



D1.4a Innovation Landscape Scenario & Strategy Plan

Klas Engvall (KTH), Giorgio Bruno Braghin (KTH)

Kuglinga Tekniska Högskolan, Stockholm, Sweden

May 2024



Document sheet

Project acronym	PYRAGRAF
Full title	Decentralized pyrolytic conversion of agriculture and forestry wastes towards local circular value chains and sustainability
Grant agreement number	101114608
Deliverable number	D1.4a
Deliverable name	Innovation Landscape Scenario & Strategy Plan
Lead beneficiary	Kuglinga Tekniska Högskolan
WP	1
Related task(s)	T1.3 – Data management, quality assurance and risk management
Type	Report
Delivery date	05.23.2024
Main author	Klas Engvall (KTH), Giorgio Bruno Braghin (KTH)
Dissemination level	
	PU

Abstract

To achieve a sustainable and fruitful long-term partnership that can improve the scientific and innovation excellence of IPPortalegre, this document presents a joint strategy planning in the scientific areas of PYRAGRAF. This deliverable corresponds to a guide for the current and future implementation of research actions and innovation, and it aims at being representative of all the expertise, infrastructures, equipment, on-going research projects of all the consortium partners, and identification of funding opportunities to enhance the relations between all the involved institutions.

Document history

Version	Date	Changes	Reviewer/ contributor
V1 – first draft	05.23.2024	-	KTH
V1 – reviews	06.18.2024	Update of the gathered data from different Partners	KTH
V1 – consolidated version	06.28.2024	Document finalisation	KTH
Final version	06.29.2024	Last check	KTH
Final deliverable submission	06.30.2024	Submission	KTH

Disclaimer of Warranties

This document is part of the deliverables from the project PYRAGRAF, which has received funding from the European Union's Horizon Europe research and innovation program under Grant Agreement No 101114608.

This document has been prepared by PYRAGRAF project partners as an account of work carried out within the framework of the EC-GA contract No 101114608.

Neither Project Coordinator, nor any signatory party of PYRAGRAF Project Consortium Agreement, nor any person acting on behalf of any of them:

- a) makes any warranty or representation whatsoever, expressed or implied,
 - i. with respect to the use of any information, apparatus, method, process, or similar item disclosed in this document, including merchantability and fitness for a particular purpose, or
 - ii. that such use does not infringe on or interfere with privately owned rights, including any party's intellectual property, or
 - iii. that this document is suitable to any particular user's circumstance; or
- b) assumes responsibility for any damages or other liability whatsoever (including any consequential damages, even if the Project Coordinator or any representative of a signatory party of the PYRAGRAF Project Consortium Agreement has been informed of the possibility of such damages) resulting from your selection or use of this document or any information, apparatus, method, process, or similar item disclosed in this document.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement n. 101114608. The information and views set out in this deliverable are those of the authors and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the following information.

Table of Contents

Abstract	3
Document history	3
Disclaimer of Warranties	4
List of figures.....	6
List of tables.....	7
1. PYRAGRAF concept and scientific domains	8
2. Research and Innovation plan.....	9
3. Following the R&I plan: short-term and medium-term activities.....	10
3.1 Research achievements.....	10
3.2 Foreseen preliminary plans (Y2)	14
3.3 Future prospects and partners' visions.....	15
3.4 Dissemination and Communication Methodology	14
4. Stakeholder engagement	16

List of figures

Figure 1: PYRAGRAF's thematic lines (Y1 / Q1-Q4) and corresponding scientific domains and partners.....	8
Figure 2: PYRAGRAF R&I plan.....	9

List of tables

Table 1: Consortium partner research activity, and period specification. (L) = Leadership 10

Table 2: List of partners with an inactive research activity during the first year of PYRAGRAF (Y1), together with a foreseen research activity for year 2 (Y2). 14

1. PYRAGRAF concept and scientific domains

Through an active collaborative system, PYRAGRAF makes the best of each partner's capabilities in the field of decentralized pyrolytic conversion of agriculture and forestry wastes with a focus on high-added value products' production. Ultimately, "PYRAGRAF" will contribute to make IPP the flagship of R&I in the production of added-value products for agriculture and forestry applications, as well as renewable energy carriers for local use, both achieved from waste biomass, in the regions of Alentejo (PT), Baden-Württemberg (DE), and Kilis (TR). Currently, this research subject is extremely important in the international scene and has considerable interest in all sectors of activity, particularly, general industrial, energy and transport. PYRAGRAF leans heavily on close collaboration of these leading institutions in a multidisciplinary approach that encompasses the existing competences and gaps in this field of research.

