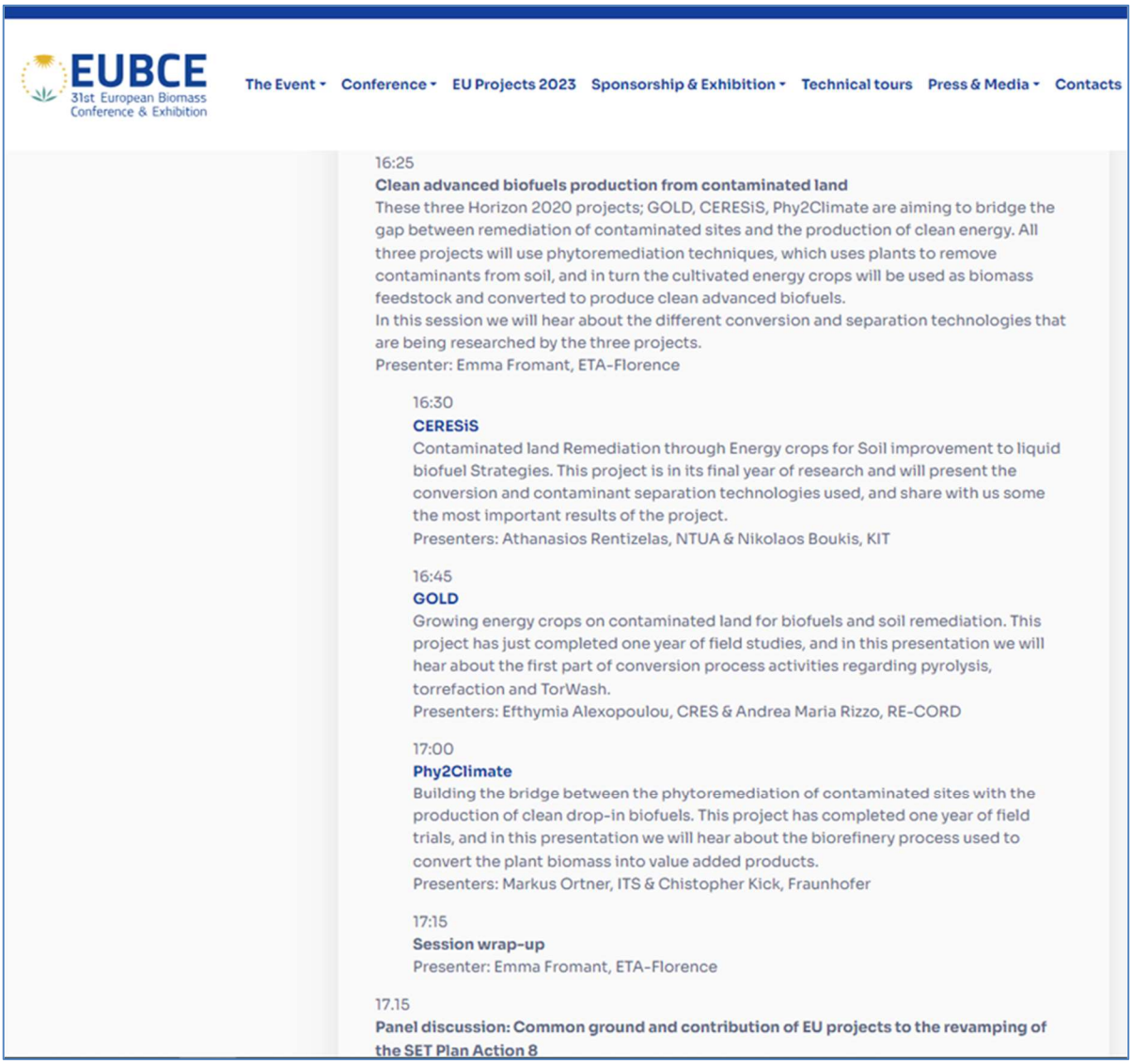
The idea for a joint event, titled **"Clean advanced biofuels production from contaminated land"**, with these three projects was originally thought of after project award, as it was realised that the projects have similar, if not the same, objectives. Therefore, through a series of online meetings involving at least one representative from each project, the agenda was formulated to include short presentations from each project, and to conclude with a panel discussion. During the first half of the Phy2Climate project, a TCR® pilot plant was built at Fraunhofer UMSICHT in Sulzbach-Rosenberg, Germany, to process biomass feedstock (selected energy crops) from contaminated soils (project pilot sites).

