



WG3 Biorefinery Applications

CA 20127

Waste biorefinery technologies for accelerating sustainable energy processes (WIRE)

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D.3.1 – Identification and market valuation of products and by-products from biorefineries – Report (M18)



INTRODUCTION

The WIRE COST Action broadly organizes into 4 KEY WORKING GROUPS (WG) that bring together experts from ACADEMIA, INDUSTRY and TECHNOLOGY TRANSFER organisations and range (1) Raw Materials, (2) Biorefinery Conversion Technologies, (3) Biorefinery Applications and (4) Communication and Dissemination. These WG will proactively contribute to (i) Promote circular economy, (ii) Promote bioenergy and bioeconomy, (iii) Promote Research & Innovation in the field (iv) Promote applied research towards biorefineries implementation (v) Promote EU-wide harmonisation of the scientific and technical approaches, thus facilitating ENGAGEMENT WITH POLICY-MAKERS and industry (vi) Pave the ground for a more effective link with the relevant INDUSTRY sectors and gathering their interest.

The target of WG3 (Biorefinery application) is focused on the identification of the main industrial applications of the biomass products from biorefinery creating an added value to the end-products, and introducing novel market solutions. Intermediate stages and networking between the industrial applications are needed.

Therefore, identifying market applications will play a key role in this working group. Bio-based industries must facilitate and contribute to the production of advanced materials and products (solid, gas, liquid) that form the basis for innovation in the industry. These industrial value chains include end-user products such as biofuels, energy storage materials, electricity, bio-based chemicals, fertilisers, polymers, pharmaceuticals, composites, membranes, electronics, building materials, and others.

The main objective of this WG is thus to enhance the interaction between groups working on different types of advanced processes and materials to accelerate innovation and deployment of novel market solutions.

WG3 will integrate groups and knowledge from a fundamental understanding of advanced biorefinery applications up to the industrial level and develop activities based on the following tasks:

T3.1 Comprehensive identification and survey of biorefineries products, by-products and their applications.

T3.2 Identification and valuation of market segments at regional, national and international levels.

T3.3 Establishing a roadmap for bio-based fuels and products across participant market boundaries.

T3.4 Identifying research gaps and key areas where knowledge transfer shall be improved.

T3.5 Assessing the circular economy viability and reproducibility.

1. MC meeting

During the first MC meeting and WGs presentation, it was proposed for WG3 activities to start with an inventory for the classification of the biorefinery products.

Building up a flexible database should be a priority to create networking and sharing knowledge.

The database:

- should be open and implemented by all the WGs and industrial partners of WIRE and supported by WG4 for possible interaction with other COST action interested in the same field.
- should be built-up as a start on the most appealing products/main industries in the market.

Raw materials properties, conversion technologies, along with their operating conditions, and finally, end-products use should be the main fields to build up a reliable, robust, and easily-accessible dataset.

The idea of the database should be a fundamental requirement to create standard procedures for the supply chain from raw materials to their end-use.



Waste biorefinery technologies for accelerating sustainable energy processes



@ plan of attack of WG3

□ T3.1 Comprehensive identification of biorefineries products / by-products / applications.

1. Collection of data based on **Literature Survey/Personal Scientific Experience**
2. Products ordering according to **physical and chemical properties**
3. **Inventory** for application field

Process	Physical status	Chemical composition	Name	Applications	Potential applications
Pyrolysis	Solid	Carbon material	Biochar	Fertilizer, adsorbent, catalyzer	Filler for nanocarbon tubes? Cosmetics?
	Liquid	Carbohydrate, furans	Bio-oil	Chemicals, biofuel	Biofuel for MILD combustion
	Gas	CO ₂ , CO, CH ₄ , H ₂	Biogas	Heat/power	Biofuel for MILD combustion

Figure 1 – Example of the Database presented during the MC meeting.

Essentially to both ensure the collaboration and the contact among the participants, and achieve the goal of T3.1 (Comprehensive identification and survey of biorefineries products, by-

products and their applications), a preliminary e-mail was sent to the WG3 applicants. The email sent in January 2022, included the WG3 description and tasks. Each participant was asked to submit a potential contribution (maximum of 500 characters) in order to identify the research area of the participant involved in WG3. In addition, a template for the building-up of database (excel file, filled with an example for the database) for the data collection and classification of the bio-refineries product was attached in the mail. However, it was pointed out that participation in one WG did not exclude the possibility of being able to participate in another WGs. Some participants sent back the table filled with their expertise in the field of:

- Hydrolysis and fermentation;
- Anaerobic Digestion;
- Photocatalytic;
- oxidation and pyrolysis process.