PYRAGRAF overall research & innovation (R&I), within the first year of activity (Y1, Q1-Q4) to which this document refers, is based on two thematic lines (Figure 1), with equally strong contributions from each consortium partner.

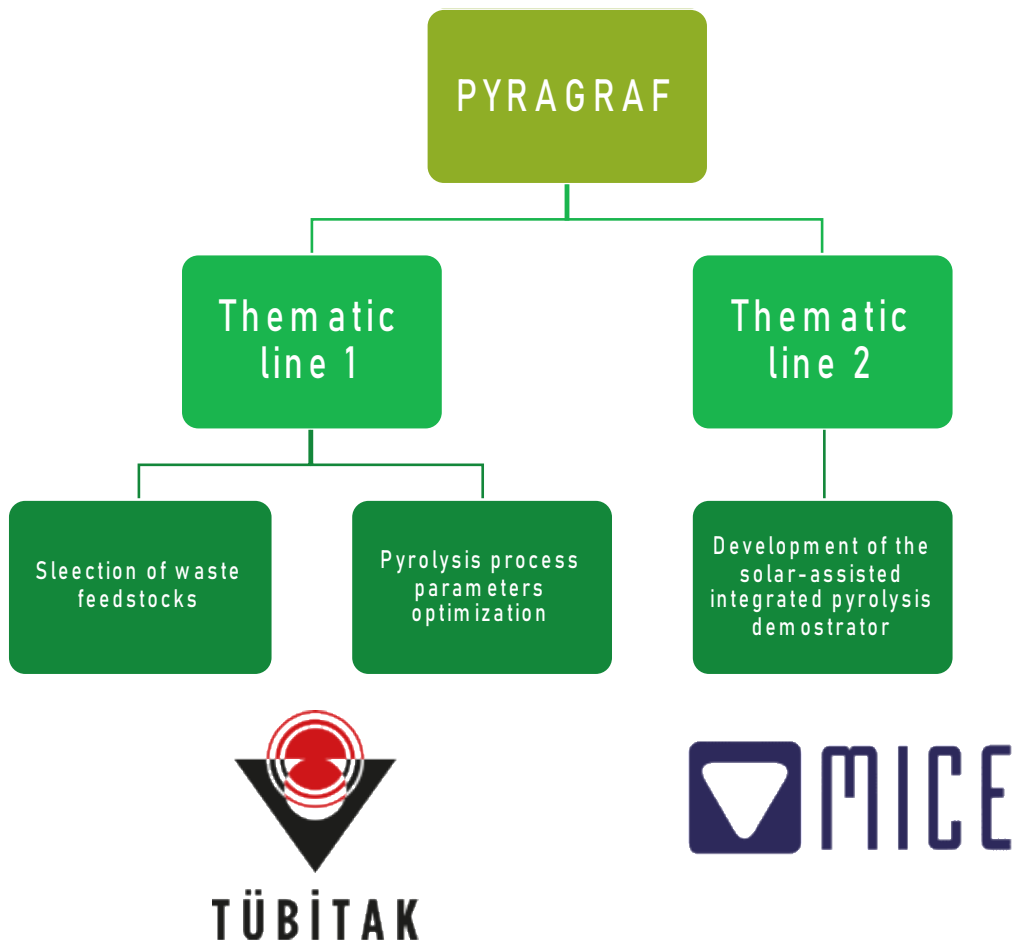


Figure 1: PYRAGRAF's thematic lines (Y1 / Q1-Q4) and corresponding scientific domains and partners.

2. Research and Innovation plan

To guarantee an effective and valuable research and innovation (R&I) planning, the first relevant aspect is providing a strong collaborative environment between all the partners, in order to develop and enhance reciprocal skills in the different research fields. The research activity of all the partners is summarized in Table 1. A project meeting is organised every semester to evaluate the progress of the research activity, discuss and exchange new ideas, as well as deeply understand the need of every partner to pursue a significant research result.

The research activity is tracked through periodic reports, which are shared across the entire partner network. Each partner's activity is monitored to ensure timely project development, allowing for any necessary clarifications or adjustments. This approach fosters effective and collaborative communication. Communication and dissemination are crucial aspects of PYRAGRAF.