Since the beginning of the project in 2021, the consortium has ensured the participation of partners as speakers to leading events at both international and national level in order to address different audiences. Phy2Climate contributions and participation to various events other than main workshops, notably to: EUBCE previous

editions (2021 and 2022), other projects' workshops, symposiums, international conferences on environment, energy and renewable fuels, etc., for example as a webinar titled "Phytoremediation with energy crops for biofuel production", 15th March 2023 (organised and presented in conjunction with the two sister projects GOLD and CERESiS), and a workshop titled "Production of low ILUC Risk biomass feedstock", 30th March 2023 in Thessaloniki, Greece, organised by the EU-funded project BIKE. Both events were considered a success, with a good number of participants and questions asked.

Workshop promotions included posts on the project website, the LinkedIn page, and through the EUBCE communication channels (website, programme, and emails).

This workshop had free access with EUBCE visitor pass registration.



Workshop promotional webpage, EUBCE 2023 website.

2 INTRODUCTION

Phy2Climate is a H2020 project with title “A global approach for recovery of arable land through improved phytoremediation coupled with advanced liquid biofuel production and climate friendly copper smelting process”. The project consortium presents long-term expertise in soil remediation, phytoremediation, biofuel technologies and energy processes, environmental and social sustainability, legislative analysis, communication and dissemination as well as business development for innovative technologies.

The project aims at validating five phytoremediation pilots in selected sites with the most common soil contaminants worldwide. These pilots aim to producing energy crops that will eventually feed a pilot biorefinery focused on the production of four types of clean drop-in biofuels for the road and shipping transport sectors at TRL-5.

In the course of the outreach activities the focus is set on the analysis and mapping of stakeholders’ value chain to identify the most relevant Phy2Climate stakeholders including remediation, contaminated site owners, transport, biorefinery and the metallurgical industry sector as well as to assess their position towards the project results to set up tailored engagement strategies. During this process connections with relevant stakeholders and end-users will be integrated throughout the project.

The European Biomass Conference & Exhibition (EUBCE, www.eubce.com) combines one of the world’s leading R&D conferences with an international exhibition, and represents the leading platform for the collection, exchange and dissemination of scientific know-how in the field of biomass.

During the 31st edition of the European Biomass Conference and Exhibition (EUBCE), organised by ETA in Bologna, Italy (5-8 June 2023), a **second workshop** was organized on Tuesday 6th June, by ETA for enabling the Phy2Climate project to engage with the international community of bioenergy engineers and researchers, as well as international industry stakeholders. The event was successful in terms of participation of internal and external audiences, and in terms of workshop outputs.

The workshop was jointly organised and was included under the umbrella of a full day workshop in conjunction with the ETIP bioenergy platform event: ‘Bioenergy and renewable fuels projects for the revamping of the SET Plan’. This session title was ‘Clean advanced biofuels production from contaminated land’, and included its two sister projects, GOLD, and CERISiS, in which all three projects presented with the focus on the conversion and separation technologies.

This report will summarise the preparation process, the content presented, and the conclusions of the EUBCE 2023 workshop.

In addition to the workshop, Phy2Climate project was presented at EUBCE 2023 as follows:

- **"Phytoremediation of Contaminated Sites to Produce Feedstock for Sustainable Biofuels"**,
  Markus Ortner, ITS, Austria, project coordinator,
  Poster with session reference 1BV.3.7, 6th June.
- **"Expectations and Reality of Upscaled Phytoremediation Field-Trials"**,
  Alfreda Kasiuliene, MB Biovala, Lithuania, project partner,
  Oral with session reference 1BO.7.1, 6th June.
- **"Development and Commissioning of an Innovative Biorefinery for the Conversion of Contaminated Biomass Into High-quality Energy Carriers"**,
  Christopher Kick, Fraunhofer UMSICHT, Advanced Carbon Cycle Technologies, Germany, project partner,
  Oral with session reference 5CO.7.4, 7th June.
- **"Phy2Climate: Life Cycle Assessment of Phytoremediation and Biofuel Production"**,
  Tomasz Simla, Silesian University of Technology, Department of Thermal Technology, Poland, project partner,
  Poster with session reference 3CV.8.13, 7th June.