Several applicants showed interest to be involved in WG3, and many contributions were received, and then collected in order to start with a database on the WG3 group.

2. 1st WEB-MEETING- WG3

The first meeting of the WIRE Cost Action Working Group 3 - Biorefinery Applications was held on 3rd March 2022, through the TEAMS online platform at 3 p.m CET.

The meeting was attended by 40 WG3-applicants, on 76 invited.

The aim of the meeting was to introduce WG3 objectives and the tasks to achieve within WG3.

The main focus of a meeting was the presentation of the work for the Task 3.1 and the building-up of a database. The presentation consisted of:

- Short review of WIRE Cost Action objectives;
- Short review of WIRE Cost WG3 objectives;
- Activities to proposal for Task 3.1 of WG3;
- Discussion on the table filled by participants.

During the meeting participants showed interest related to the database constructions. The interest was mostly focused on the introduction of more information in the database related to biorefinery products such as:

1. the quality and quantity of raw-material/biomass that is used for each process in relation to the end-product from biorefinery;
2. yield and conversion yield of biomass on product

3. introduce a reference for all data (if from articles or project reports) the quality and quantity of raw-material/biomass that is used for each process in relation to the end-product from biorefinery;
4. take into account the TRL due the important for industrial scale applications;
5. start compiling the database on the basis of own experience and background, and then include data from literature survey;
6. introduce a reference for all data included (if from articles or project reports).

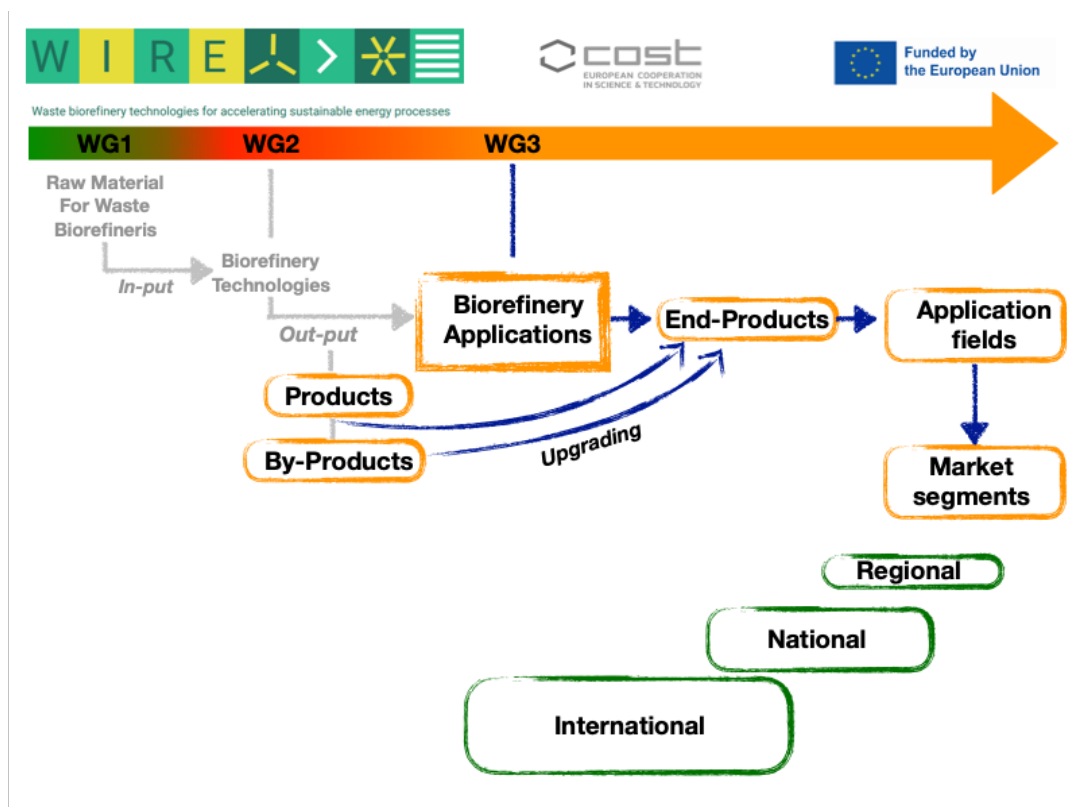


Figure 2 – WGs interactions

The last 5 minutes of the meeting concerned the questions related to the organization of the first general meeting in Portalegre (PT) in March 2021.