Figure 2: PYRAGRAF R&I plan.

2.1 Dissemination and Communication Methodology

Within PYRAGRAF network, a specific partner (WIP) has the role of promoting an effective dissemination and communication on the global research project. In detail, the Shared Point is identified as the most effective means for connecting participants. It is essential that each partner regularly checks the Dissemination and Communication sheet, serving as a common platform for monitoring activities. Beyond the consortium, regular newsletters are distributed every six months via LinkedIn, alongside the publication of press releases twice a year detailing significant project advancements. Submitted deliverables are uploaded to the project website, which also features events where PYRAGRAF is represented, as well as consortium meetings. Social media channels are actively utilised to disseminate information about PYRAGRAF and its activities. An introductory video will be published in month 15 (M15) to outline the project concept and basics, with a second video scheduled for release in the final stage (M42) to showcase project results. Additionally, PYRAGRAF is being presented at various conferences.

3. Following the R&I plan: short-term and medium-term activities

3.1 Research achievements

During the first year of PYRAGRAF, some network partners scientifically contributed to the project, depending on the assigned tasks, and speciality. Anyhow, to gather information related to the conception of PYRAGRAF, even the partners with an inactive research activity during the first year were involved in this deliverable.

Table 1: Consortium partner research activity, and period specification. (L) = Leadership

Partner	R&D activity			Activity period
	WP(s)	General (tasks)	Y1, Q1-4	
IPP	WP1 (L)	T1.1: Project management T1.2: Scientific and technical coordination T1.3: Data management, quality assurance and risk management T1.4: Equality and equity monitoring	Portugal feedstock selection and characterization; Biochar and wood vinegar characterization; Preparation of surveys on-farm energy demands.	Y1 – Y4
	WP2	T2.1: Selection of local feedstocks and supply chain T2.4: Characterisation of pyrolysis products T2.5: Modification and improvement of biochar characteristics T2.6: Optimisation of process parameters for the gasifier burner		
	WP3	T3.3: Development and construction of the different solar-assisted integrated pyrolysis modules T3.4: On-site assembly, testing, validation and operation of the solar-assisted pyrolysis modules T3.5: Biochar, wood vinegar, bio-oil and pyrogas production and quality assurance		
	WP4	T4.1: Demonstration of the potential of biochar T4.2: Demonstration of the potential of tailor-made biochar T4.3: Demonstration of the potential of wood vinegar		
	WP5	T5.1: Pyrogas clean-up and catalytic upgrading of raw pyrolysis vapours T5.3: Energy assessment of pyrogas and bio-oil applications		
	WP6	T6.1: On-farm energy assessments and benchmarking of peak demands and seasonal energy use T6.3: Techno-economic assessment T6.4: Environmental Life Cycle Assessment		
	WP7	T7.1: Dissemination and Communication Strategy T7.3: Liaison and Networking Activities and Final Conference		
UEVORA	WP3	Solar collector development for integration in the pyrolysis process	Design, optimization and integration of high concentration solar concentrators in thermochemical processes, with a particular emphasis on agroforestry biomass pyrolysis processes.	Y1, Q2 – Y4, Q14
LPIT	WP6	SLCA	-	Y1 – Y4

	WP7		D7.7 deliverable Joint market assessment of pyrolysis products-methodology development, engaging project partners and delivering data on country level	
TUBITAK	WP2 (L)	Biomass thermochemical decomposition processes, i.e. drying, pyrolysis and gasification	Two local agricultural and forestry residues feedstocks and supply chains are selected for Portugal, Germany, and Turkey. Information from national statistics, governmental reports and data on local waste management processes was used while selecting the feedstocks. The selected samples are characterized in terms of their physico-chemical properties and calorific values. Thermochemical decomposition characteristics are also determined for the selected feedstocks. Screw conveyor dryer (SCD) is developed and the effects of different process conditions (air temperature, screw speed, dryer temperature) for moisture removal are investigated. Gasifier in MAM premises are being upgraded for gasification studies.	Y1, Q1 – Y2, Q6
BIOREF	WP2	T2.2 - Development of smart and innovative screw conveyor biomass dryer.	Development of a numerical model to simulate the operation of a biomass screw conveyor dryer, using a control mechanism based on a proportional-integral-derivative (PID) algorithm. The controller takes the moisture content present in biomass, compares it with the desired moisture at the end, and adjusts the screw speed over time using the PID algorithm until the final moisture is reached. Different controller parameters will be tested for reaching the optimal configuration.	Y1
	WP5 (L)	T5.2: Bio-oil upgrading and blending	-	Y2, Q7 – Y4
WIP	WP7 (L)	T7.2 – Exploitation and business strategy	In coordination with LPIT, we are working on the market assessment. So far, we have completed the PESTLE analysis for the project countries (namely Germany, Turkey, Portugal, and Sweden). We are	Y1 – Y4