All these related papers are published in the Conference proceedings that are free of charge for interested people.

Phy2Climate project stand (Visibility point) at EUBCE 2023, Bologna, Italy.

Phy2Climate project was also presented at EUBCE 2023 through a project stand (Visibility point) and the Live Stage in the Exhibition area.

Phy2Climate project presented in the Live Stage, EUBCE 2023, Bologna, Italy.

3 PREPARATION FOR THE WORKSHOP AT EUBCE 2023

The aim of the workshop was to enable these three H2020 sister projects to present together, each giving an overview of the individual project and the different conversion and separation technologies that each project is researching.

At the time of the workshop CERESiS was in the final year of the project so was able to present some of the most important results of the project, as well as the conversion and contaminant separation technologies used. Whereas GOLD and Phy2Climate had just completed one year of trial crops in the field, and therefore presented more of the first stages of the conversion process.

Workshop organization:

This session was jointly organised not only with the two sister projects, but also in conjunction with the wider full day ETIP event, all of which include ETA-Florence as the communications and dissemination WP Leader. Therefore, the process started with an internal meeting to set the agenda for the day and designate time slots for each of the project workshops (four in total).

The following agenda was designated for this session:

16:25 Clean advanced biofuels production from contaminated land

These three Horizon 2020 projects; GOLD, CERESiS, Phy2Climate are aiming to bridge the gap between remediation of contaminated sites and the production of clean energy. All three projects will use phytoremediation techniques, which uses plants to remove contaminants from soil, and in turn the cultivated energy crops will be used as biomass feedstock and converted to produce clean advanced biofuels.

In this session we will hear about the different conversion and separation technologies that are being researched by the three projects.

Introduction: Emma Fromant, ETA-Florence

16:30 CERESiS

Contaminated land Remediation through Energy crops for Soil improvement to liquid biofuel Strategies. This project is in its final year of research and will present the conversion and contaminant separation technologies used, and share with us some the most important results of the project.

Presenters: Athanasios Rentizelas, NTUA & Nikolaos Boukis, KIT

16:45 GOLD

Growing energy crops on contaminated land for biofuels and soil remediation. This project has just completed one year of field studies, and in this presentation we will hear about the first part of conversion process activities regarding pyrolysis, torrefaction and TorWash.

Presenters: Efthymia Alexopoulou, CRES & Andrea Maria Rizzo, RE-CORD

17:00 Phy2Climate

Building the bridge between the phytoremediation of contaminated sites with the production of clean drop-in biofuels. This project has completed one year of field trials, and in this presentation we will hear about the biorefinery process used to convert the plant biomass into value added products.

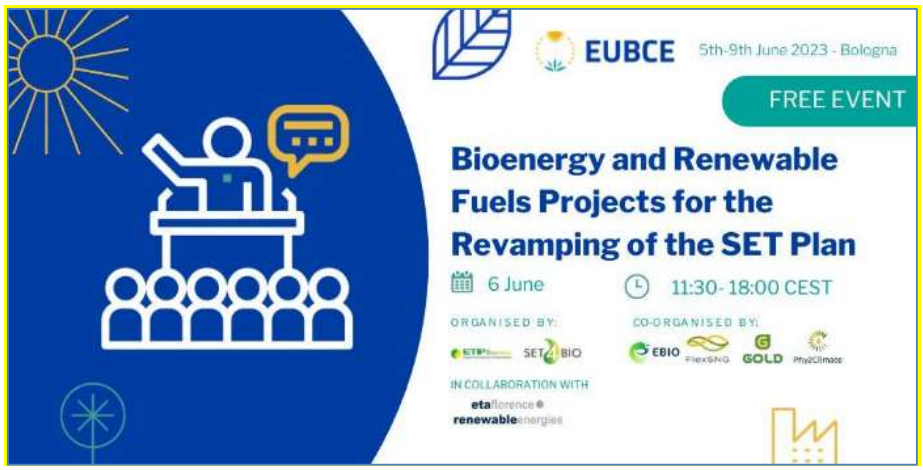
Presenters: Markus Ortner, ITS & Chistopher Kick, Fraunhofer UMSICHT