In conclusion, next objectives were defined as follow:

- Create a WG3 group on TEAMS;
- Share the excel-file accessible to WG3 participants in TEAMS;
- Work on a shared file on TEAMS that it can be accessed simultaneously from all the participants.

2nd WEB-MEETING- WG3

The second web meeting of the WIRE Cost Action Working Group 3 - Biorefinery Applications was held on 14 September 2022, through the TEAMS online platform at 3.30 p.m CET.

The Meeting was attended by 62 participants, on 150 invited.

The participants received in previous mail the invitation for the meeting, the TEAMS link, and a list of the topics of the meeting:

1. brief introduction of WG3 to new WIRE participants;
2. Microsoft TEAMS and database, and next activities;
3. organization and coordination of the 'Round Table' scheduled for the WG - workshop in Napoli 6-7 October.

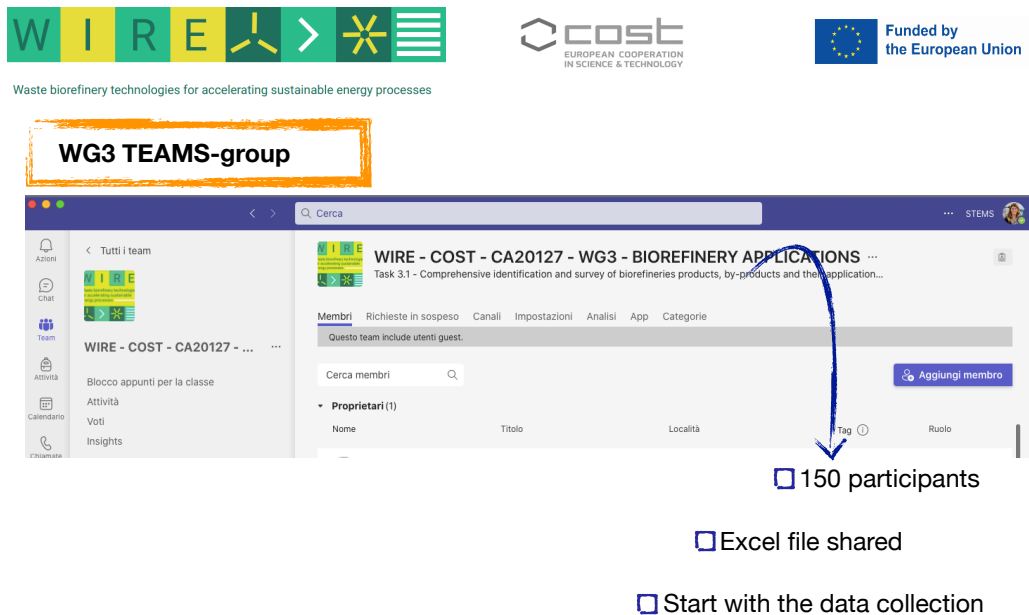


Figure 3 – Microsoft TEAMS program used for the WG3 activities.

At the beginning of the meeting WG3 activities done during the first period of WIRE and the future activities related to the task and deliverable for April 2023 were presented.

The presentation consisted of:

- Short review of WIRE Cost Action objectives and brief presentation of WG3 for the new participants;
- Activities related to Task 3.1 and Task 3.2;
- Definition of the inventory for field and creation of new sub-groups;
- Nomination of delegates for the single research area.

The Delegates should coordinate and inform the participant of each sub-group:

The main activities are reported below:

- Check the excel file in TEAMS and network with participants from same research field;
- create a new excel file or new tab in the existing file in TEAMS;
- in the file, coordinate the collect literature data received from the other participant by scientific expertise (data from publications, projects, data from industry);
- web-meeting with WG leader and other participants involved in the sub-group.