			working on the pyrolysis products, and stakeholder analysis is currently being conducted to identify target groups for each country and at the EU level. All partners are contributing for their country. We are mainly conducting desktop research to perform these analyses. The first version includes an introduction, the methodology of the study, a chapter on local conditions and pyrolysis product potential, and stakeholder and regulatory analysis. This deliverable is due to M12-end of June 2024.	
AU	WP4 (L)	Laboratory and field-scale screening of biochars and wood vinegars developed during T3.5	-	Y2, Q7 – Y4
IDEA	WP3	T3.3: Development and construction of the different solar-assisted integrated pyrolysis modules	We are in a dialogue with Task 3.1 and Task 3.2 about the demand of solar energy and the possible solutions, given the project constraints. The main points are: (1) power demand, (2) working temperature, (3) size and precision in tracking of the solar collector vs movability.	Y1, Q3 – Y4, Q14
KIT	WP3	T3.1: Process simulation and flowsheet development with mass and energy balance T3.5: Biochar, wood vinegar, bio-oil and pyrogas production and quality assurance	In the first year, the PYRAGRAF process concept was worked out in more detail. The challenge is to harmonize the different types of process modules pyrolysis, gasification, drying and concentrated solar power (CSP) for heat supply. For the slow pyrolysis process, a screw-reactor with direct and, alternatively indirect gas heating is considered. Hot gas can be provided by CSP, gasification of biomass or biochar and the gas formed during pyrolysis. Feedstock selection and characterization carried out in others WPs are important input (type of biomass, humidity, particle size, ash content, heating value, etc).	Y1, Q2 – Y2, Q6 Y4, Q13 – Y4, Q14
UHOH	WP4 (L)	UHOH is leader of WP4, which is related to biochar and wood vinegar ecosystem services, coordinated in different tasks, by demonstrating the potential of biochar, of tailor-made biochar, and of wood vinegar.	-	Y2, Q7 – Y4, Q16
LNEG	WP5	T5.2: Bio-oil upgrading and blending. T5.3: Energy assessment of pyrogas and bio-oil applications.	-	Y2, Q7 – Y4

MICE	WP3 (L)	MICE is the lead beneficiary for WP3, about the solar-assisted integrated pyrolysis demonstrator. The WP is coordinated in different tasks, and the main investigation activity is related to the development of a sunlight-fed pyrolysis apparatus able to process for at least 500 hours, and 50kh/h of biomass.	T3.2: Design and basic engineering for solar-assisted integrated pyrolysis unit & T3.3: Development and construction of the different solar-assisted integrated pyrolysis modules & T3.4: On-site assembly, testing, validation, and long-term operation of the solar-assisted integrated pyrolysis	Y1, Q2 – Y4, Q14
------	---------	--	---	------------------

3.2 Foreseen Preliminary Plans (Y2)

The partners that have not an active research activity within the first year (Y1) of PYRAGRAF are listed here below:

- Ankara University (AU)
- National Laboratory of Energy and Geology (LNEG)
- University of Hohenheim (UHOH)

Based on their assigned tasks, each institution will concentrate on the designated research activities. Some partners have significant roles that extend beyond a single work package, potentially contributing to multiple areas. The planned research activities are summarised in Table 2, which also identifies the partners without a quantitatively active research role during the first year of PYRAGRAF.

Table 2: List of partners with an inactive research activity during the first year of PYRAGRAF (Y1), together with a foreseen research activity for year 2 (Y2).

Partner	Foreseen Research Plan (>Y2)
AU	Gathering information about local feedstocks and supply chains and sharing it with WP2 leader, TUBITAK.
LNEG	Development of a techno-economically sustainable process to improve bio-oil. Reduce tar formation during HDO. Obtainment of a biofuel that meets the specification/standards.
UHOH	UHOH is leader of WP4, which is related to biochar and wood vinegar ecosystem services, coordinated in different tasks, by demonstrating the potential of biochar, of tailor-made biochar, and of wood vinegar.