The overall day concluded with a panel discussion, under the title ‘Common ground and contribution of EU projects to the revamping of the SET Plan Action 8’, with Dina Bacovsky (BEST, Austria) as the chairperson, and a representative from each of the thematic sessions during the day, George Vourliotakis, Exergia, was the representative for the workshop.

CERESiS, GOLD and Phy2Climate project coordinators at EUBCE 2023.

Workshop promotion:

Workshop promotions included posts on the project website, the LinkedIn page, and through the EUBCE communication channels (website, programme, and emails).



Promo card posted on social media channels.

4 SUMMARY OF EUBCE JOINT EVENT: Phy2Climate, GOLD and CERESiS

The EUBCE 2023 side event “Bioenergy and renewable fuels projects for the revamping of the SET Plan” provided a forum for a joint and wide-perspective discussion on the clean energy research and innovation developments in Europe, as outlined by the

Strategic Energy Technology (SET) Plan, and on the role played by bioenergy and renewable fuels technologies.

The aim of this joint event, organised on the 6th of June 2023 in Bologna, was to enhance the potential for synergistic initiatives in line with the targets of implementation of SET Plan Action 8 - Renewable Fuels and Bioenergy. Chaired by the European Technology and Innovation Platform for Bioenergy (ETIP Bioenergy), it hosted SET Plan representatives, policy experts, and ten EU research projects working on emerging technologies in the field contributing to the SET Plan Action 8.

The morning session illustrated the policy framework, the emerging trends in research and industry in the field, together with needs and opportunities identified for the scale-up of innovative technologies in line with the SET Plan implementation. Then the afternoon part hosted three thematic sessions each one focusing on a specific cluster of technology solutions and applications:

1) electrochemical conversions from biobased compounds;

2) syngas technologies, value chains, and market potential;

3) clean advanced biofuels production from contaminated land.

The first session was opened by Franco Cotana, Co-chair of the Implementation Working Group 8 (IWG8) who presented the SET Plan genesis, structure and functioning with relation to the EU R&I policy environment, with a focus on the SET Plan revamping process and the evolution Action 8 scope.

Patrik Klintbom, Chair of ETIP Bioenergy, gave a preview of the newly updated Strategic Research and Innovation Agenda (SRIA) of ETIP Bioenergy, that will be released soon. The SRIA articulates research and innovation roadmaps and priorities in the field of bioenergy for the next years, and also aims to provide a reliable source of information and opinion on the development of biofuels for transport in the EU.

Maria Georgiadou, Senior Expert at European Commission DG RTD, delivered some key messages on research and innovation trends in relation to main developments in EU energy and climate policies – notably the Revision of Renewable Energy Directive II and the REPowerEU Plan – clarifying some relevant aspects for the bioenergy and renewable fuels sector. She highlighted new opportunities for research and industry in the field, with a focus on the Horizon Europe Work Programme 2023-2024 for Cluster 5 (Climate, Energy and Mobility) and on recently-launched initiatives, such as the Biomethane Industrial Partnership (BIP).

The issue of mobilizing resources and enabling policies for the scale-up and deployment of emerging bioenergy technologies was addressed by SET4BIO, a H2020 project specifically aimed to support and accelerate the implementation of the SET Plan Action 8. As successfully approaching its conclusion, the SET4BIO project partners presented the final project results from a 3-year research in the field: drawn from a comprehensive analysis of research results, five key policy recommendations were illustrated by Elina Maki (VTT), while Judit Sandquist (SINTEF) and Paola Mazzucchelli (CIRCE) outlined a roadmap of funding and financing opportunities for R&I projects in the bioenergy and renewable fuels field.

The event titled: 'Bioenergy and renewable fuels projects for the revamping of the SET Plan' was subdivided into four topical sessions. One session was titled: 'Clean advanced biofuels production from contaminated land' in which three Horizon 2020 projects: Phy2Climate, GOLD and CERESiS, held a one-hour workshop dedicated to the projects and the separation and conversion technologies.