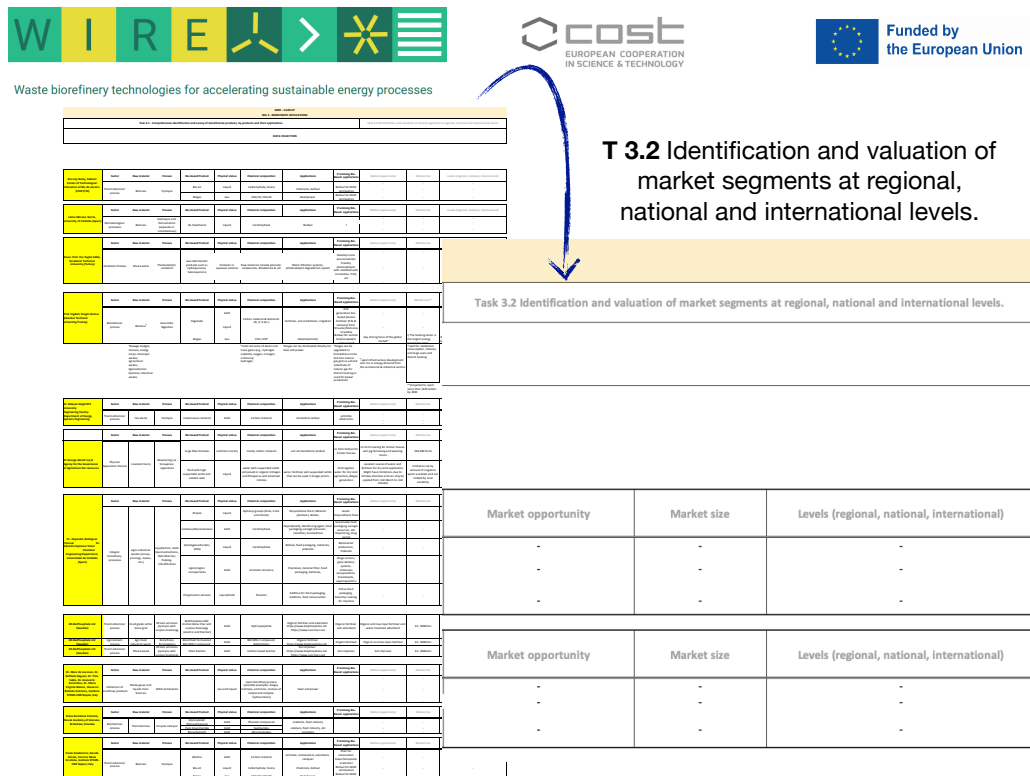


Figure 4 – Database filled by WG3 participants.

In addition, a discussion of future prospects related to Task 3.2 were faced out during the discussion:

- one Delegate for each Country, regardless of the search field;
- Networking with participants from the same country;
- collecting data at regional and national level for all research and industry sectors - report the data in a new excel file or new tab in the existing file in TEAMS.

During the meeting participants showed interest to be a delegate for field /products related to the database constructions. The interest was mostly focused on the introduction of more information in the database related to biorefinery products such as:

1. How to classify the end-products, in three classes (biofuel; biomaterial; bioenergy) or in end-products in details as biogas, bio-oil; -biofuel, and others;
2. Communicate with the WG2 in order to not overlap the activities.

In agreement with all participants connected, the subgroups for each end-product were defined. Some participants nominated themselves as delegates and co-delegates for the different subgroups.

In the table are listed the sub-groups name and the corresponding delegates of WG3 leader, for the coordination and dissemination of the activities within WG3.

N. Sub-Group	Sub-Group	Delegate	Co-Delegate
1	Biogas (via anaerobic treatment)	Cigdem Yangin-Gomec	Ioannis Fotidis
2	Biofuels and bioethanol	Sven Eckart	Jaime Moreno Garcia
3	New Material (Biochemistry)	Elena Karnišová Potocká	Michela Alfe
4	Products from thermochemical process	Rui Galhano dos Santos	Isil ISIK-GULSAC

Figure 5 - Delegate and Co-Delegate list for WG3 subgroups.

The last 20 minutes of the meeting concerned the proposed ROUND TABLE scheduled for the WIRE- Workshop WG- 6- 7 October 2022. The moderator, as well as the question/comments/discussion on current issue regarding the topics of WIRE were announced in advance.

In conclusion, three next objectives were highlighted:

- Create a sub-group for field with delegate;
- Share the new excel-file accessible to WG3 participants in TEAMS;
- Work on a shared file on TEAMS that it can be accessed simultaneously from all the participants.