4. Future prospects and partners' visions

Every partner was invited to share their vision and thoughts regarding the future perspectives of PYRAGRAF. Overall, the sentiments from the various partners were optimistic. Many opinions focused on the project's technical aspects, particularly emphasizing the potential of solar-assisted pyrolysis as a promising technology. This method could significantly enhance the use of biofuels and biomass-derived products within the European context. A major point of discussion was the high market potential of these products, driven by their cost-effectiveness and their competitiveness against traditional oil-based alternatives.

Several partners highlighted PYRAGRAF's ability to elevate social awareness about using pyrolysis products both in agronomic applications and energy production. Additionally, there was a consensus on how PYRAGRAF facilitates international collaboration, fostering valuable scientific research. This collaboration sets a precedent and has a substantial impact, potentially paving the way for future research initiatives.

However, there were some reservations among the partners. Concerns were raised about proving the competitive edge of PYRAGRAF technology over more traditional methods. Furthermore, questions about the industrial scalability of the overall process were discussed. It remains unclear how much time is required to produce a specific quantity of products like biochar, leading to concerns about the process's efficiency and compatibility with existing standards.

5. Stakeholder engagement

OBS! This section is extracted from the Deliverable 7.7, and relates to the stakeholder engagement within the project on EU-level. For additional information specific for every Country involved in the project, consult D7.7.

On European level three international organisations have been identified.

- Heavy Finance, Carbon Farming (<https://heavyfinance.com/pl/>)
- The V4 Biochar Platform (<https://v4biochar.czu.cz/en/r-15568-platform-and-objectives>)
- The European Society of Agricultural Engineers (EurAgEng)(<https://eurageng.eu/>)

These stakeholders are important at the EU level due to their roles in promoting sustainable agricultural practices, fostering innovation, and facilitating collaboration between research and industry. Heavy Finance, with its mission to finance sustainable agriculture, provides investment opportunities and support. The V4 Biochar Platform is essential for advancing the utilization and standardization of biochar, a key pyrolysis product, through its network and research activities. EurAgEng bridges the gap between scientific research and practical applications.

6. Conclusions

This document was relevant to keep track of the experimental activity conducted under the umbrella of PYRAGRAF. All the partners contributed by providing information related to their tasks, by filling out a Microsoft Form (see the last pages). More in detail, every partner was asked to summarise the research activity during the first year of PYRAGRAF, together with mentioning their opinion and future perspectives related to the project. Even the partners without an active research activity during the first year of PYRAGRAF gave some hints related to their future research, and what they want to achieve within PYRAGRAF.

A section extracted by the D7.7 about stakeholder engagement (§5) was filled, as it is relevant to analyse the collaboration between the public and the private sector.

Overall, every partner seems to be enthusiastic about the project and very keen to increase their skills in the matter of biomass technologies. Most of them sustain that solar-assisted biomass pyrolysis is a promising technique which represents a plausible and effective solution to decrease and fight the climate emergency and the fossil-fuel dependency.

Supplementary Information

D1.4a - Innovation Landscape Scenario & Strategy Plan

Hello and welcome!

In this form you will be able to upload the summary (max 200 words) about what has been done, within your research activity, during the first year of PYRAGRAF (Y1, Q1 - 4).

You will be asked to reply some quick questions, such as what is your Institution, what WP you belong to, and which task you are involved in, and which one you will summarise. If you do not have an active research activity, then you can skip the summary query (question 5), and go on to the "future perspective box" (question 6). WIP has a dedicated question. **The deadline is set to 2024 June 15th.**

Thanks a lot for your collaboration! :D

Best,
Giorgio Bruno Braghin & Klas Engvall (both affiliated to KTH)

* Required

1. Institution *

2. Email address *

3. What WP do you belong to? *

4. What task(s) is your research activity connected to? *

5. Do you have an active research activity in Y1, Q 1-4? *

Yes

No

6. What is your task in Y1, Q 1-4?

7. If you have an active research activity, please, summarise what has been done in 200 words.

8. What are your future perspectives about PYRAGRAF? Please, write some words, bullet lists, or short sentences. *

9. **Only for WIP.** Please, summarise - in maximum 200 words - how we communicate/disseminate both within and outside PYRAGRAF.

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.