The workshop commenced with the CERESiS Project, the project overview was presented by the project coordinator Athanasios Rentizelas (NTUA, Greece) followed by Nikolaos Boukis (KIT, Germany) who presented on the project technologies and results. The two technologies researched in this project are Supercritical water gasification (SCWG), and fast pyrolysis.

During the CERESiS presentation Professor Boukis summarised the development, challenges and outcomes of the two technology pathways, a summary is as follows:

1) Development of a hybrid EC –EO process for effective removal of organics and HMs from SCWG brine / wastewater. The challenge to Effectively remove organic and inorganic pollutants with fast kinetics, no use of chemicals and reduced energy consumption. The process to address this challenge included Design and construct in-house of a novel Electrocoagulation flotation (ECF) lab pilot unit. Selection and purchase of appropriate electrode materials for the ECF (Fe, Al, Si) and EO testing (BDD, Ti-based). Operational parameter optimization and modeling using the response surface methodology (RSM) will for evaluating the effect of key operating parameters for both the ECF (Pb as model compound) and EO (Phenol as model compound) processes. Integration of the ECF and EO processes by testing two different cell configurations: a) electrode setups in series, and b) electrodes in parallel connection in a single setup.

2) Development of a microfiltration (MF) membrane separation process to remove the undesirable heavy-metal-laden char particles (less than 10 micron in size) from the

Fat Pyrolysis (FP) bio-oil. The challenge was to understand, quantify and reduce membrane fouling, and to deal with highly viscous liquid streams. The challenge was addressed through the Design and construct of in-house of a flexible MF pilot unit. Market analysis, purchase and characterisation (water permeability) of customized symmetric, ceramic membranes Preliminary experiments with the aid of synthetic mixtures emulating the relevant bio-oil properties (Glycerol-water solution at 75/25 wt.%). And tests with slow pyrolysis (SP) bio-oil using selected membranes before and after their hydrophobic modification (by Chemical Vapour Deposition technique, using hexyltrimethoxysilane stabilized by 1% ethanol.

Project GOLD were the next to present with project coordinator Efthymia Alexopoulou (CRES, Greece) providing the project overview, whilst Andrea Maria Rizzo (RE-CORD, Italy) presented the two conversion routes that are being investigated in this project: High Temperature Entrained Flow Gasification, and Autothermal Biomass Pyrolysis.

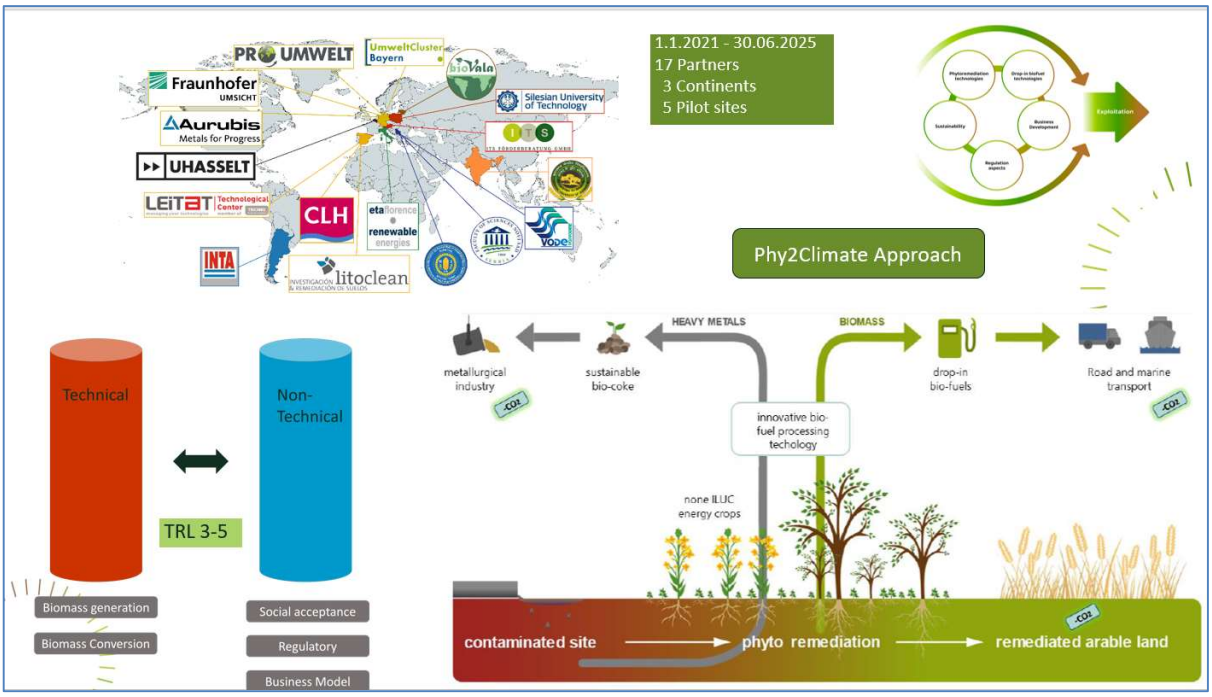
The presented outcomes of the TNO patented technology 'Torwash' pre-treatment included:

- Conditions (pH, acid type, temperature) are tuned to prioritize partitioning of metals into the liquid phase
- Salts (Cl, Na) are also "washed" into the liquid phase
- Resulting solids are more suitable for downstream processes (gasification)

The following results for the slow pyrolysis pre-treatment pilot scale runs were presented:

- Continuous screw reactor with condensation system
- 1-3 kg/h feedstock capacity
- Operating condition: 600 °C, 30 min
- Inert pyrolysis
- Oxidative pyrolysis (0.06 ER)
- Char yield was slightly lower in oxidative operation
- Relevant increase in aqueous phase
- Decrease in oil phase
- No relevant differences in proximate and ultimate analysis of char from inert and oxidative pyrolysis
- Metal recovery for Zn and Pb in char around 100%

Finally, the project rounded off with Phy2Climate, the project overview was presented by project coordinator Markus Ortner (ITS, Austria), followed by Christopher Kick (Fraunhofer UMSICHT, Germany) who presented the project's pilot plant and the related TCR® technology.

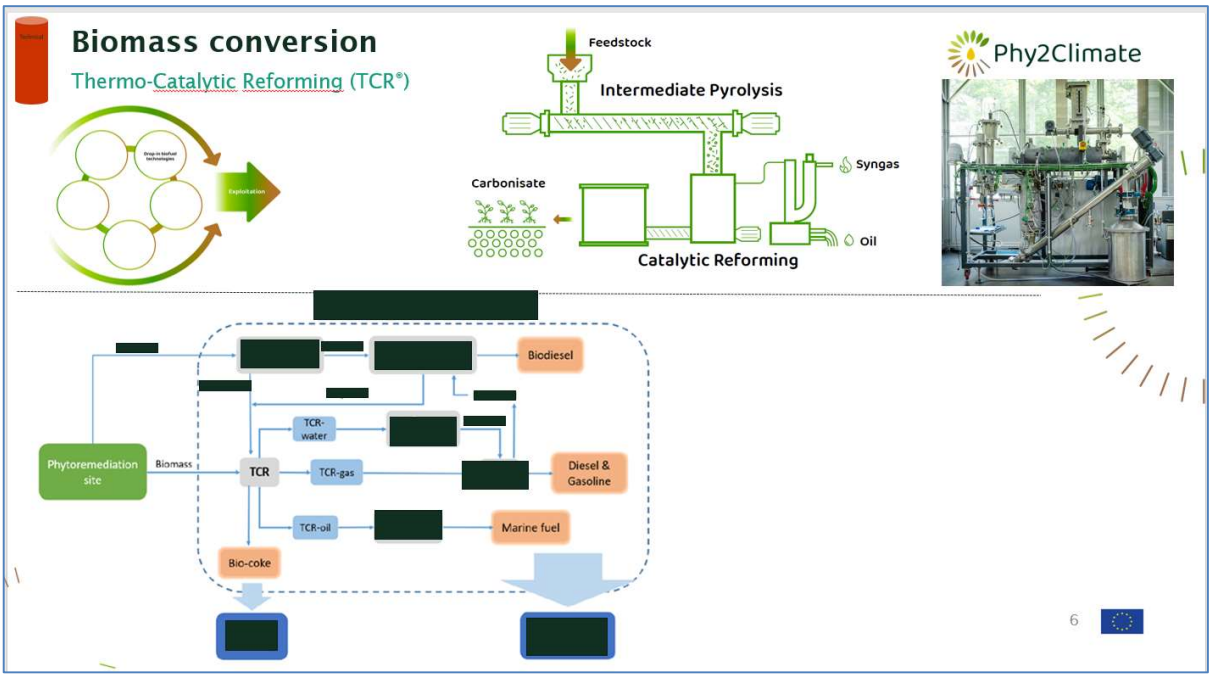


Phy2Climate concept overview, Markus Ortner presentation slide.

For these presentations an overview of the concept and the technology that will be used during the Phy2Climate project was presented and a summary of the process stages was presented as follows:

First stage: Biomass is broken down into carbonisate and volatile components in a continuously operating auger reactor at medium temperatures (< 500 °Celsius). The formation of tar and other pollutants is prevented by optimized process conditions in the various reactor zones.

Second stage: In a post-reformer, the carbonisate and vapors are catalytically refined to improve gas yield and product quality. The vapors are then cooled. During condensation, oil and process water are separated. The remaining gas is cleaned.



Phy2Climate conversion process overview, Markus Ortner presentation slide.

Phy2Climate Presenters: Markus Ortner and Christopher Kick.

After the three presentations a panel discussion was conducted by Dina Bacovsky (BEST, Austria), under the title 'Common ground and contribution of EU projects to the revamping of the SET Plan Action 8', with a representative from each of the thematic sessions during the day, as well as two external representatives. George Vourliotakis

(Exergia, Greece) was the representative for the workshop, whilst the other participates included: Roman Tschentscher (SINTEF, Norway), Ilkka Hiltunen (VTT, Finland), Thomas Schleker, (European Commission, DG RTD), and (Luc Pelkmans, IEA Bioenergy).