3. 3rd WEB-MEETING- WG3

On 28th October, the first meeting was held among the delegates representing the WG-3 subgroups. The topics of discussion were:

1. Definition of subgroups;
2. Presentation of the numbers of participants for each subgroup.
3. Activities to be done for task 3.1 and deliverable at month 18.

The Delegates held web-meetings with the participants who joined each subgroup, respectively. During these meetings, the participants discussed on the activities to conduct for the Task 3.1, and on the additional information to include in the databases of each subgroup.

In TEAMS-WG3 there are available folders with the corresponding database for each sub-group.



Overview Sub-Group WG3

✓Sub-Group 1- Biogas (via anaerobic treatment)	Web-meeting 14-11-2022 (Meeting Report)
✓Sub-Group 2- Biofuels and bioethanol	No Web-meeting (organization in off-line - filling the file in TEAMS)
✓Sub-Group 3 - New Material (Biochemistry)	Web-meeting 30-11-2022
✓Sub-Group 4 - Products from thermochemical process	Web-meeting 07-12-2022

Figure 6 - WG3 subgroups web-meeting plan.

Based on the cooperation of delegates and participants, it was possible to determine the actual number of participants contributing to the work of WIRE - WG3 (about 50).

Based on this number, it was possible to identify a percentage by country, process and applications involved in WG3. As shown in Figure 7, the country with the largest number of participants is Turkey. As for processes and applications, thermochemical processes are involved with 35 %, and for applications about 24 % are related to heat and power generation.

Task 3.1

44 Contributions for Task 3.1

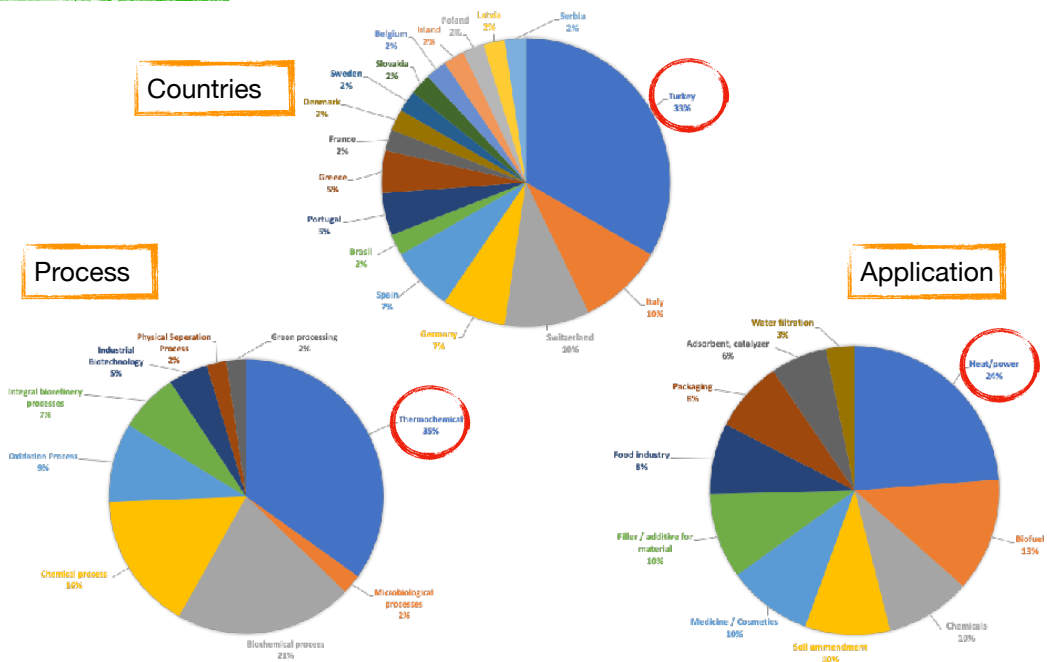


Figure 7 - WG3: Task 3.1 contributions for Countries, Process and application.

However, a thorough analysis of the database, allows the data to be cross-referenced and identify by process and end-products application at different regional and international distribution.

The next step of WG3 in collaboration with the sub-activities conducted with the support of the delegates are to explore in details the single activities reported in Figure 7. In particular, the activities and countries under different line of process and products has to be explored.