During the panel discussion, the panellists discussed about the strategy to transfer results from HEU projects into demonstration, scaling up and deployment of the technologies, and to support viable technologies in the market in the longer term.

Concerning development and implementation of technologies through targeted R&D, the panellists also identified a series of non-technical barriers to overcome and analysed the use of the immense knowledge built through HEU/H2020/FP7 projects to evaluate how projects/research teams/companies can benefit from each other, thus stimulating innovation.

5 CONCLUSIONS

In order to engage with the international community of biomass experts and bioenergy engineers and researchers, as well as international industries, a second workshop (jointly organised in collaboration with two other EU projects: CERESiS and GOLD) was held during the European Biomass Conference and Exhibition (EUBCE) that is organized annually by ETA.

Selected partners were invited to participate as speakers, and different aspects of the project related to phytoremediation and biofuels production were included in the agenda, from feedstock production and supply chains to technological aspects.

The workshop was free to attend and open to all, therefore allowing the audience to come and go as they pleased. It was counted to be between 25 – 30 people continuously in the meeting room, and slightly more for the final panel discussion, with a maximum of 45 - 50 people. The presentation slides are available in the EUBCE proceedings.

In addition to the event organized by the project, the consortium has also ensured the participation of partners as speakers at EUBCE 2023 and to leading events at national and international level, to address different audiences (i.e., sustainability fairs, renewable energy events and conferences etc.).

6 ACKNOWLEDGEMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006912.

This report was written in conjunction with GOLD project (Grant Agreement number: 101006873). This deliverable reports on a joint event and although partially similar to GOLD's report, modifications and additional information were added to comply with the Grant Agreement conditions for Phy2Climate (Grant Agreement number: 101006912).

7 BIBLIOGRAPHY / REFERENCES

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- Deliverable D7.2: Preliminary Communication & Dissemination Plan & periodic updates n° 2;
- Deliverable D7.6: 1st project workshop at the EUBCE;
- https://commission.europa.eu/index_en;
- https://www.eubce.com/.